TRANSITION OF ARMY GROUND SYSTEMS FROM PRODUCTION TO SUSTAINMENT

Patrick Macheske

3 April 2016

Submitted to Lawrence Technological University College of Management in partial fulfillment of the degree of Master of Global Leadership and Management

Submitted to Defense Acquisition University in partial fulfillment of the requirement of the Senior Service College Fellowship

Approval Page

Author: Patrick Macheske

Organization: Program Executive Office – Ground Combat Systems

IRB Approval: Lawrence Technological University, December 18, 2015

OPSEC Approval: TACOM G2, June 24, 2016

Table of Contents

List of Figures

List of Tables

Abstract

The purpose of this research was to understand how Transitions of ground vehicle systems to Sustainment are managed at the TACOM LCMC, Warren Michigan. The management of the transition to sustainment for ground vehicle systems has been growing in importance as the wars in Iraq and Afghanistan have wound down. The goal of this research was to evaluate current management processes across the organization to prepare for future challenges as the number of systems that transition to sustainment grows.

This research used a mixed methods process that included a review of published literature and a survey that was distributed to the workforces located in the PEOs and the TACOM LCMC. The survey asked demographic questions, and questions about processes, obstacles, roles and responsibilities, leadership, and communications that are followed, recognized, and observed as transition to sustainment plans are developed and put into action.

The data gathered from the survey was analyzed using descriptive statistics for correlations among the data collected, and to analyze items that were grouped into elements.

The data analyses also included evaluation of participant responses to each survey question to understand and describe their perceptions of the management of transition to sustainment.

The conclusions from the data analyses were that the management of Transitions to Sustainment is not efficient or being managed in ways that will make it to become efficient.

There are three areas that need to be addressed to improve the management of transition to sustainment: Develop or update outdated guidance that addresses transition to

sustainment; adjust resource plans to provide technical expertise during and after T2S occurs; and improve communications across the organizations at TACOM LCMC.

Chapter 1 - Introduction

The U.S. Army manages combat and tactical vehicle and other major procurement programs through congressionally appointed Program Managers at the grade of Lieutenant Colonel (05) or Civilians at the General Schedule 15 or equivalent level. The Program Manager acronym "PM" is used generically in this study to encompass the terms Product Manager, Project Manager, and Program Manager. These titles apply to personnel with differing levels of authority and responsibility who manage projects and programs for the Army. PMs are assigned to manage major items of materiel such as combat or tactical vehicles or entire system of systems in the Army inventory, and designated in their charters as the total life cycle system manager for their assigned products.

PMs are granted full responsibility for the systems delegated to them when they are appointed. The designation Total Life Cycle System Manager (TLSCM) comes from Department of Defense Instruction 5000.02 (DoDI 5000.02). DoDI 5000.02 describes how a PM is assigned responsibility for the management of a given system. Management of a program can be assigned at any point in a system's life cycle between initial concept exploration and disposal at the end of the systems economic useful life (USD AT&L, 2015). In the case of Army sustainment of Ground Systems (Combat and Tactical Vehicles), sustainment is overseen by the US Army Materiel Command (AMC) located in Huntsville, Alabama.

Day to day sustainment of ground systems is normally delegated to the TACOM-LCMC, Integrated Logistics Support Center in Warren, Michigan, with individual systems managed by civilian Sustainment Managers. The costs involved with operation and maintenance are a primary focus of sustainment planning since the sustainment of a product

is the costliest element in a program's life cycle. For Ground Systems, Sustainment costs average upwards of 63% of a system's lifecycle cost (DoD OSD Cape, 2014).

A substantial amount of work is performed by PMs to reduce the costs of the products they manage. PMs develop Sustainment Plans that describe how a system will be maintained and supplied throughout its lifecycle with spare parts, part provisioning plans, and maintenance operation descriptions, to maintain their systems operational effectiveness in the field (US Army, 2011). The sustainment planning process is guided by Logistics Management personnel in PM offices. They are assigned to lead Integrated Process Teams (IPT) consisting of government and contractor experts in the areas of engineering, logistics, quality, and acquisition.

The sustainment planning process begins during concept exploration of the Acquisition Lifecycle when defined user needs are solidified, and products that are considered capable of meeting those needs are evaluated. This is also referred to as the Technology Maturation Risk Reduction (TMRR) phase (U.S. DoD, 2015). In order for sustainment planning processes to be successful, there has to be a direct link between the PM and the organization that will assume sustainment management of the system when production has been completed.

Program Managers define and test their product's Life Cycle Sustainment Plans (LCSP) during the Engineering and Manufacturing Development, and Production - Deployment Phases of the Defense Acquisition Management process. The testing of sustainment planning is done concurrently with system testing, and is linked to other work such as the preparation and editing of technical manuals that are also tested by validating and verifying their content and fitness for use. The validation and verification process that is

used to evaluate technical documents for a system introduces soldiers to the sustainment development process. Soldiers are brought in to assure that documentation that is developed by a PM is clearly understandable and ready to be used by soldiers. The litmus test of sustainment planning effectiveness occurs after a system is transition from production to sustainment to be maintained by a sustainment organization. Sustainment plans are put into action when systems are being produced but they need to be 100% complete when the transition to sustainment occurs and soldiers take over their day to day care.

The LCSP evolves from a strategic outline to a comprehensive management plan that is used as a detailed plan to describe how the system will be sustained. LCSP's include how sustainment activity metrics will be determined, measured, modified, and reported from system fielding through disposal (U.S. DoD, 2015).

The LCSP provides the ground rules and guidance for the development of technical documentation such as field maintenance, and operator manuals that are refined as a program progresses and put in place for use while production occurs, and as the system is operationally tested and deployed in Milestone C. Depot level repair manuals for use in overhauling of a system are also prepared and validated at this time. Depot Maintenance Work Requirement (DMWR) and National Maintenance Work Requirement (NMWR) are another set of documents that are produced as a system is developed. Each describes the standards that are to be followed in sustainment activities that are conducted at an Army depot or field maintenance facility. The repairs that can be accomplished at a given facility are dependent upon how the facility is outfitted. Army Depots are outfitted to conduct overhaul and repairs that require the full array of vehicle repairs to include complete disassembly, machining, modification, and reassembly (HQ DA, 2014) (Medlin, 2011). As a

program progresses through the Milestone C production phase, technical and configuration issues that are tied to requirement's definition documents are resolved, and the fielding of the system begins. The development of Technical Documentation that is developed and completed during Milestones B and C activities are used to develop sustainment processes and procedures. All system sustainment processes and procedures are required to be in place when system support is taken over by a sustainment organization so that it can be maintained throughout the remainder of its planned service life (USD AT&L, 2015).

Key Terms and Clarifying Notes put this at end of chapter or in appendix

The following key terms are used throughout this paper.

Transition to Sustainment (T2S). The transfer of a system that has been fully developed that has met its planned production goals to being sustained following preplanned maintenance activities that will maintain it in a fully mission capable status to the end of its estimated useful service life.

Program Manager (PM). The term Program Manager and its acronym are used throughout this paper to indicate the office appointed to oversee the management of acquistion processes for ground vehicle systems that are developed, produced, operated, and sustained. The acronym "PM" is used generically in this study to reduce confusion and because the researcher did not attempt to study or represent the several separate levels of program management as being the focus of the research conducted.

Sustainment Manager (SM). The term Sustainment Manager and its acronym "SM" are used throughout this paper to indicate the office appointed to oversee the management of acquisition processes for ground vehicle systems that are being managed while they are being

sustained after completion of their production and fielding to the end of their estimated economic useful life.

Statement of Problem

The drawdown of military forces as a result of the end of the wars in Iraq and Afghanistan has created the need to selectively retain ground vehicle systems that are no longer being produced and delivered to the US Army (Parsons, 2014). Retention of ground vehicles for future use requires that they be maintained in a constant state of readiness so they can be used by soldiers whenever a domestic or foreign need arises. To efficiently maintain ground systems they have to transition from being managed in production to being managed in sustainment.

The transition to sustainment of 120 to 130 ground systems will create a large amount of work within the next five years as the drawdown of forces continues and the need to sustain larger numbers of ground systems in the Army inventory increases. Transition to sustainment has not been a common activity and as such the management of T2S needs to be studied to fully understand what will be needed to be prepared before the expected bow wave of incoming work.

Statement of Purpose

This research studied the effectiveness of the processes and procedures followed when the transition from production to sustainment of a combat or tactical vehicle system is managed at the TACOM-LCMC. This paper was prepared to determine whether the organizations that make up the TACOM-LCMC are working together efficiently when transitions to sustainment occur and the sustainment of a system is taken up by a sustainment management organization. This paper also determined whether transition to sustainment

processes and procedures are being communicated, understood, and followed by Program and Sustainment Managers who all play a role in transition to sustainment management processes at the TACOM-LCMC.

Research Questions

The researcher sought to determine the differences between PMs and SMs regarding the importance of workplace factors that have an impact on the efficient management of the T2S of a ground system by addressing these two questions.

RQ1: Are the organizations that make up the TACOM working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization?

RQ2: Are transition to sustainment processes and procedures being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM?

The workplace factors studied to address the research questions were the importance of: 1) the processes and procedures that are followed when a T2S is being planned and when they occur; 2) the management of obstacles that can have an impact on the success of a T2S; 3) the roles and responsibilities that PMs and SMs share while planning and managing a T2S; 4) the clarity of leadership and guidance that is provided during a T2S; and 5) the adequacy and effectiveness of communication between PMs, SMs, and their stakeholders, to PMs and SMs.

Significance of this Research

This research has significance to leaders and staff personnel who are tasked with the management and sustainment of military ground systems. The information that has been

collected will assist with the management of the Transition to Sustainment of numerous ground systems that will be maintained in the US Army inventory for the foreseeable future. Information gathered and analyzed as a result of this research will provide insight into where changes may need to be made in management processes, describe where roles and responsibilities may be misaligned, expose areas where obstacles exist, and indicate areas where leadership and communication may be lacking or otherwise need to be addressed.

Limitations of the Study

The results of the study are limited to Program Executive Office- Combat Support & Combat Services Support (PEO-CS&CSS), Program Executive Office- Ground Combat Systems (PEO-GCS), and TACOM-LCMC Integrated Logistics Support Center (ILSC) personnel and may not be representative of other organizations within the U.S. Army. The answers to the survey were dependent upon individual respondent perceptions and experience with ground system program management, and ground system sustainment.

Overview of the Research Methodology

Data for this study was gathered through a literature review and via a survey. The literature review was conducted by the researcher using Army policy documents, internet periodicals, library assets of Lawrence Technical University and the Defense Acquisition University, and scholarly articles posted to the internet. The research survey was released to PEO and TACOM LCMC ILSC personnel located in Warren, MI, and directed towards personnel in Program Management (PM) and Sustainment Management (SM) in the functional areas of acquisition, business management, logistics, engineering, etc.

The survey questioned participants about the management of system Transition to Sustainment (T2S) in the areas of process and procedures, obstacles that arise in managing

T2S, roles and responsibilities of PMs and SMs before, during, and after T2S occurs, leadership that is available when managing T2S, and communication across the PEO and TACOM LCMC. The research gathered and presents information about the way T2S is being managed and provides information about processes, obstacles, roles and responsibilities, leadership, and communication. The survey was released for a period of approximately one month starting December 22, 2015 and closing January 13, 2016. The survey resulted in collecting a sample of 247 responses from a population of 5268 personnel in the PEO and TACOM LCMC organization workforces.

Objective and Outcomes

The objective of this research was to study how the Transition to Sustainment of Ground Systems is being managed to determine whether there are areas where processes that are in place need to be evaluated and potentially updated. The Transition to Sustainment (T2S) of Ground Systems has not been a common practice for the past 14 years as the wars in Iraq and Afghanistan have been fought and wound down. As a result, now that the Army and its component agencies, the Army National Guard, and Army Reserve are contracting in size, the number of ground systems that are planned to be transitioned to sustainment has grown to an estimated 120 to 130 ground systems within the next three to five years (MG, Wyche, L.D., 2013).

The work that is done prior to a transition to sustainment requires a significant amount of teamwork between Program Managers and Sustainment Managers to assure that comprehensive planning has been done to maintain a system until the end of its lifecycle. The desired outcome of this study was to gain an understanding of how T2S is being conducted

and inform TACOM leadership how T2S is being managed and where issues may arise as T2S workload increases.

Validity of the Research

This research was conducted under the oversight of Lawrence Technological University and Defense Acquisition University faculty who are versed in research methods and the study of human subjects. The research utilized a survey instrument that was evaluated prior to release to personnel at TACOM, Warren Michigan, and approved after being reviewed by the Institutional Review Board at Lawrence Technological University.

Reliability of Responses

Survey invitations were distributed to all associates in the Program Executive Offices and TACOM LCMC ILSC without restriction. He survey included an informed consent question that required participants to agree to continue to take the survey. Participation was not mandatory or coerced in any way and participants were offered the option to stop the survey at any time. The reliability of the data from the survey is due in part to the fact that the sample of participants in the Career Field demographic was in roughly the same proportions as the population surveyed. The survey sample of participant's by career field was compared to the same career fields in PEO-GCS. The breakdown of sample participants by career field can be seen in Figure 1.

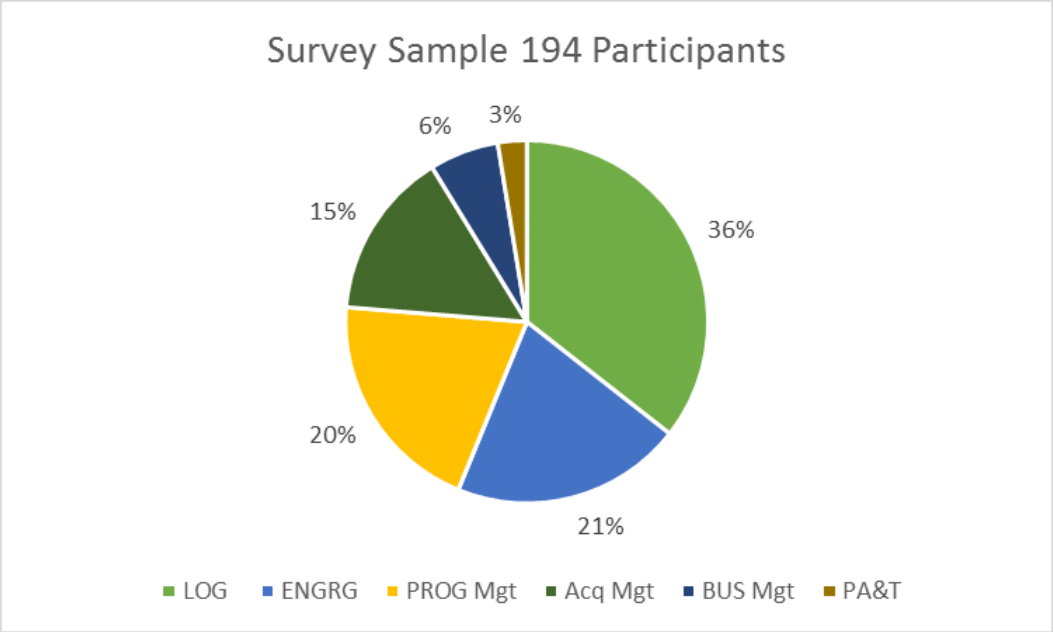


Figure 1 - Sample Participant Career Field Distribution

Comparisons of the personnel who comprise the same career fields by percentage in PEO GCS were used to test the validity of the sample. The comparison reveals that there are minor differences between the sample and the PEO-GCS population, but not to a degree that the outcome of statistical analyses would be greatly affected[1]. The breakdown of the PEO GCS population by career field can be seen in Figure 2.

[1] The PEO-GCS includes a staff of 13 Information Technology personnel none of whom were found to have responded to the survey. The actual number of PEO GCS personnel at the time of the survey was 770.

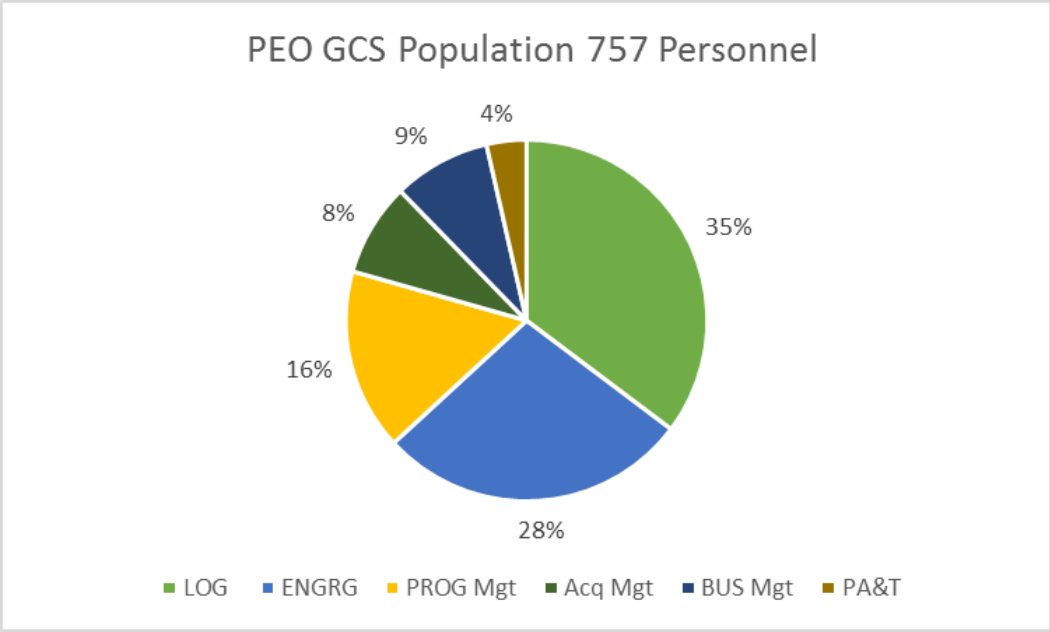


Figure 2 - PEO-GCS Representative Population by Career Field Distribution

Organization of this Paper

This paper consists of five chapters. Chapter 1 has introduced the study. Chapter 2 is a review of the literature that is available on the topic to understand it. Chapter 3 describes the research methodologies that were used. Chapter 4 presents the results of analyses of data collected during the study. And Chapter 5 describes the findings and conclusions drawn from the study.

Chapter 2 – Literature Review

Introduction

This research will study the effectiveness of the processes and procedures followed when the transition from production to sustainment of a combat or tactical vehicle system occurs at the TACOM-LCMC. This paper will evaluate whether the organizations that make up the TACOM-LCMC are working together efficiently when transitions to sustainment occur and the sustainment of a system is taken up by a sustainment management organization. This paper will also determine whether transition to sustainment processes and procedures are being communicated, understood, and followed by Program and Sustainment Managers who play a role in Transition to Sustainment management processes at the TACOM-LCMC.

Description

The topic of how the Army will sustain Army equipment has grown with ever increasing importance as the drawdown of US military forces in Iraq and Afghanistan has occurred, the need for the production of new vehicle systems has reduced, and as Army acquisition policies have been updated. The number of vehicle systems that were developed and produced during the wars in Iraq and Afghanistan added to but in most cases did not displace systems that were in use prior to the war, so the number of vehicle systems grew at the same time that the quantity of individual vehicles in fleets grew.

The processes involved with the transition of systems from production to sustainment are not a major topic of discussion or published writings but there have been a few articles written as reports, and discussions given about the topic at forums such as conferences where the U.S. Army's plan for sustainment have been broached. The discussion of transition to sustainment

is normally discussed at the same time discussions are held about plans to select candidate systems for divestment. Divestment decisions allow the Army to shed itself of equipment that is no longer needed or economical to sustain reducing Operations and Maintenance budgets and strain on the Army supply system. Divestment decisions cause funding reallocations that allow the Army to maintain fleets of the latest and most capable systems.

Transition to Sustainment Panel Discussion NDIA

A panel discussion titled “Transition to Sustainment” held at the National Defense Industrial Associations Tactical Wheeled Vehicle conference in May 2014 with Lieutenants General Raymond Mason, Patricia McQuiston, Mitchell Stevenson, Major General Harold Greene and Industry leaders from Oshkosh Defense spoke of and discussed the challenges facing the Army as the budget had begun to fall. The need to buy new vehicles (Wheeled in this case) was no longer an immediate need due to fleet age and density but the need to sustain vehicles that will remain in the inventory has become a major concern (Parsons, 2014).

General Dennis Via, Chief of the Army Materiel Command echoed some of General Mason’s comments going on to explain the massive efforts that were being made to transition from a wartime footing and begin the sustainment of vehicles and other items of materiel that are being returned to the United States from Afghanistan and Iraq after thirteen years of war. General Via explained how many of the systems being returned would be repaired, modified and redistributed for re-use in the active Army to Reserve units, and to the National Guard bureau. And that selecting systems for sustainment such as models of the Mine Resistant Armor Protected (MRAP) that was not originally planned to be a long term item of inventory

has created a need to begin the sustainment planning process for those systems (Parsons, 2014).

Don Tison, the Assistant Deputy chief of Staff for Army G8, stated that "The Army plans to keep around 11,100 MAXX-Pro, M-ATV and Route Clearance Vehicles of the 16,000 that it has now. They are all relatively new. They're not in bad shape. The trick will be … to get them out of theater, do whatever upgrades we need to them and then have a sustainment conversation" while others are determined to be no longer required and either scrapped or divested (Parsons, 2014).

The problems with what to do to support and sustain MRAP vehicles is not unique. The same issue has been raised about numerous tactical and combat vehicle systems that were armored and are planned to be maintained. As this process has begun to play itself out the challenges and concerns that accompany moving from a resource rich environment that has been the rule of the day for the past thirteen years to the historically resource limited sustainment process.

This switch to sustainment is raising concerns within the Army and industries that support the Army over the ability to maintain complex vehicle systems as they need to be maintained for them to remain relevant and ready (USD AT&L, 2011). Many vehicle system platforms have been modernized and updated with embedded software driven systems that require a significant amount of funding and effort to maintain them compared to their predecessor systems fielded in the 1980's.

Transition to Sustainment at TACOM LCMC

The question about how transitions to sustainment will occur for multiple systems in the near term is on the mind of leaders in the Program offices and the TACOM-LCMC. Command briefings presented by the TACOM LCMC and statements made by Lieutenant General Raymond Mason during the National Defense Industrial Associations Tactical Wheeled Vehicle conference in May 2014 indicate that over 100 vehicle systems will transition from production to sustainment by the year 2020. The role the TACOM LCMC has in system sustainment has been the management of fielded system operational readiness to maintain the capability of systems as they are utilized in the field. The shift from production to sustainment of over 100 systems within the next five years will shift the scope of planned effort from production of systems to sustainment of them as budgets are continually expected to be reduced (Parsons, 2014).

The role of the TACOM LCMC in managing sustainment has evolved as the wars in Iraq and Afghanistan progressed and wound down and Army regulations that defined how a system was to transition from production to sustainment have changed. In the late 1990's the Detroit Arsenal published regulation 70-68 (DETAR 70-68) which referenced Army Regulation 70-1, Army Acquisition Policy, which defined Transition to Sustainment as "The process of transferring systems management responsibility from one organization/activity to another" (USA TACOM, 1994). In July 2011 Army Regulation 70-1 was revised and updated.

The term transition was not redefined but roles of the Program Manager and the Sustainment Organization that would sustain a system through its lifecycle were. The 2011 revision to AR 70-1 defined Total Life Cycle Systems Management in Chapter 1-5, Tenets of

Army Acquisition, stating “PM’s are responsible and accountable for the life cycle management of their assigned programs from program initiation through demilitarization and disposal. This is known as Total Life Cycle Systems Management (TLSCM)”. The next sentence states “There is no transition of life cycle management responsibility away from the PM”. They will manage assigned programs in a manner consistent with the policies and principles articulated in governing regulations and in Chapter 2, below (USD AT&L, 2011).

The prohibitory statement “There is no transition of life cycle management responsibility away from the PM” added by the July 2011 revision put the PM in the position of bearing responsibility for system sustainment along with materiel development and production responsibilities (USD AT&L, 2015).

Transition to sustainment used to be a transfer of management control and responsibility of a system from Program Management to a Sustainment Management organization. The transition process was regularly planned to occur when production of the system had been completed. Transition to sustainment is now limited to the transition of funding streams from Procurement funding lines to Sustainment funding lines (ASA AL&T, 2015).

The update of AR 70-1 indicating that a Program Manager is not to transition the management responsibility for any portion of a program, does not provide guidance that defines how Program Managers are to assume the work performed by Sustainment Managers, or report to a separate chain of command when it comes to reporting sustainment metrics such as readiness rates and system availability. Sustainment of Ground systems has historically been managed by organizations such as the Army Materiel Command which has

a separate chain of command than a Program Manager. The Army Materiel Command is a separate chain of command from the PEO structure.

Summary and Analysis of the Literature Review

The literature available on the topic of Transition of Systems from Production to Sustainment is limited to descriptive studies of what is expected to be encountered in sustaining specific fleets of grounds systems such as tactical and combat vehicles (Parsons, 2014). Much of the literature that was located during research consisted of several short articles in media publications that are directed towards the Defense industry and a primarily military audience (Peltz E. , 2003).

The sustainment of vehicle systems for long periods to be prepared and ready for activation is a normal military practice that is much different than practices followed by commercial industry. Commercial industries monitor, manage and control the maintenance requirements for fleets of equipment that are employed in transportation or the manufacture of goods. In industry replacement occurs as systems become inefficient, worn out or otherwise unprofitable.

The long term sustainment of a system or item of equipment that is not actively producing returns for money that was invested in it, is not given attention or written about because it is not a common practice. Industry does not retain equipment that is not in relatively continuous use because it is unprofitable. Unlike industry, the military focus is to sustain systems for long periods of time so they can be used for training and are constantly ready to go into battle when needed (Peltz E. L., 2002). This is articulated in an Army sustainment white paper wherein the author states “The army is moving from an Army at war

to an Army of preparation" with the focus being on preparedness for future challenges in theaters of operation that vary widely from ten years of battlefield experience in the Middle East (MG, Wyche, L.D., 2013).

Chapter 3 – Research Methodology

Statement of Purpose

This research studied the effectiveness of the processes and procedures followed when the transition from production to sustainment of a combat or tactical vehicle system is managed at the TACOM-LCMC. This paper was prepared to determine whether the organizations that make up the TACOM-LCMC are working together efficiently when transitions to sustainment occur and the sustainment of a system is taken up by a sustainment management organization. This paper also determined whether transition to sustainment processes and procedures are being communicated, understood, and followed by Program and Sustainment Managers who all play a role in transition to sustainment management processes at the TACOM-LCMC.

Research Questions

The researcher sought to determine the differences between PMs and SMs regarding the importance of workplace factors that have an impact on the efficient management of the T2S of a ground system by addressing these two questions.

RQ1: Are the organizations that make up the TACOM working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization?

RQ2: Are transition to sustainment processes and procedures being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM?

The workplace factors studied to address the research questions were the importance of: 1) the processes and procedures that are followed when a T2S is being planned and when they occur; 2) the management of obstacles that can have an impact on the success of a T2S; 3) the roles and responsibilities that PMs and SMs share while planning and managing a T2S; 4) the clarity of leadership and guidance that is provided during a T2S; and 5) the adequacy and effectiveness of communication between PMs, SMs, and their stakeholders, to PMs and SMs.

Research Process

This research was conducted using a mixed methods research study employing quantitative and qualitative research methods. Mixed methods research was used because the topic of the research is narrow in application being primarily a military process, and because the ability to prove the data through quantitative methods alone is limited. Mixed methods research is gaining acceptance in cases such where initial studies of concepts need to be mapped before their individual aspects can be being intensively studied (Trochim, 2007).

Mixed methods research was selected because the accepted and understood practice prior to July 2011 at TACOM was to transfer responsibility for the system to the sustainment organization whenever a system was transitioned to sustainment. That practice changed as a result of a change to Army Regulation 70-1, which requires the PM to retain all management of a system throughout its lifecycle through disposal (USD AT&L, 2011)

The purpose of the quantitative study was to gather data about personnel and their diverse understanding of the transition to sustainment process, the obstacles they encounter, how roles and responsibilities are perceived, the part leadership plays, and whether communication between organizational units is adequate and effective. The qualitative

element of the study was addressed using two ranking questions as part of the survey offering participants the opportunity to provide information as to what they viewed as most important to successfully transition a system to sustainment and to provide insight into what issues they perceived as needing to be addressed to solve problems that arose after a transition occurred.

The survey was released to the Program Executive Offices and TACOM LCMC Integrated Logistics Support Center to collect quantitative data from a cross section of personnel in Program Management and Sustainment Management offices to evaluate their level of understanding of the Transition to Sustainment process.

Data Collection

Data for the research was collected using an on-line survey via the website Survey-Monkey©, that included four demographic questions and twenty two questions about aspects of the transition to sustainment process at TACOM. Participants were asked to reply to the transition to sustainment questions using a five point Likert scale enumerated as follows with their meanings:

1) Strongly Agree
2) Agree
3) Unknown
4) Disagree
5) Strongly Disagree.

The last two questions in the survey were ranking questions that asked respondents to rank six items according to their level of importance from 1 to 6 with 1 as most important and 6 as least important.

Survey Instrument

The survey, located at Appendix A, was released December 21, 2015 to the PEO-GCS, PEO-CS&CSS, and TACOM LCMC –ILSC. The survey was sent via e mail from the offices of senior leaders within each organization with a note indicating their gracious support that contained a web-link that gave participants instant access to the survey's introductory letter and consent form.

Survey responses were collected between December 21, 2015 and January 13. 2016 to maximize the collection of responses as the December holiday season passed. The survey link transferred the participant to the web based survey service Survey Monkey© survey tool.

Demographic data that was collected for this study did not require the identification of participants. A personally identifying information data was eliminated from the collection process to include Internet Protocol (IP) data that identifies response data sent from individual computers. The survey asked twenty seven questions, the first five consisted of an informed consent question and four demographic questions. The remaining twenty two questions were split among five elements that have effects on the management of T2S. The five elements of the study were: 1) how are current transition to sustainment processes being managed; 2) are there obstacles in effectively managing a T2S; 3) how are leader roles and responsibilities being perceived; 4) is leadership and guidance being provided; and 5) is communication across organizations adequate and effective.

Survey Distribution, Sample Size, and Participation

The survey was distributed to personnel in the Program Executive Office for Ground Combat Vehicles, the Program Executive Office for Combat Support & Combat Services Support, and the TACOM LCMC–ILSC. There was a population of approximately 5,268

personnel employed by the three organizations contacted to participate in the survey when it was released. There were 247 responses to the survey within the survey data collection period which opened on December 22, 2015 and closed January 13, 2016. The number of responses received amounted to 4.68% of the population with the participation of personnel from each of the eight career fields listed in the survey.

Data Collection Procedures and Statistical Analysis

The survey instrument was released to collect demographic information about participants and have them respond to survey questions using a five point Likert scale (Brown, 2010). The survey instrument also contained two questions that were qualitative in design requiring participants to rank items based on their perceived importance in managing and solving issues that occur during transition to sustainment and afterwards.

Participants in differing career fields, with differing levels of experience and rank provided answers to questions that asked about the way they perceived the management of system transition to sustainment in five elemental areas. The five elemental areas are directly linked to the research questions and summarized in the analyses as: Processes, Obstacles, Roles and Responsibilities, Leadership, and Communication.

The data drawn from the survey were analyzed using Minitab 16© software to test whether the data from the sample of participants was reliable in terms of being consistent across the sample. The data for the sample were tested using a one sample *t* test of the composite sample and one sample *t* tests of each of the elements. The results indicated that the responses were reliable for evaluating whether the organizations that make up the TACOM are working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization.

The determination whether transition to sustainment processes and procedures are being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM was also tested using a one sample *t* test. The question in this case is whether personnel in each office involved in managing parts of the transition of systems to sustainment process are following a predetermined set of processes and procedures to accomplish the task.

The data collected in the survey were also tested for validity but the results were not consistent. The researcher performed qualitative analysis to complete the study evaluating data gathered for the twenty questions that were responded to using the 5 Point Likert scale and the last two questions that were asked at the end of the survey using a simple mean averages to rank the responses that were received. The last two questions in the survey were ranking questions that required participants to rank six items from what they considered most to least important in managing the transition to sustainment process, and in solving problems with sustainment after transition occurred.

Summary

This chapter explained the mixed methods approach used to collect and data on the management of T2S processes, and perceptions of how a T2S occurs. The chapter also described analyses that were utilized to evaluate whether Program Management and Sustainment Management organizations are working together efficiently during a transition and whether processes and procedures that guide the transition to sustainment process are being communicated, understood and followed. The research survey instrument, workforce population, number of responding participants, data collection process, research questions, and the elimination of incomplete data for failure to complete the survey were described to

provide an overarching view of how the study was conducted and the amount of data that was received.

Chapter 4 – Findings

This research studied the effectiveness of the processes and procedures followed when the transition from production to sustainment of a combat or tactical vehicle system is managed at the TACOM-LCMC. This paper was prepared to determine whether the organizations that make up the TACOM-LCMC are working together efficiently when transitions to sustainment occur and the sustainment of a system is taken up by a sustainment management organization. This paper also determined whether transition to sustainment processes and procedures are being communicated, understood, and followed by Program and Sustainment Managers who all play a role in transition to sustainment management processes at the TACOM-LCMC. This chapter describes the results of analyses that were performed on data that was collected.

Introduction

This study investigated the management of the Transition to Sustainment (T2S) of Ground systems using a sample of 194 personnel in the TACOM LCMC workforce. Participants completed an online survey that collected employment demographic data and responses to questions about T2S processes, obstacles, roles and responsibilities, leadership, and communication between PM and SMs. Demographics included participant primary career field, years of service in a primary career field, current career status, and position by title.

Transition to Sustainment was measured using 20 questions that were grouped into five workforce factor elements. Each of the 20 items was scored along a 5-point Likert scale, with 1 = strongly disagree, 2 = disagree, 3 = unknown, 4 = disagree, and 5 = strongly agree. The five workforce factor elements that were used to measure T2S were: Process (4 items),

Obstacles (5 items), Roles and Responsibilities (2 items,[2]), Leadership (3 items,[3]), and Communication (4 items).

u said all of this in ch 3In addition to the 20 items, two questions that were asked in the survey required participants to rank their responses in order of importance from most to least. The two areas sought data that ranked a list of six items that would most likely improve the T2S process and a ranking of the same six items to understand what participants considered to be the most important in solving problems that arose after a T2S occurred.

The researcher sought to determine the differences between PMs and SMs regarding the importance of workplace factors that have an impact on the efficient management of the T2S of a ground system by addressing these two questions.

RQ1: Are the organizations that make up the TACOM working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization?

RQ2: Are transition to sustainment processes and procedures being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM?

The workplace factor elements studied to address the research questions were the importance of: 1) the processes and procedures that are followed when a T2S is being planned and when they occur; 2) the management of obstacles that can have an impact on the success of a T2S; 3) the roles and responsibilities that PMs and SMs share while planning and managing a T2S; 4) the clarity of leadership and guidance that is provided during a T2S; and 5) the adequacy

[2] One item was deleted for its inconclusive impact on reliability.
[3] One item was deleted for its inconclusive impact on reliability.

and effectiveness of communication between PMs, SMs, and their stakeholders, to PMs and SMs.

All available data were analyzed using Minitab 16.2 using general linear modeling of inferential statistics to test the reliability of the data collected. The mean scores, standard deviations, Cronbach's alpha reliability measures, and Pearson correlations (P-value) were calculated. The analyses revealed that there were correlations within the data gathered for each of the workforce factor elements indicating that data was reliable, but the results were not found to be valid for drawing all-encompassing answers the research questions.

Population & Sample Size

The survey was distributed to personnel in PEO-GCS, PEO-CS&CSS and the TACOM LCMC–ILSC. The population when the survey was released was approximately 5268 personnel employed by the three organizations. There were 247 responses to the survey within the survey data collection period which opened on December 22, 2015 and closed January 13, 2016. The number of responses received amounted to 4.68 percent of the available population with participation of personnel from each of the 8 career fields listed in the survey.

The sample was considered adequate in number of responses to perform quantitative analyses as a representative sample (Morgan, 1970). The 247 responses to the survey included 53 replies that contained with missing values. The 53 incomplete responses were deleted from the analysis leaving 194 participants in the study reducing the percentage of the workforce studied to 3.68 percent. The equation used to determine the validity of the sample size can be seen in Figure 3 (Stat Trek.com, 2016). Values used in the equation are shown in Table 1.

$$n = [(Z^2 * p * q) + ME^2] / [ME^2 + Z^2 + p * q / N]$$

Figure 3 - Sample Size Equation (Stat Trek.com, 2016)

Table 1 *Values Used in Sample Size Equation*

Variable	Value
N	190 (Sample size required)
Z	1.96 (for 95% Confidence Interval)
p	.85 (Portion of the population surveyed)
Q	1-p
ME	0.05 (Margin of Error)
N	5268 (Total Population)

Descriptive Statistics

Descriptive statistics were used to describe the sample participants and their responses to the survey questions. The four demographic areas that were used to collect data were primary career field, years of service, status as civilian or military, and years of service in a primary career field position. The demographic data also provided data about the roles participants were aligned with in the areas of Program Management and Sustainment Management.

Demographic Statistics

The distribution of sample participants based on primary career field at the TACOM LCMC can be seen in Figure 4. The largest sample of participants, 36% are in the field of Logistics, the second largest, 21% are in the field of Engineering.

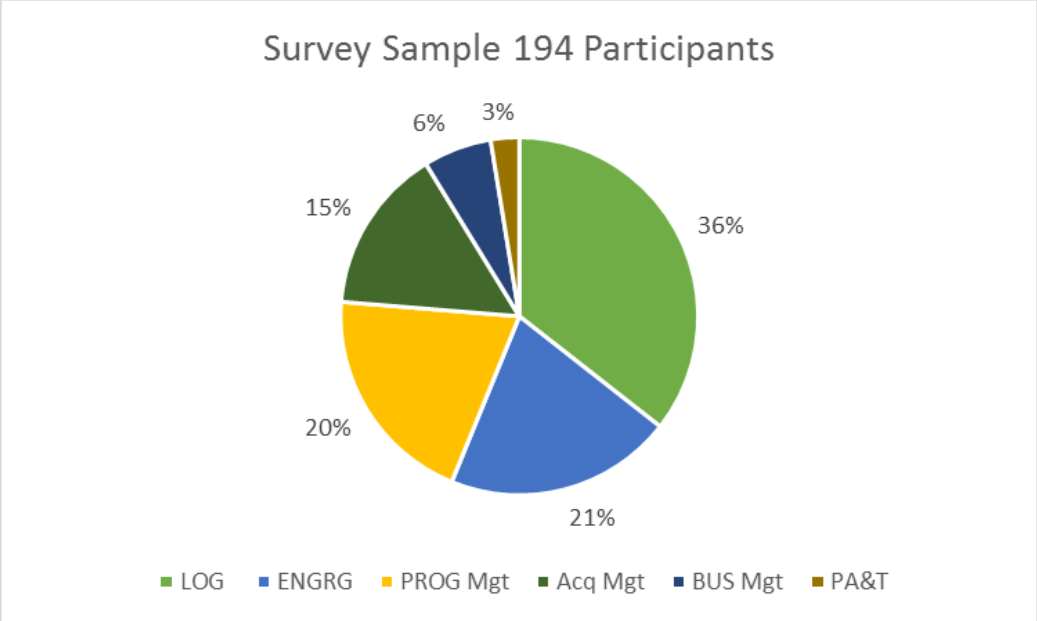


Figure 4 – Survey Sample Participants

The distribution of sample participants based upon years of in their primary career field can be seen in Figure 5. The largest population of respondents, 34% has been working in their primary career field for 8 to 15 years. The second largest population, 22% has been working in their primary career field for 1 to 7 years.

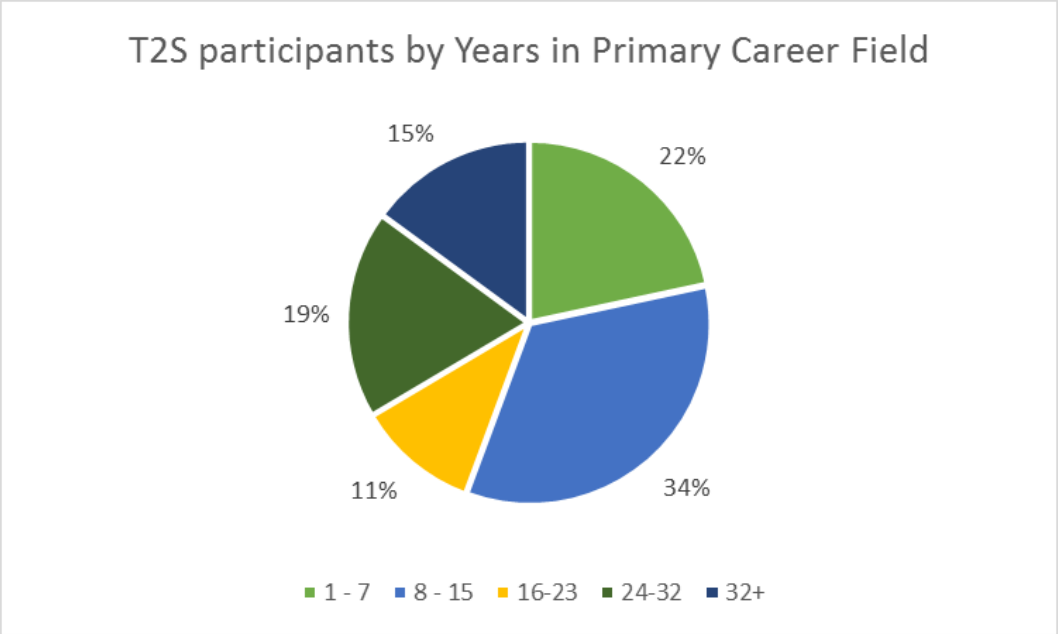


Figure 5 - Primary Career Field Distribution

The distribution of sample participants based upon their career status can be seen in Figure 6. The largest population of participants, 95% were Department of Defense civilian. The second largest population, 5% were U.S. Army Military.

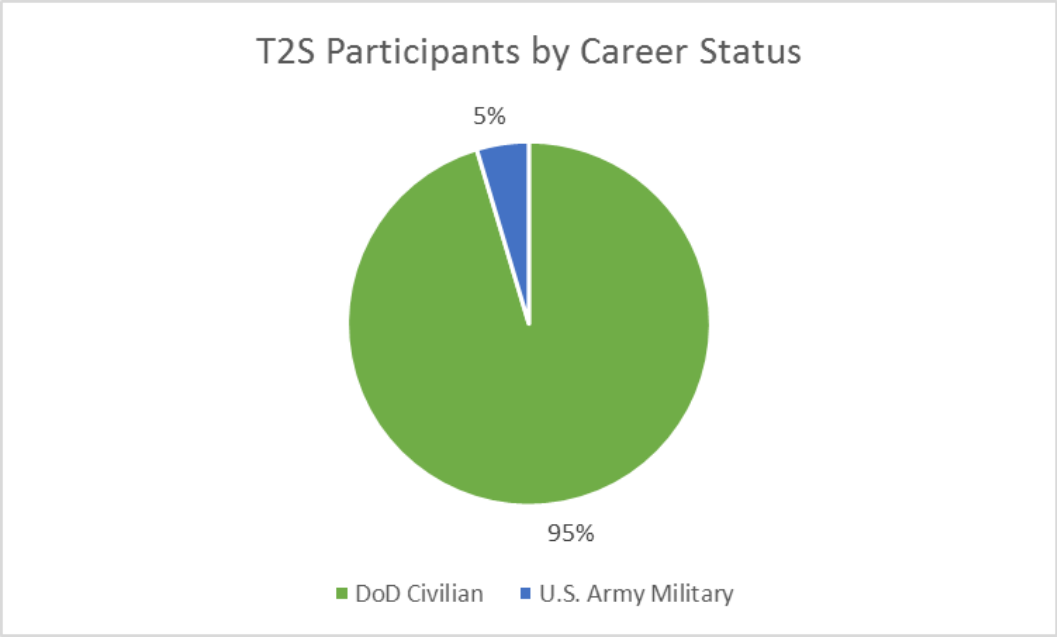


Figure 6 - Career Status Distribution

The distribution of sample participants based upon their current positions can be seen in Figure 7. The largest population of participants, 44% are Team Members. The second largest population of participants, 22%, are Team Leaders.

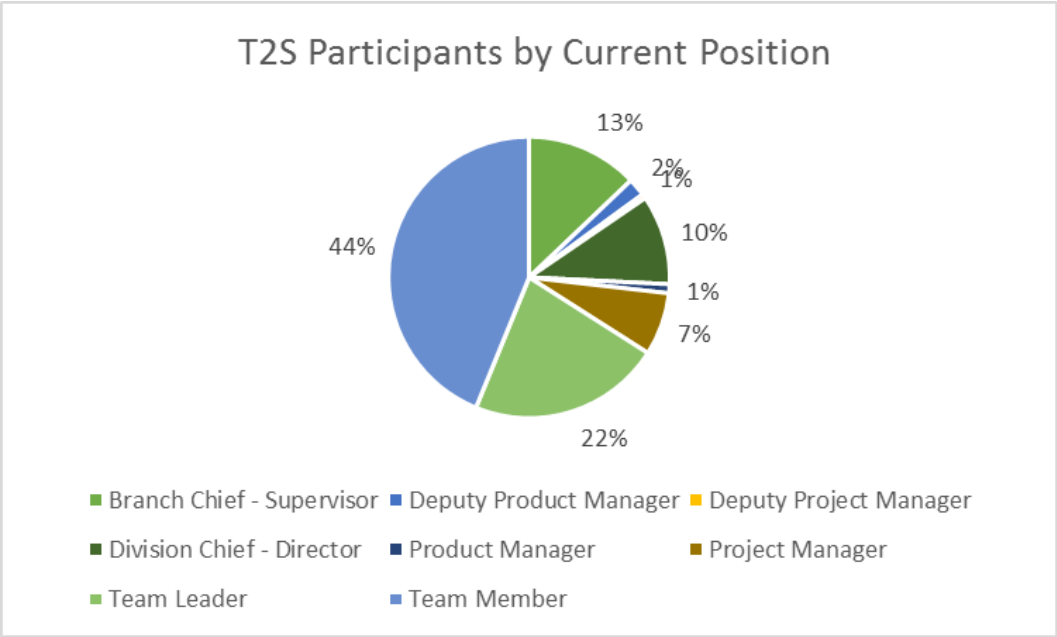


Figure 7 - Current Position Distribution

The distribution of participants who perform program management and sustainment management functions can be seen in Figure 8. Program Management comprises the largest population of participants, 43% with personnel in program offices who are in the fields of Program Management, Engineering, Acquisition, and Business Management. Sustainment Management the next largest population of participants, 36%, with personnel in the fields of Logistics Sustainment, Logistics Maintenance and Contracting. The information in Figure 8 was extracted from the demographic data that was collected in the survey instrument in response to the questions that asked about participant's primary career field and their current position.

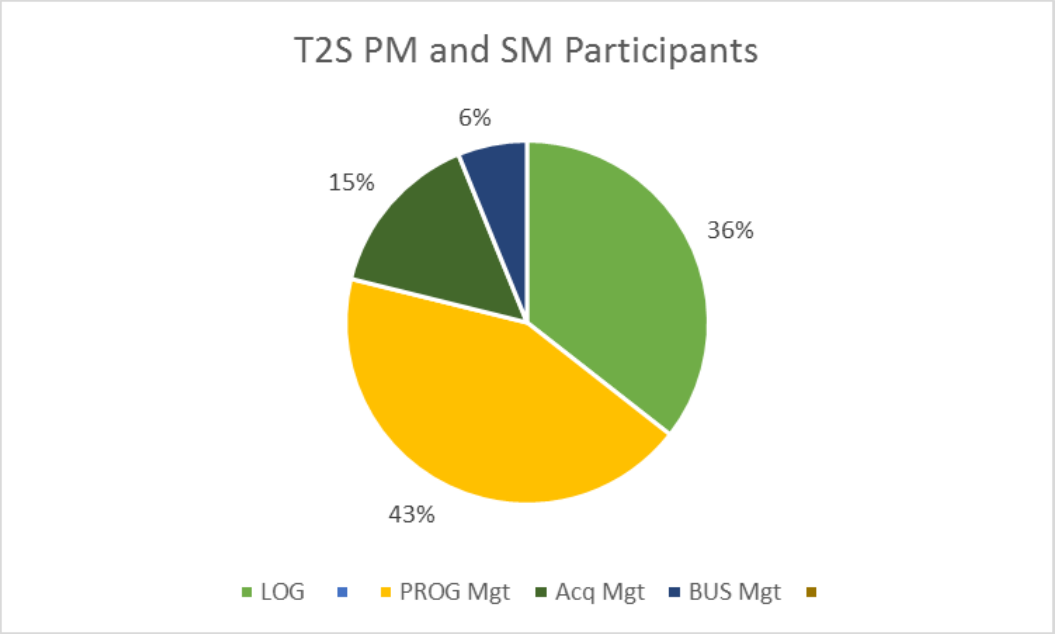


Figure 8 - T2S Participants in PM and SM by role Distribution

Survey Responses

The research survey included five elemental areas that have varying impacts on the management of T2S. The elemental areas are; Process, Obstacles, Roles and Responsibilities, Leadership, and Communication. Each elemental area included a number of questions that

were asked to gain insight into how participants viewed the management of T2S to evaluate where positive or negative agreements exist. The data that was collected and finding are presented below with the composite responses and their mean scores as a lead graph, followed by individual graphs for each question that was part of the composite. The survey used a 5 point Likert scale that is shown below the responses to each question.

Process Element Findings

The T2S Process element was evaluated by averaging the responses to questions 6, 7, 8 and 17 that inquired about processes and procedures that are followed in the planning and execution of Transitions to Sustainment. The responses to questions 6, 7 and 8, indicate high levels of positive agreement from participants.

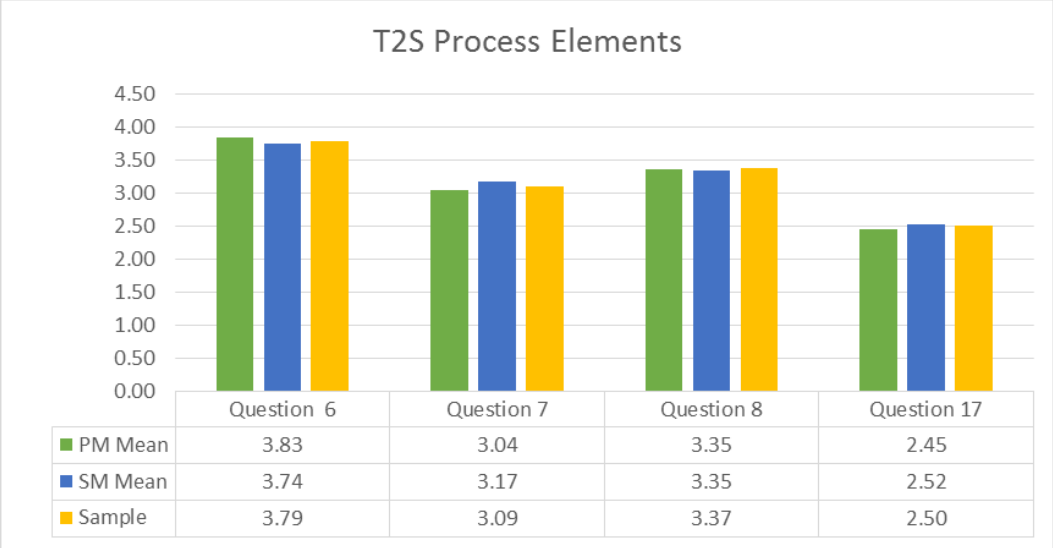
Question 6 asked whether participants had participated in Lifecycle Sustainment Planning in the framework of Integrated Product Process Teams (IPPT) using Integrated Product Team (IPT) processes. Respondents indicated that 77.2% of them had participated in Lifecycle Sustainment Planning in the framework of IPPTs and IPTs. The use of Integrated Product Process Teams and Integrated Product Teams indicates a familiarity with sustainment planning and that participants have managed complex processes that require structure across multiple functional areas of expertise (DOD, 1998).

Question 7 asked whether T2S was managed as a Major Milestone Decision (MMD). The data collected found that 49.23% of participants who are familiar with the management of major program decisions, feel that T2S is being managed as a major milestone decision. Transition to Sustainment is a significant event in the program lifecycle and data confirms that the majority of participants feel T2S is being managed the same as other major program decision.

Question 8 asked whether Product Managers developed transition plans that included estimated cost, schedule, and performance parameters for their assure they were able to successfully transition from production to sustainment. Respondents indicated that 59.9% have experience with PMs who have produced transition plans that include Cost, Schedule, and Performance parameters for the systems they manage.

Question 17 asked whether the transition from production to sustainment of a vehicle system, is an efficient process with clear definitions of what the PM and SM organization is responsible to do and when? Participants indicated that 63% do not find T2S to be an efficient defined process with clear definitions of PM and SM responsibilities. The data in this case indicates that PMs and SMs need additional information, updated guidance, and T2S procedures to structure and improve how T2S is managed.

The composite mean scores of PMs and SMs and the overall sample in response to questions 6, 7, 8 and 17, can be seen in Figure 9. The individual survey questions and data that were gathered from them are presented in corresponding figures below Figure 9.



	Question 6	Question 7	Question 8	Question 17
PM Mean	3.83	3.04	3.35	2.45
SM Mean	3.74	3.17	3.35	2.52
Sample	3.79	3.09	3.37	2.50

Figure 9 - T2S Process Elements Composite Mean Scores

Details of participants responses to Question 6; Life Cycle planning that you participate in is conducted within the framework of an Integrated Product Process Team using Integrated Product Team. Participant response to question 6, can be seen in Figure 10.

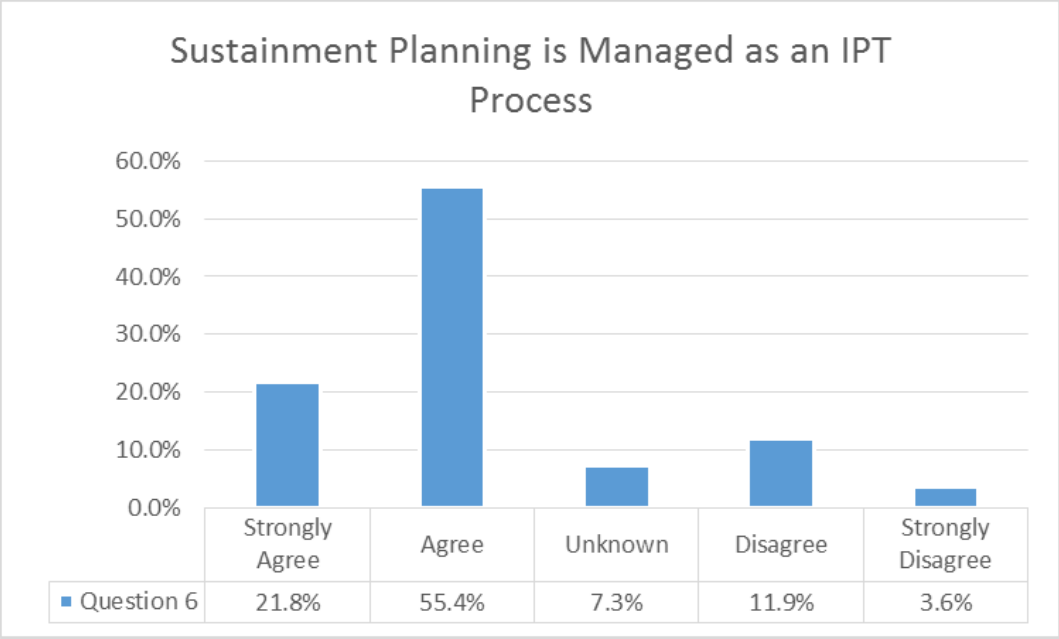


Figure 10 - Sustainment Planning is managed as an IPT Process

Details of participants response to Question 7; The transition to sustainment from production of a vehicle system is managed in the same way as a major program milestone decision, with predetermined exit and entry criteria for the transition from product management to sustainment management to as the production of the system ends? Participant response to question 7, can be seen in Figure 11.

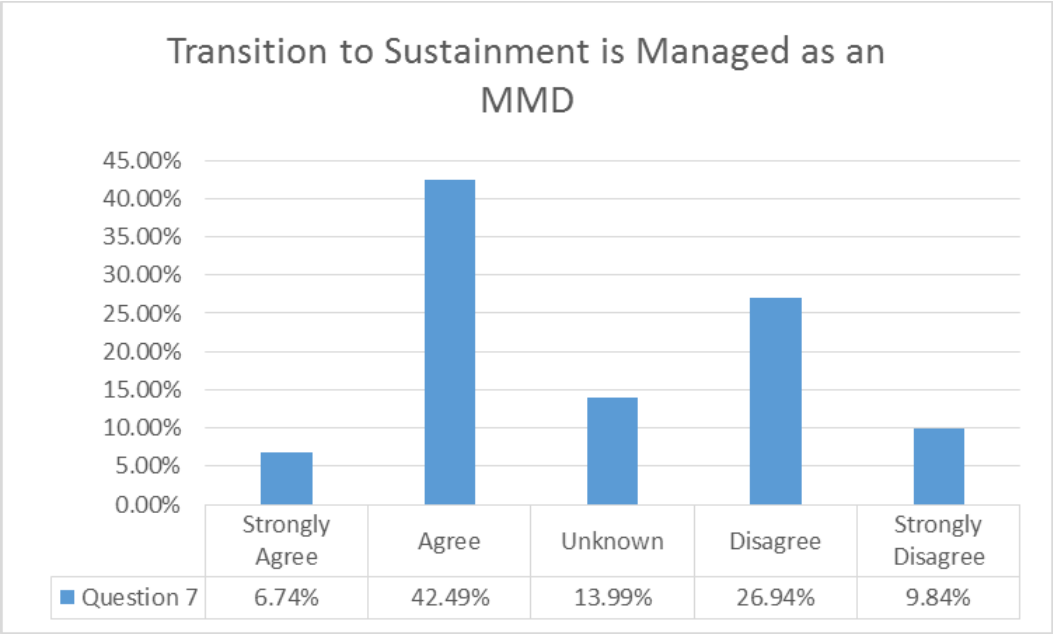


Figure 11 - Transition to Sustainment is managed as an MMD

Details of participants response to Question 8; Product Managers develop transition plans that include estimated cost, schedule, and performance parameters for the systems they manage to assure systems are able to successfully transition from production to sustainment? Participant response to question 8, can be seen in Figure 12.

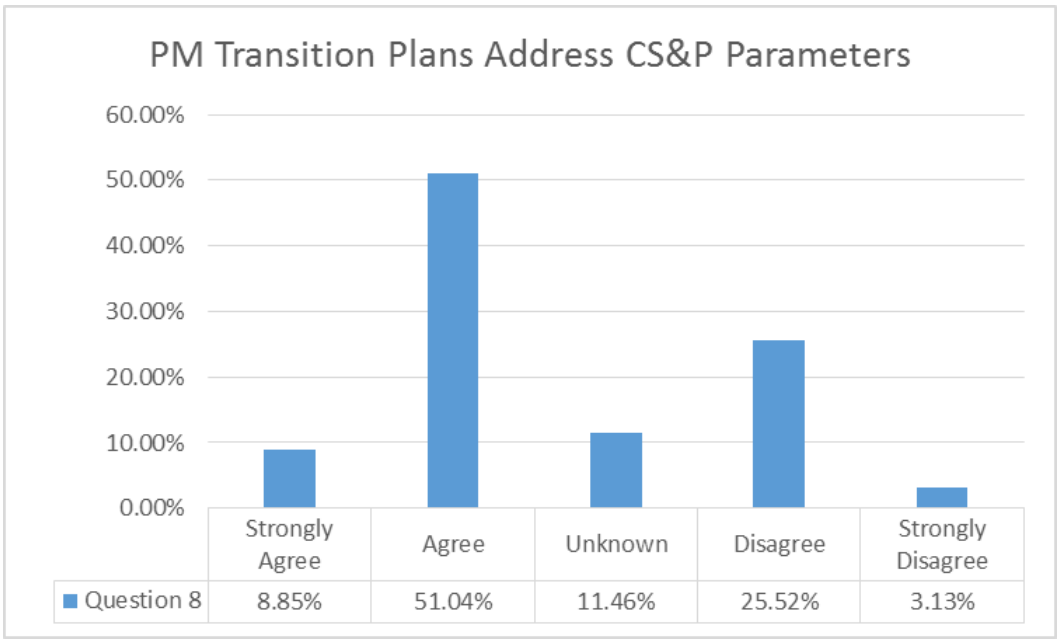


Figure 12 - PM Transition Plans Address Cost, Schedule and Performance

Details of participant response to Question 17: The transition from production to sustainment of a vehicle system, is an efficient process with clear definitions of what the PM and SM organization is responsible to do and when? Participant response to question 17, can be seen in Figure 13.

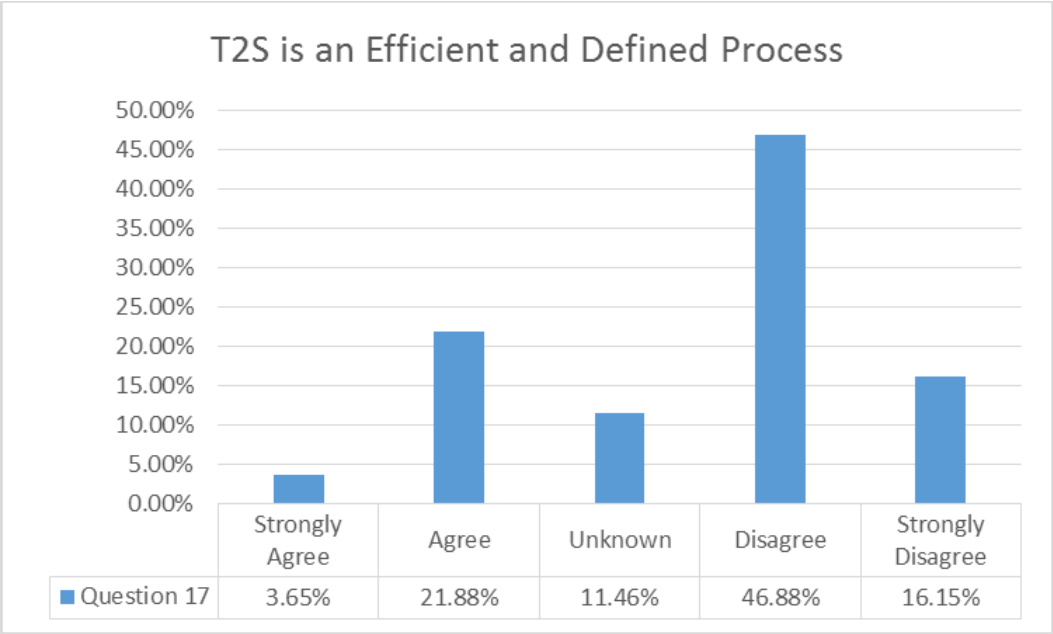


Figure 13 - T2S is an efficient and Defined Process

Obstacles

The T2S obstacles element was evaluated by averaging the responses to survey questions 11 12, 14, 20 and, 24, that inquired about the availability of technical expertise, system specific technical services, organizational separations, current processes, and perception of the end of the system lifecycle.

Data collected for question 11 indicated that 59.6% of participants felt there was a continuing need for technical services after a T2S occurs. The response to question 14 found that 58% of participants agree that the PEOs and LCMC separate missions cause the organizations to operate in a stovepipe manner. Data collected in response to question 20 found that 75.3% of participants feel that current T2S processes and procedures create obstacles and challenges for PMs and SMs.

The two remaining questions were questions 12 and 24. Question 12 asked whether PM provided technical services such as Systems Engineering ended after T2S occurs. The participant response to question 12 was evenly split.

A mixed response may in part be due to the latitude given to PMs and SMs in managing their programs. Situations that arise can result in differing responses from PMs. PMs may or may not be able to assist when an issue arises. The availability of resources and regulatory guidance on how funds can be used play a large role in how a PM can respond when a technical issue arises (DoD OSD Cape, 2014).

Question 24 asked whether there is a perception that PMs view T2S to be the end of a systems lifecycle .Responses to question 24 indicate that 49.8% of participants agree that PMs view T2S as being the end of a systems lifecycle.

The consolidated obstacles element with mean scores of PMs and SMs and the composite sample mean in response to questions 11, 12, 14, 20 and 24, can be seen in Figure 14. The individual survey questions and data that were gathered from them are presented in corresponding figures below Figure 14.

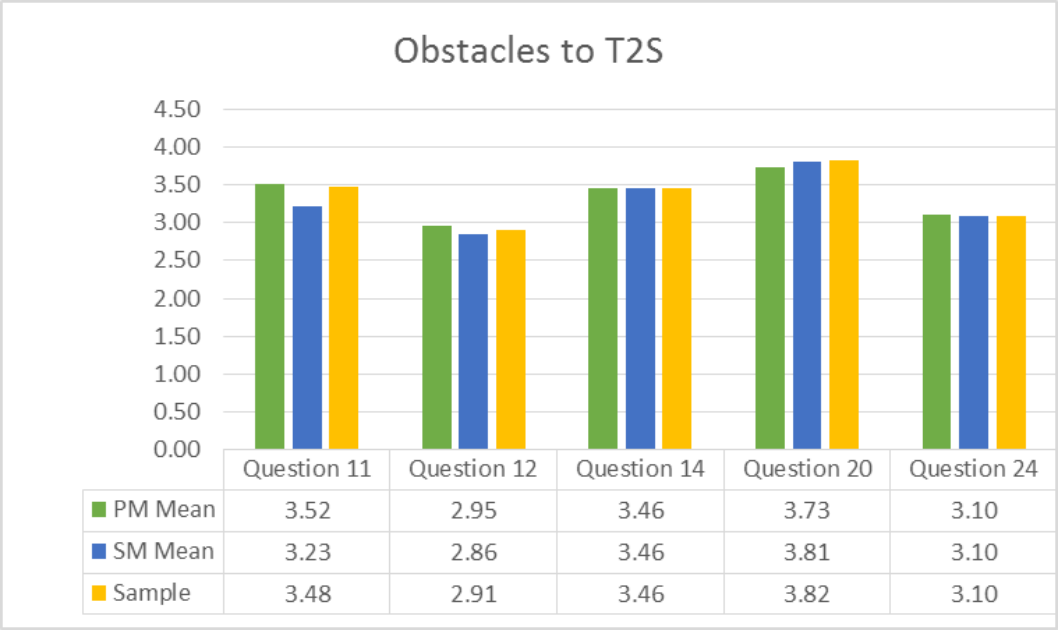


Figure 14 - Obstacles to Transition to Sustainment

Details of participant responses to Question 11: System specific technical expertise provided by engineering and quality assurance SME's are not staff functions that are maintained by sustainment organizations for systems in sustainment. Participant response to question 11, can be seen in Figure 15.

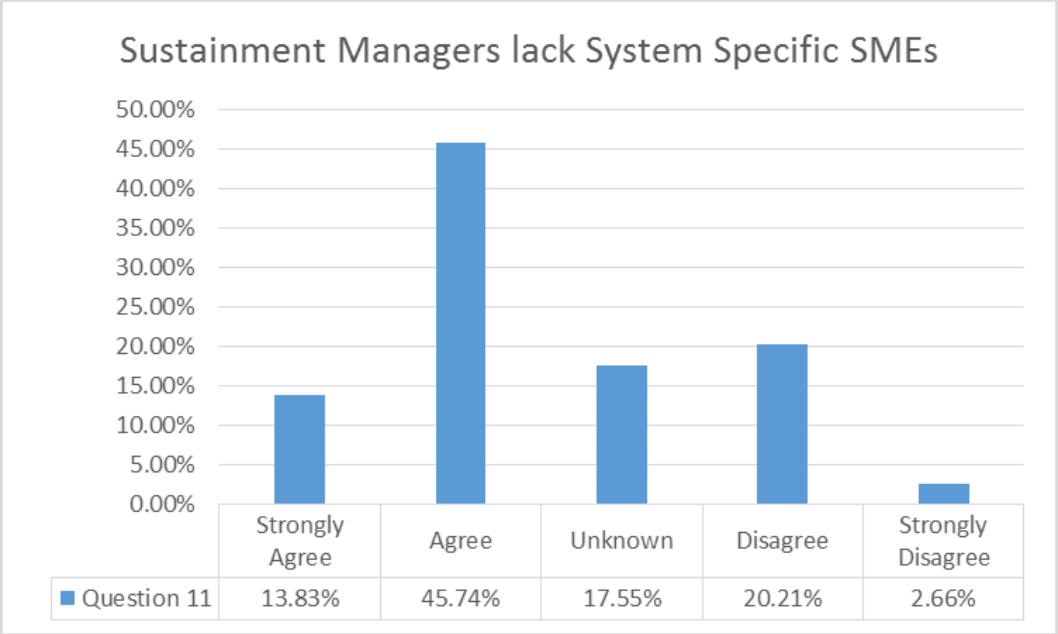


Figure 15 - Sustainment Managers lack System Specific SMEs

Details of participant responses to Question 12: Technical services from PM engineering staff that are available when a system is in production, end when a system transitions to sustainment. Participant response to question 12, can be seen in Figure 16.

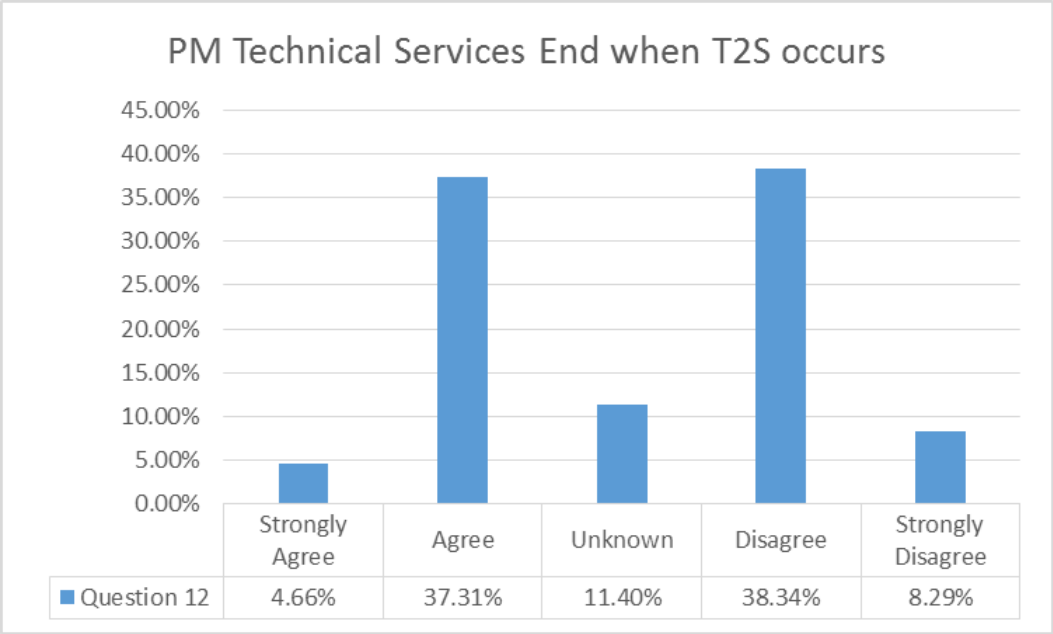


Figure 16 - PM Technical Service End when T2S occurs

Details of participant responses to Question 14: The PEO and TACOM LCMC organization's separate missions and objectives cause them to operate in a stovepipe manner when planning for and managing systems that are transitioning to sustainment. Participant response to question 14, can be seen in Figure 17.

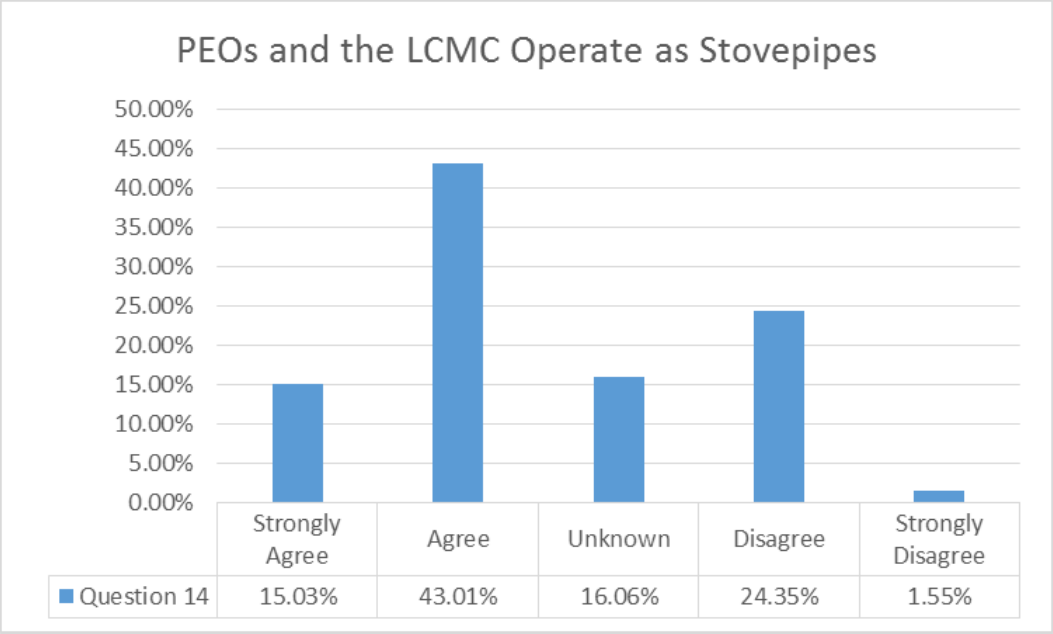


Figure 17 – PEOs and the LCMC Operate as Stovepipes

Details of participant responses to Question 20: The processes that are currently followed when a system is transitioned from production to sustainment create obstacles and challenges between Program Managers and Sustainment Managers. Participant response to question 20, can be seen in Figure 18.

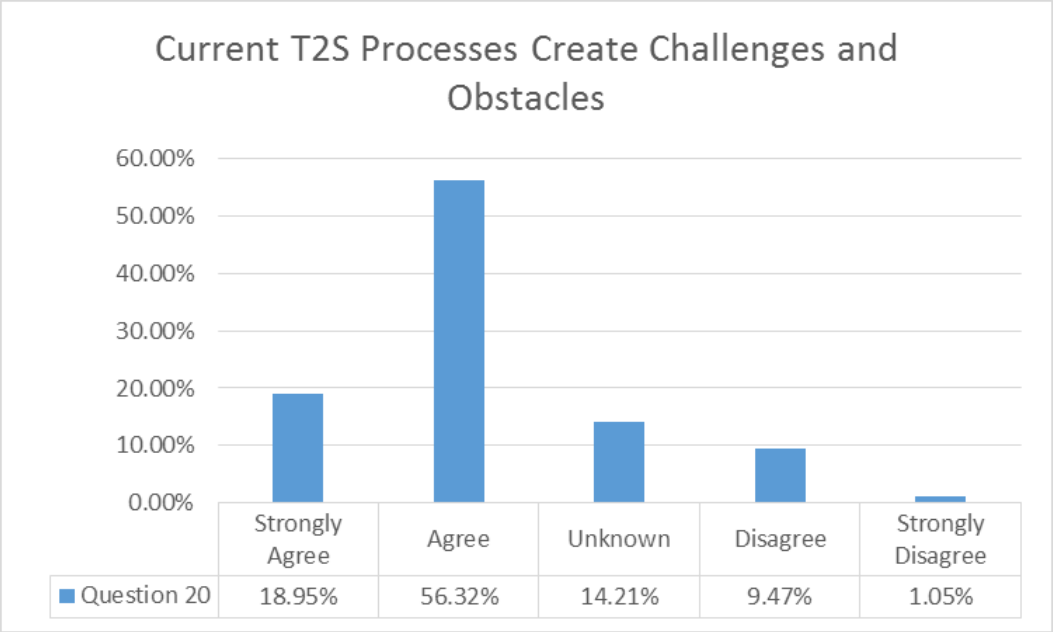


Figure 18 – Current T2S Processes Create Challenges and Obstacles

Details of participant responses to Question 24: Systems that transition from production to sustainment are viewed as being effectively at the end of their lifecycle by the Product Management Office. Participant response to question 24, can be seen in Figure 19.

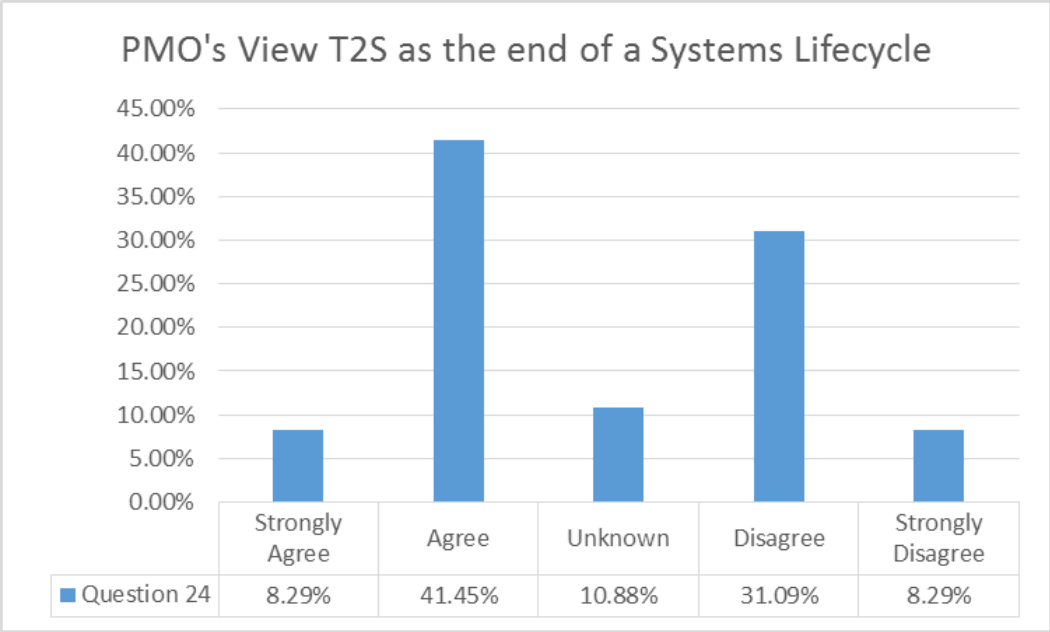


Figure 19 – PMOs view T2S as the end of a Systems Lifecycle

Roles and Responsibilities

The T2S roles and responsibilities element was evaluated by averaging the responses to questions 9, 10 and 22, that inquired about forward planning, PM subject matter expertise, and coordination between PMs and SMs. Question 9 asked whether participants felt that comprehensive forward planning for budgetary and manpower requirements were being conducted prior to transition from production to sustainment of a vehicle system.

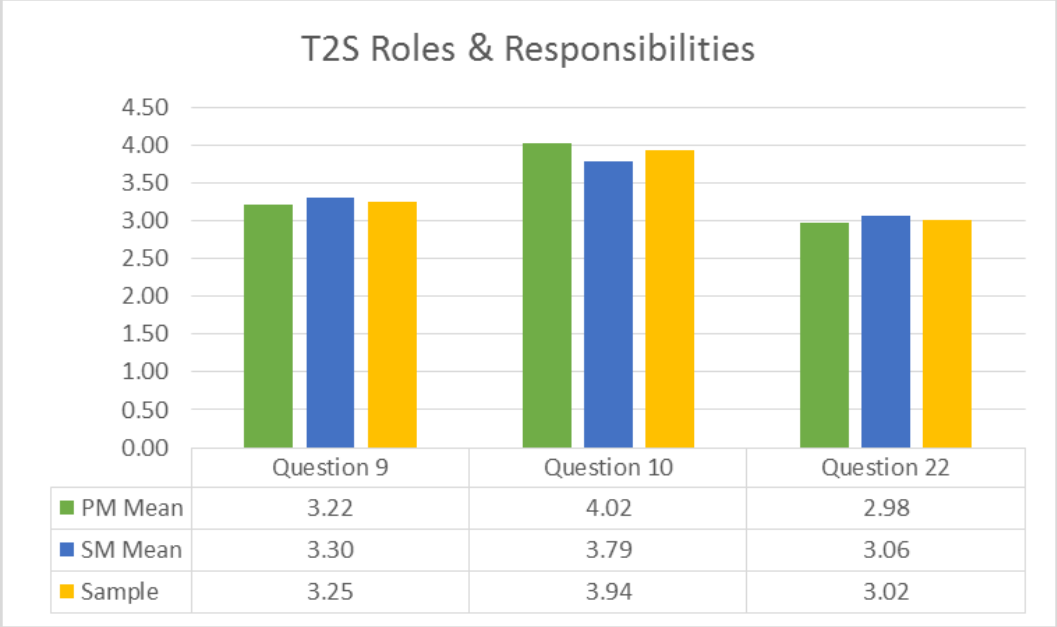
Response from participants indicates that 53% felt that forward planning was being conducted which is a positive move in the right direction. The successful management of

sustainment activities is dependent upon funding and personnel and a key element in Lifecycle Sustainment Planning. As the number of systems that are planned to T2S grows the data developed in early LCSP development efforts will provide the groundwork for future transitions.

Question 10 asked whether Product Management offices were the primary source of engineering and quality assurance technical expertise for the specific systems that PMs managed. Data collected indicates that 80.3% of participants agreed that PMs provide the bulk of engineering and quality assurance technical expertise. The need to maintain technical expertise during sustainment has been noted in the Process and Obstacles elements that have been studied the data in this case reinforces that theme.

Question 22 asked whether Sustainment Managers were coordinating with Product Managers throughout the development and production phases of the lifecycle. Response from participants indicates that 53% felt that early coordination between SMs and PMs was occurring. On the other hand 41% of participants felt that this was not the case. The need to begin sustainment planning early in the system development lifecycle is described in current DoD Instructions and Army regulatory guidance (USD AT&L, 2015) (USD AT&L, 2011).

Findings indicate that there is a need to address and reinforce early communication between SMs and PMs to improve communication across the enterprise. The responses to questions 9 and 10 indicate agreement exists among the participants but not so for question 22. The mean scores of PMs and SMs and the overall sample in response to questions 9, 10, and 22, can be seen in Figure 20. The individual survey questions and data that were gathered from them are presented in corresponding figures below Figure 20.



	Question 9	Question 10	Question 22
PM Mean	3.22	4.02	2.98
SM Mean	3.30	3.79	3.06
Sample	3.25	3.94	3.02

Figure 20 - T2S Roles and Responsibilities

Details of participant responses to Question 9: Comprehensive forward planning for budgetary and manpower requirements is being conducted prior to transition from production to sustainment of a vehicle system. Participant response to question 9, can be seen in Figure 21.

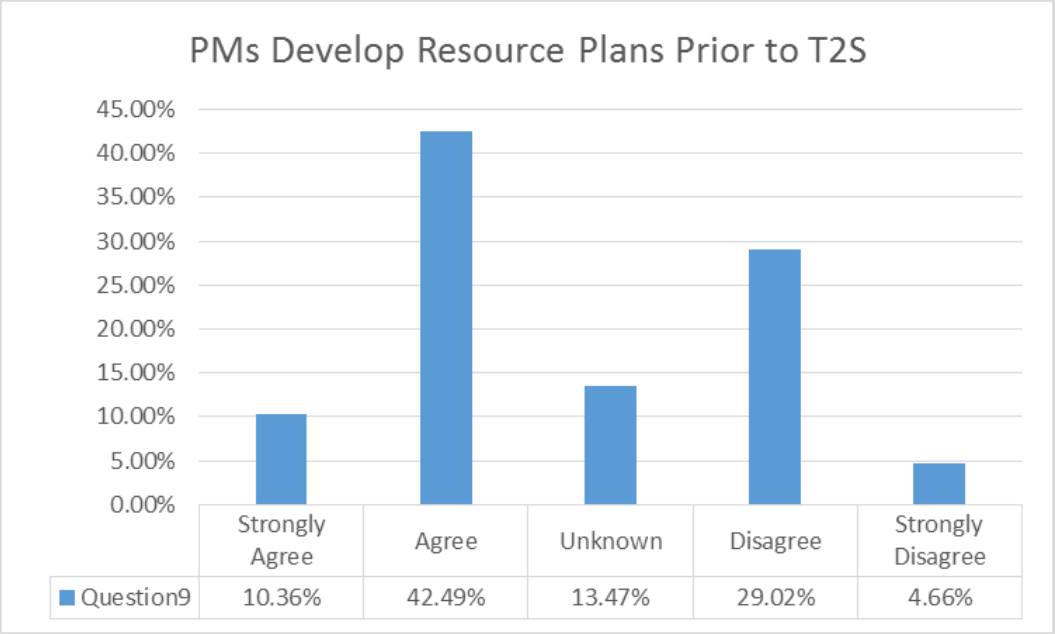


Figure 21 - PMs Develop Resource Plans Prior to T2S

Details of participant responses to Question 10: Product Management offices are the primary source of engineering and quality assurance technical expertise for the specific systems they manage. Participant response to question 10, can be seen in Figure 22.

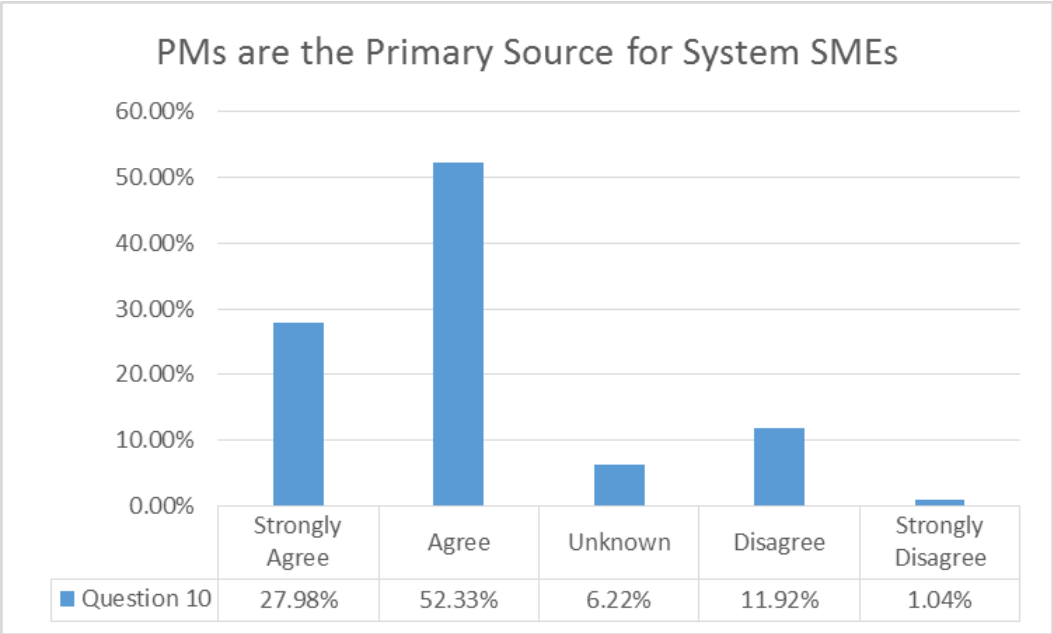


Figure 22 – PMs are the Primary Source for System SMEs

Details of participant responses to Question 22: Sustainment Managers coordinate with Product Managers throughout the development and production phases of the lifecycle. Participant response to question 22, can be seen in Figure 23.

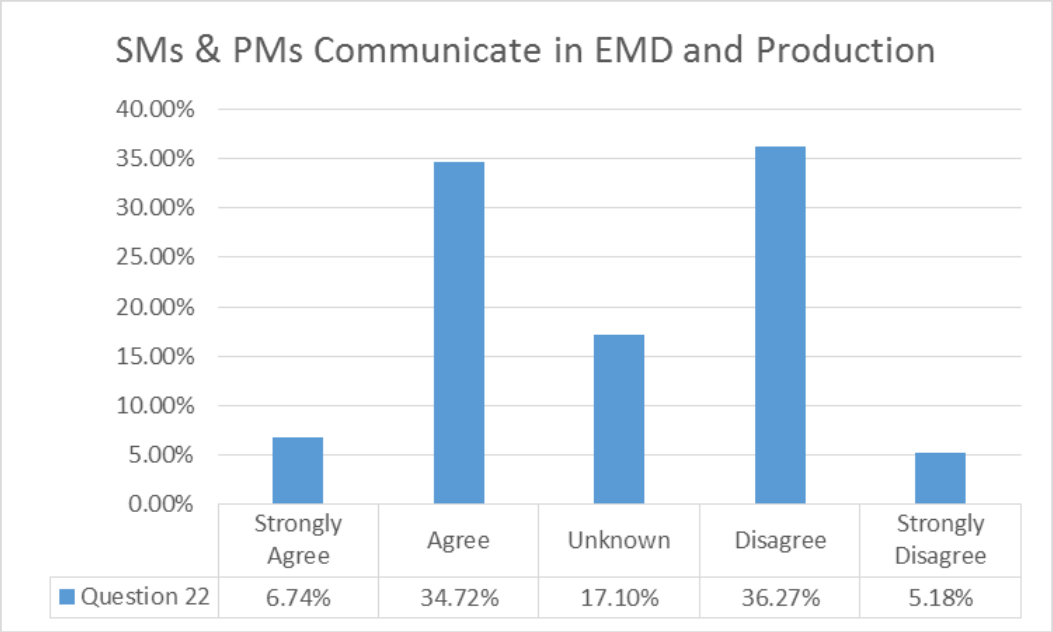


Figure 23 - SMs and PMs Communicate in EMD and Production

Leadership

The T2S leadership element was evaluated using the responses to questions 18 and 19. These questions inquired about the use of established processes and procedures and the development of transition plans for the planning and execution of transitions to sustainment. There was a notable difference in response to question 18 indicating opinions are mixed.

Question 18 asked whether established base processes and procedures were being followed when a system was being transitioned from production to sustainment. The majority of participants 49% indicated that they felt established base processes and procedure were being followed. On the opposite side 39% of participants indicated that they felt that

established base processes and procedures were not being followed. Findings are that a need exists to address established processes and procedures to reinforce their use with SMs and PMs and consider updating them. The literature review verifies this point as it found that there has been little structure accompanying transitioning to sustainment regulations that were released in 1994 (TACOM, 1994).

Question 19 asked if transition plans developed by Integrated Product Teams were required to include estimates of costs, schedule, and readiness performance goals to be met prior to a transition from production to sustainment occurred. Participant response to question 19 was positive with 64.4% of participants affirming that IPTs were including cost estimates, developing schedules, and defining performance readiness goals for sustainment.

The mean scores of PMs and SMs and the overall sample in response to questions 18 and 19, can be seen in Figure 24. The individual survey questions and data that were gathered from them are presented in corresponding figures below Figure 24.

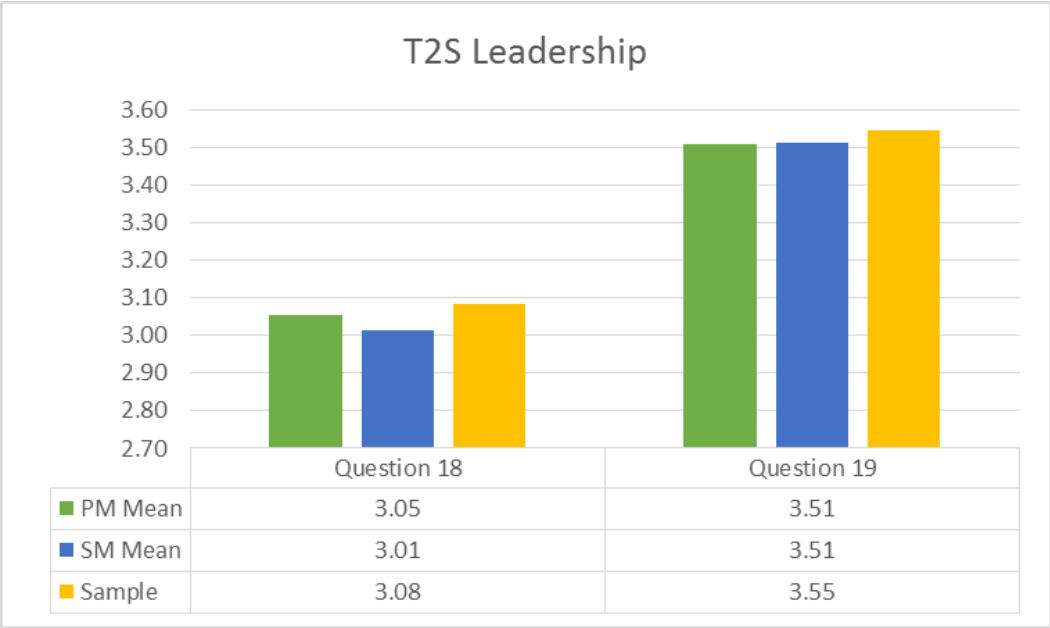


Figure - 24 T2S Leadership

Details of participant responses to Question 18: There are established base processes and procedures that are followed when a system is transitioned from production to sustainment. Participant response to question 18, can be seen in Figure 25.

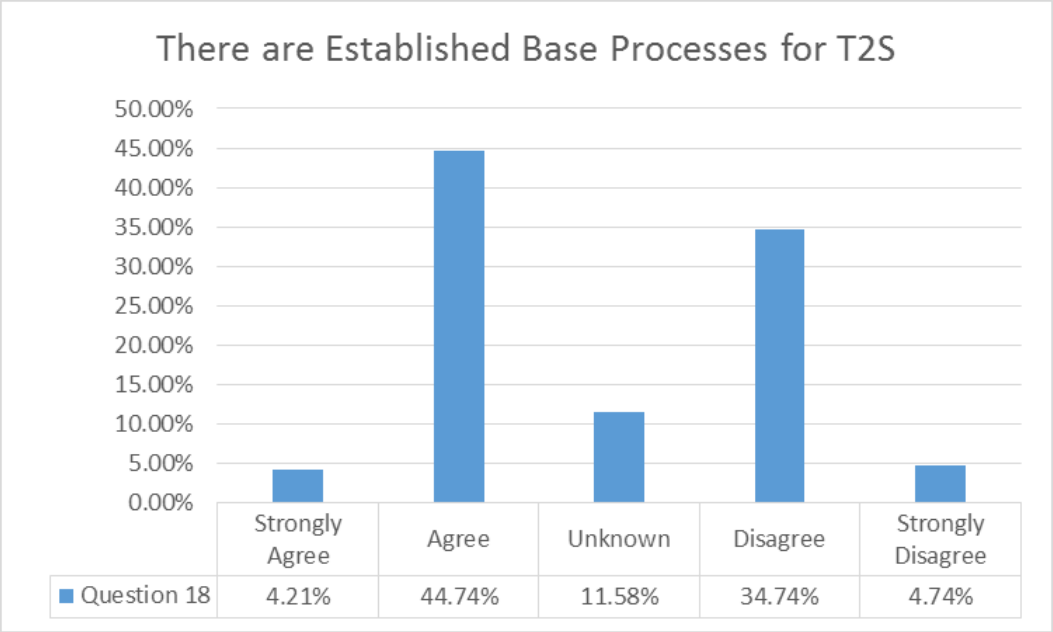


Figure 25 – There are Established Base Processes for T2S

Details participant responses to Question 19: Transition plans developed by Integrated Product Teams are required to include estimates of costs, schedule, and readiness performance goals to be met prior to a transition from production to sustainment. Participant response to question 19, can be seen in Figure 26.

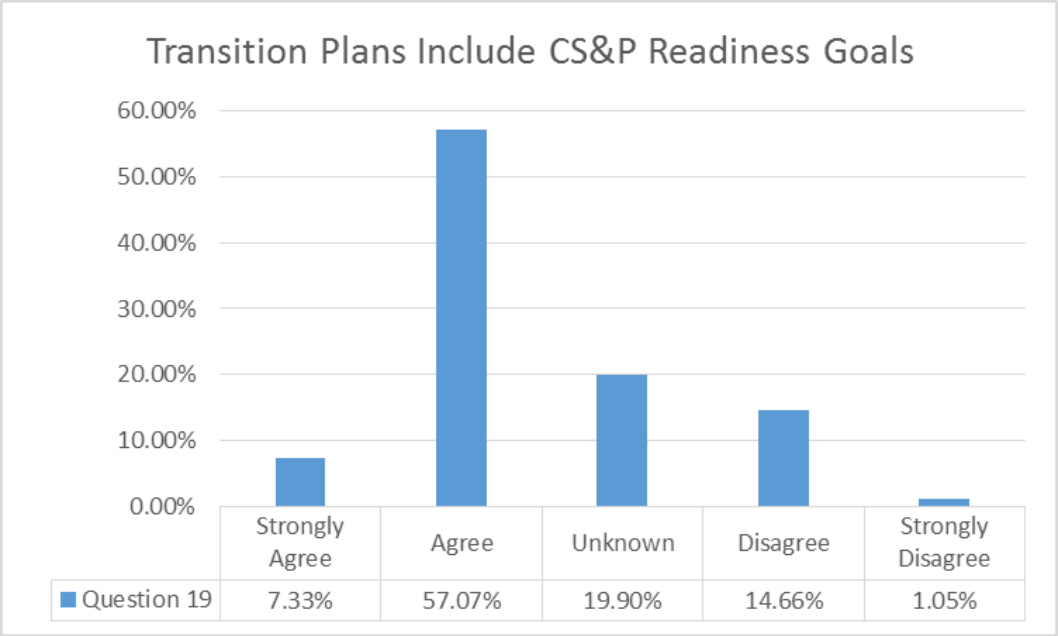


Figure 26 – Transition Plans Include CS&P Readiness Goals

Communications

The T2S leadership element was evaluated by averaging the responses to questions 13, 15, 16 and 23, that inquired about communication within chains of command, with sustainment managers in developing LCSP's, with external stakeholders, and between PMs and SMs during the development of sustainment plans. There was a statistical difference in the responses to questions 13 and 23 indicating that opinions are mixed.

Question 13 asked if Product Managers and Sustainment Managers effectively communicate through their respective chains of command when a system is being transitioned to sustainment. The majority of participants 47% indicated that they felt the

respective Chains of Command were not hindering communications during T2S. On the opposite side 38% of participants indicated that they felt that Chains of Command had a negative impact on communication. This difference in opinions between the participants indicates that communications and collaboration along with the data that support the supposition that the PEOs and TACOM LCMC are stovepipe organizations, needs to be evaluated further and efforts made to address ways to improve communication across the command.

Question 23 asked if Product and Sustainment Managers collaborate and communicate effectively in developing transition plans for the transition of systems from production to sustainment. The data indicates that 43% of participants disagree indicating that SMs and PMs are not communicating or collaborating effectively. On the opposite side 37% of participants agreed that that communication and collaboration was effective between the two. The findings for question 23 support the idea that there is a need for additional study of communication and collaboration at the command.

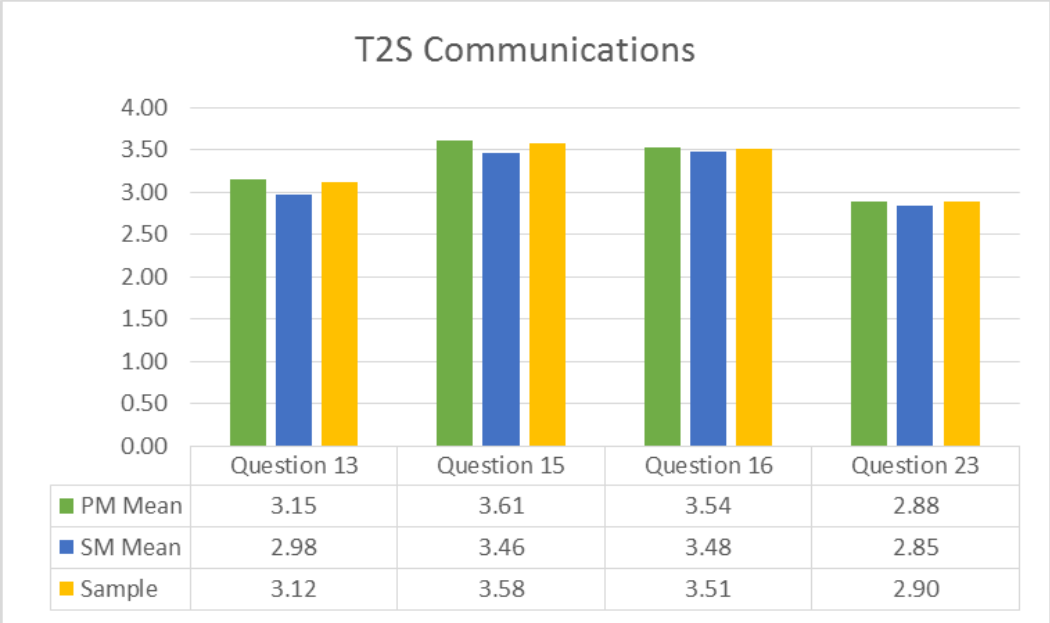
Question 15 asked if Life Cycle Sustainment Plans were being prepared with the input and involvement of Sustainment Managers who represent the TACOM LCMC ILSC. The data indicates that a majority of participants 67% agree that LCSPs are prepared with the involvement of SMs from the ILSC.

Question 16 asked if Life Cycle Sustainment Plans being prepared in a PM office were prepared with the input from stakeholders such as user representatives, the sustainment management organization, business management, and senior leadership from each organization affected. The data indicates that a majority of participants 67% agree that input from stakeholders is collected and taken into account in the development of LCSPs by PMs.

The responses to question 15 and 16 were identical and positive indicating that personnel at the functional and middle management areas are working in IPTs developing LCSPs and Sustainment Plans that will be used during T2S.

The findings for the communication element are that SMs and PMs are not communicating or collaborating effectively as they could or should be. A more comprehensive study may be needed to understand why these communication issues exist to evaluate them further and develop ways to address them and improve communication across the command.

The mean scores of PMs and SMs and the overall sample in response to questions 13, 15, 16 and 23, can be seen in Figure 27. The individual survey questions and data that were gathered from them are presented in corresponding figures below Figure 27.



	Question 13	Question 15	Question 16	Question 23
PM Mean	3.15	3.61	3.54	2.88
SM Mean	2.98	3.46	3.48	2.85
Sample	3.12	3.58	3.51	2.90

Figure 27 – T2S Communications

Details of participant responses to Question 13: Product Managers and Sustainment Managers effectively communicate through their respective chains of command when a system is being transitioned to sustainment. Participant response to question 13, can be seen in Figure 28.

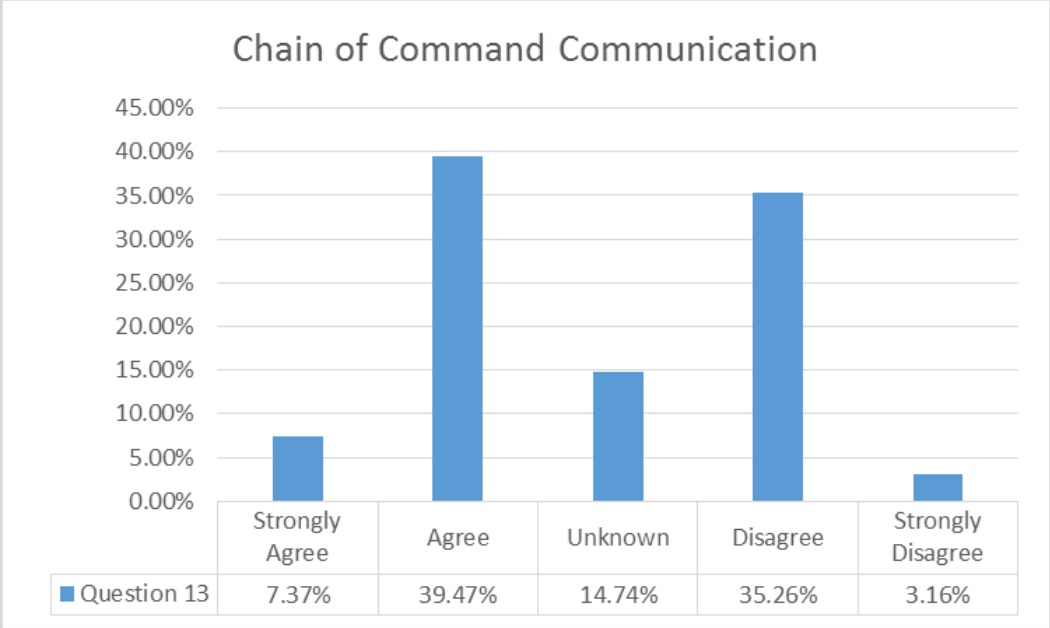


Figure 28 – Chain of Command Communication

Details of participant responses to Question 15: Life Cycle Sustainment Plans are prepared with the input and involvement of Sustainment Managers who represent the TACOM LCMC ILSC. Participant response to question 15, can be seen in Figure 29.

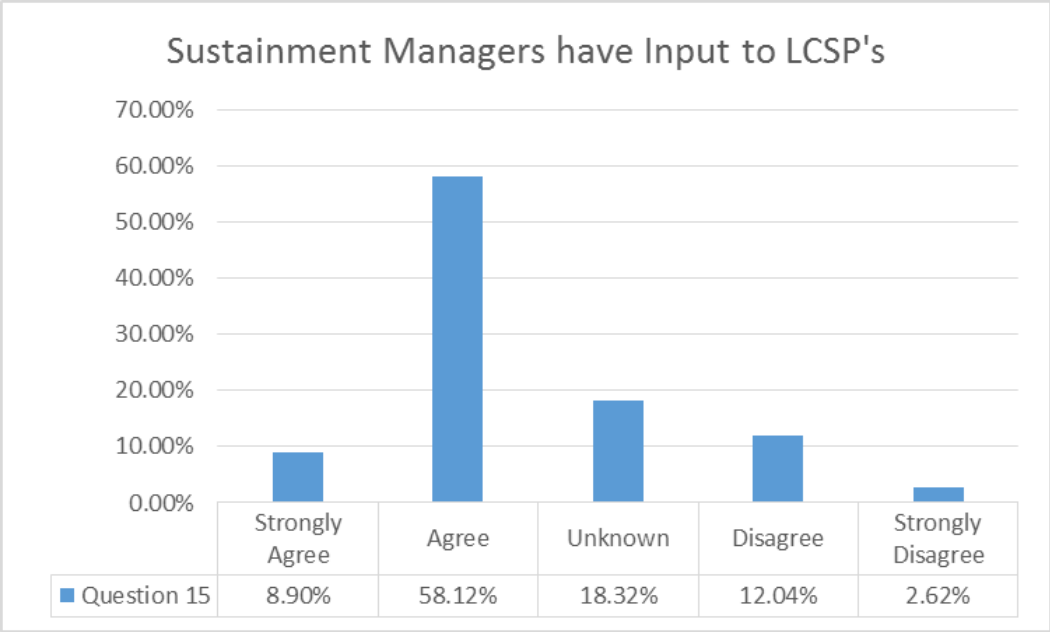


Figure 29 – Sustainment Managers have Input to LCSPs

Details of participant response to Question 16: Life Cycle Sustainment Plans prepared in a PM office are prepared with the input from stakeholders such as user representatives, the sustainment management organization, business management, and senior leadership from each organization affected. Participant response to question 16, can be seen in Figure 30.

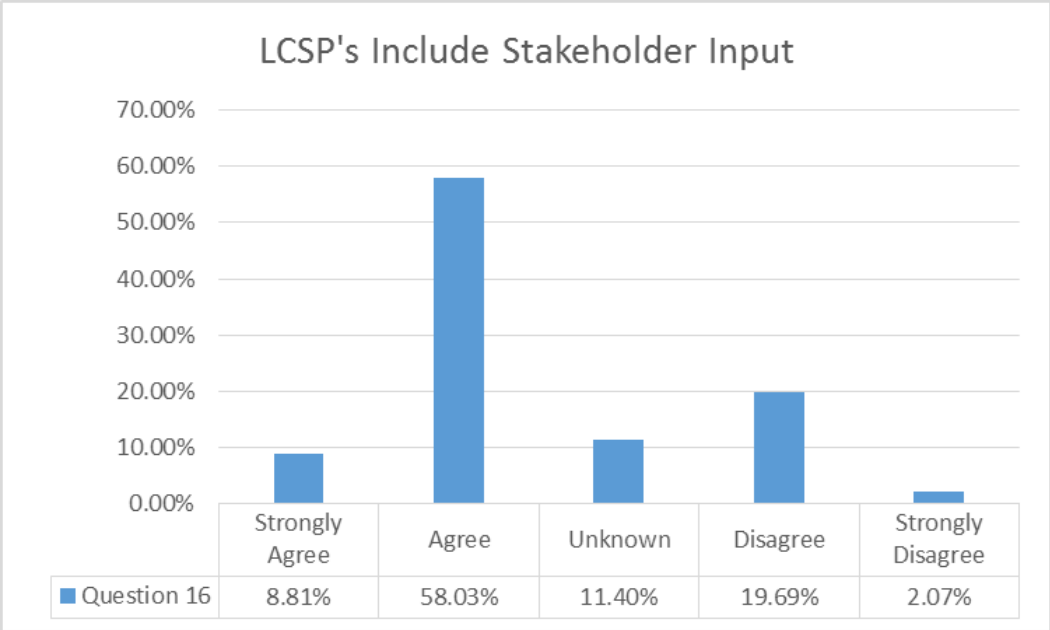


Figure 30 – LCSP's Include Stakeholder Input

Details of participant response to Question 23 Product and Sustainment Managers collaborate and communicate effectively in developing transition plans for the transition of systems from production to sustainment. Participant response to question 23, can be seen in figure 31.

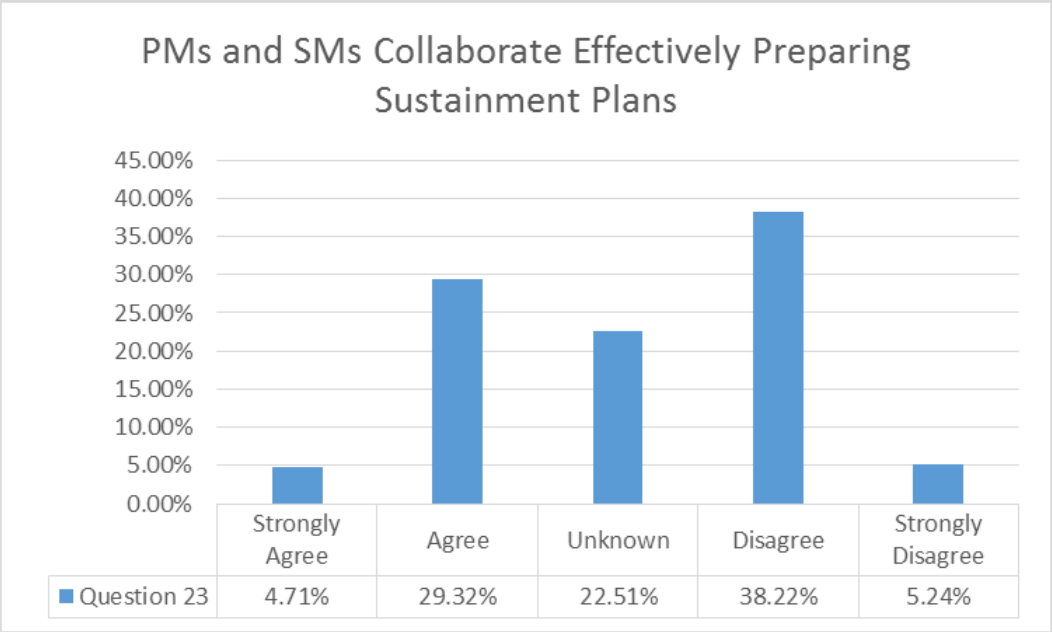


Figure 31 – PMs and SMs Collaborate Effectively in Preparing Sustainment Plans

Reliability and Validity

A one-sample t test of the five elemental areas that were addressed in the Transition to Sustainment survey that asked about Process, Obstacles, Roles and Responsibilities, Leadership, and Communication was conducted on the composite T2S mean score (the mean of all of the responses for each of the questions asked). The *t* test found that the mean of the answers to be (95%CI) = 3.30 (3.23-3.37), T = 8.58, $p < 0.001$.

For the purposes of this study, a mean score greater than 3.00 indicates positive agreement in the responses to the workforce factor elements or individual items in the survey. Those workforce factor elements and items that show a mean score less than 3.00 indicate negative responses from participants and the need for those areas to be studied further.

The data analyses revealed that even though an overall Mean score for the composite element might be greater than 3.00 there were items in the data with Mean scores that were less than 3.00. There were three items in the composite survey sample that had a mean score that was found to be less than 3.00 and three cases where the mean score was just slightly greater than 3.00

Initial reliability tests found two of the five T2S elements contained items that were found to be not reliable, i.e., alpha was less than the mean of 3.00. One item was in Roles& Responsibilities and one item was in Leadership. Accordingly, these two elements were modified by removing the individual items that were found to have an inconclusive impact on reliability. Specifically, for Roles & Responsibilities, 1 item was dropped from Roles and Responsibility and a different item was exchanged with an item that was in the Process element (due to the wording of the question), and 1 item was dropped from Leadership due to the wording of the question being inconclusive.

The resultant T2S data analysis contained 18 items (instead of 20), with 4 items for Process, 5 items for Obstacles, 3 items for Roles & Responsibilities, 2 items for Leadership, and 4 items for Communication. The results of the One-sample *t* test of the five element with their associated items can be seen in Table 2.

Table 2 *Reliability of 18 Survey Items Measuring T2S and it Elements*

Survey Items	Mean[1]	SD[2]	Alpha[3]
T2S Composite (18 items)	3.30	0.49	0.704
Process (4 items)	3.19	0.81	0.787
LCSP development follows the IPT process	3.79	1.03	
T2S is an MMD with entry & exit criteria	3.09	1.16	
PM transition plans include CS&P goals.	3.37	1.05	
T2S is managed efficiently between PM's& SM's	2.50	1.11	
Obstacles (5 items)	3.36	0.61	0.455
SMO's don't maintain system specific SME's	3.48	1.04	
PM provided S-E services end at T2S	2.91	1.13	
PEO's and LCMC missions are stove-piped	3.46	1.07	
T2S process causes friction with PM's and SMs	3.82	0.88	
PMO's view T2S as the end of the system Lifecycle	3.10	1.18	
Roles & Responsibilities (3 items)	3.40	0.74	0.464
PMO's plan ahead for T2S	3.25	1.12	
PMO's provide S-E SME's for their systems	3.94	0.97	
SMO's & PM's coordinate during EMD & Prod.	3.02	1.09	
Leadership (2 items)	3.31	0.83	0.547
There are established base processes for T2S	3.08	1.07	
CS&P goals are met before to T2S	3.55	0.87	
Communication (4 items)	3.28	0.78	0.708
PM's & SM's communicate effectively during T2S	3.12	1.08	
SM's have input in PMO LCSP and T2S planning	3.58	0.91	
PMO LCSP's include & involve all stakeholders	3.51	0.98	
PM's & SM's communicate in planning T2S	2.90	1.03	

Note. A one-sample t test conducted on the composite T2S variable found mean (95%CI) = 3.30 (3.23-3.37), T = 8.58, $p < 0.001$. The Mean of items within scale were each sets of elemental items measured on a 5-point Likert scale, 1 = strongly agree, 5 = strongly disagree. Cronbach's alpha reliability measure of internal consistency of 0.704 is considered as acceptable reliability. Pearson Correlation: P-Value is significant at $p < 0.001$.

Inter-correlations between Study Variables

The inter-correlations of Process, Obstacles, Roles & Responsibilities, Leadership, and Communications and their respective constitutive factors can be seen below in Table 3.

As shown, all variables were significantly positively correlated with each other at $p < 0.001$. These results suggest positive relationships among the elemental items is understood as being required for T2S to be managed successfully and efficiently.

Table 3 *Inter-correlations between Study Variables*

Variable	T2S	P	O	RR	L	C
T2S	1.000					
Process	0.850**	1.000				
Obstacles	0.203**	-0.076	1.000			
Roles&Resp.	0.774**	0.622**	0.148*	1.000		
Leadership	0.737**	0.721**	-0.104	0.510**	1.000	
Communications	0.806**	0.614**	0.152*	0.699**	0.551**	1.000

Note. **$p < 0.001$**. Pearson product moment correlation between study variables (N = 194). T2S = Transition to Sustainment, P = Process, O = Obstacles, RR = Roles and Responsibilities, L = Leadership, C = Communications.

Ranking Questions

This study also sought to discover what the most and least important items of concern were to participants in the management of T2S, and in problem solving after T2S occurs. The survey included two questions number, 26 and 27, that required participants to rank six items in order of most to least importance.

Question number 26 asked participants to rank items that would assist in successfully managing the transition of a system from production to sustainment. The data provided in response 26 was assessed using a statistically derived Mean and Standard Deviation to consolidate the data. The item ranked most important was; “Managing T2S as a formal process

The practice of transferring a program from one organization to another without a formal status review results in a situation where information is lost because it is missed or fails to be fully understood. The participant’s ranking formalization of the T2S process as

being most important also indicates a need exists for the definition of criteria that must be met before a T2S occurs. The process of defining of criteria that must be met prior to a program being approved to move from one stage in its lifecycle to the next is the accepted practice for all Army programs and described in DoD instruction 5002.02 (USD AT&L, 2015).

The items "Empowered Effective IPT's, Resources-Planned Budget, PM has a Complete Approved Transition Plan" were ranked in order as having progressively lesser levels of importance in the management of T2s. The last two items "Completed Technical Manuals, and the Sustainment Manager has an Integrated T2S Management Process" were ranked as having a low importance in managing the T2S process.

The need for the SM to have an Integrated T2S management Process was ranked as being the least important item in the list was counter to the idea that T2S needs to be managed as a formal process. The Sustainment Manager is an equal partner in managing a Transition to Sustainment so they have a vested interest in assuring that there are management processes in place for a T2S to be successful. The results of the evaluation of responses to question 26, can be seen in Table 4.

Table 4 *Ranked Q26, Items Ranked from Most to Least Important for Successful Management during a T2S*

Question 26	Mean	SD
T2S Managed as a Formal Process	4.58	1.70
Empowered Effective IPTs	3.79	1.28
Resources - Planned Budget	3.42	1.71
PM has a Complete Approved Transition Plan	3.30	1.39
Completed Technical Manuals	3.07	1.82
SM has an Integrated T2S Management Process	2.86	1.71

Note. Mean scores > 3.00 indicate participant perception of the importance placed on each ranked item. SD = standard error of Beta, N = 194.

The second ranking question, question number 27 asked participants what they felt might help solve issues that occur with systems after they transition to sustainment. The data provided in response to question 27 was evaluated the same way as question 26, a statistically derived Mean and Standard Deviation were calculated to evaluate which items were considered to be most-to-least important.

The most important item for solving problems after T2S occurred was indicated by participants as having “SME’s embedded within the Sustainment Management Offices”. The level of importance attributed to maintaining system specific technical expertise after a T2S occurs, indicates that the majority of participants have experienced problems with technical issues that arise when managing sustainment.

The next several items ranked from most to least important were “Formal MOUs or Agreements between PMs and SMs, Resources - Planned Budget, Empowered Effective IPTs, and Guidance that defines elements of LCSP. The least important item in the ranking for solving problems after T2S occurred was Completed Technical Manuals.

Completed technical manuals are key to assuring maintenance activities are correctly identified and performed by providing replacement part identification and required maintenance actions to maintain a system. Completed Technical Manuals received the least important ranking because technical manuals are not prepared to offer potential solutions to unanticipated problems that arise during sustainment. The results of the evaluation of question 27, can be seen in Table 5.

Table 5 *Ranked Q27, Items That Are Important to Successful Management after a T2S Occurs*

Question 27	Mean	SD
SME's Embedded within Sustainment Mgt. Offices	4.29	1.73
Formal MOUs or Agreements between PM & SM	3.72	1.56
Resources - Planned Budget	3.47	1.65
Empowered Effective IPTs	3.39	1.70
Guidance that defines elements of LCSP	3.34	1.52
Completed Technical Manuals	2.71	1.71

Note. A Mean score greater than 3.00 indicates agreement with the importance placed on the item. SD = standard error of Beta, N = 194.

Findings

The data analyses found that there are several areas where the Program Management offices and Sustainment Management offices agree about how T2S is managed, but it also revealed areas that need to be studied further and potentially addressed for T2S management to improve.

Answer to Research Question 1

The answer to the research question 1; Are the organizations that make up the TACOM working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization?

Research question one is addressed by the literature review and responses to the survey questions in the process and obstacles elements.

The literature review indicates that T2S has not been a regular practice while the wars in Iraq and Afghanistan have been fought for the past 14 years (Parsons, 2014) as a result personnel may not perceive T2S as being efficient or clearly defined because it is not a process that they are familiar with.

Responses to process question 17 indicate that 63% of survey participants feel that management of T2S is not efficient or clearly defined. Participants also indicated that there were obstacles in communication across the organization and with the processes used to

manage T2S. Reponses to obstacle question 14 indicate that 58% of participants feel that the PEO's and TACOM LCMC's separate missions cause them to operate as organizational stovepipes. The response to obstacle question 20 were similar with over 75% of participants indicating that they feel current T2S processes create challenges and obstacles in the management of T2S.

The findings for research question one were that the organizations that make up the TACOM are not working together efficiently when managing the T2S of ground systems.

Answer to Research Question 2

The answer to the research question 2; are transition to sustainment processes and procedures being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM?

Research question two was addressed in the survey elemental areas of process, obstacles, and communications.

Analyses found that all three elements revealed negative responses to questions asked about communication, which is key to understanding the processes and procedures that need to be followed when PMs and SMs manage T2S.

The process element question 17 indicated that 63% of participants feel that management of T2S is not efficient or clearly defined, meaning that participants are not being given clear guidance to follow. The response to obstacles element questions 14 and 20, were also negative. The responses to question 14 indicate that 58% of participants feel that the PEOs and the TACOM LCMC operate in a stovepipe manner. A stovepipe organization indicates limited cross organizational communication occurs.

The response to question 20 was also negative with 75% of participants indicating that they feel that the way T2S is managed creates challenges and obstacles, further indicating a lack guidance that would assist in planning ahead to head off challenges or obstacles.

The response to communications element question 23 indicates that 43% of participants did not feel that effective collaboration was occurring between PMs and SMs in preparing Sustainment plans.

Analyses of the data to answer research question two revealed that a recurring theme exists in the need to improve communication between PMs and SMs across the TACOM LCMC organizations. The negative data in response to cross organization communication indicates that communication about T2S processes and procedures, are not being communicated, understood or followed by PMs and SMs who play a role in managing T2S processes at TACOM.

Ranking Question Findings

Quantitative and qualitative analyses of the two ranking questions 26 and 27 that asked participants to rank items from most to least important resulted in data that supports the quantitative analyses performed on the survey's workforce factor elements. Question 26 asked participants to rank the six items below in order from 1 to 6 indicating the items that they felt were most important "1" to least important "6" to successfully manage the transition from production to sustainment process. The outcome of the rankings in order of importance for question 26 are:

- T2S Managed as a Formal Process
- Empowered Effective IPTs

- Resources - Planned Budget
- PM has a Complete Approved Transition Plan
- Completed Technical Manuals
- SM has an Integrated T2S Management Process

The highest ranked answer for question 26 was “T2S Managed as a Formal Process”. This indicates that the majority of participants believe that formalizing the transfer of the day to day management of a system with a clear transfer of authority would improve its management in sustainment. The lowest ranked item “the SM has an Integrated T2S Management Process” is totally contradictory to the item that was rated as most important. Sustainment Managers are partners in the successful management of the T2S. Participant indication that an integrated T2S management process is not important may be attributable to the limitations of the study.

Question 27 asked participants to rank the six items below in order from 1 to 6 with most important “1” to least important “6”, to indicate what they felt might help solve issues that occur with systems after they were transitioned to sustainment. The outcome of the rankings in order of importance for question 27 are:

- SME's Embedded within Sustainment Mgt. Offices
- Formal MOUs or Agreements between PM & SM
- Resources - Planned Budget
- Empowered Effective IPTs
- Guidance that defines elements of LCSP
- Completed Technical Manuals

The highest ranked answer for question 27 was, “SME's Embedded within Sustainment Mgt. Offices”. This indicates that there is a need to recognize the complexity of systems that are being transitioned to sustainment with personnel who understand their complexity and can address technical issues that arise as systems in sustainment suffer the effects of use and age. The lowest ranked item, completed technical manuals was ranked as it was because technical manuals deal with maintenance and expected technical issues, not unexpected problems that arise.

Summary

This chapter presented the purpose for the research, the analyses of the data that was collected, and the findings for each element of the subject being studied. The composite mean of workforce factor elements were presented followed by participant responses to individual survey questions. The population and sample size of the personnel whose information was studied were given along with explanation of statistical analyses that were performed on the composite data to evaluate whether data relationships existed.

The answers to the two research questions were negative. The answer to RQ1 is that the organizations TACOM LCMC are not working efficiently in managing T2S due to a need for updated T2S guidance, and because communication across the organizations is stove piped. The answer to RQ1 is that T2S processes and procedures are not being communicated because of communication stovepipes, and that the way T2S is being managed creates obstacles and challenges that lead back to communications between PMs and SMs, and between the PEOs and TACOM LCMC organizations.

Positive findings in the data analyses were that participants responded positively to the use of IPTs in developing LCSP’s and sustainment plans. Participant response to question

6, indicates that 77% are agree with the use of IPTs. Participants also indicate that their leadership is providing some guidance and forward planning for T2S in response to questions18, where 49% of participants agree that guidance that is available is being followed. There was also a positive response to questions about stakeholders who are impacted by T2S having a voice in developing LCSPs and Sustainment plans. Participant response to questions 15 and 16 that asked about SMs and stakeholders having input to LCSP's were both positive with over 68% of participants indicating agreement.

Chapter 5 – Conclusions and Recommendations

This research was undertaken to understand the effectiveness of the processes and procedures followed when the transition from production to sustainment of a combat or tactical vehicle system occurs at the TACOM-LCMC. This study sought to determine whether the organizations that make up the TACOM-LCMC are working together efficiently when transitions to sustainment are put into action and the sustainment of a system is taken up by a sustainment management organization. This paper also sought to determine whether transition to sustainment processes and procedures are being communicated, understood, and followed by PMs and SMs who play a role in T2S management processes at TACOM-LCMC.

This chapter provides conclusions about the literature that was reviewed and the research that was conducted, and recommendations that might be the focus of further study.

Summary of Results and Discussion

The literature review did not locate data that has been previously studied or analyzed about the effectiveness or efficiency of the management of T2S by the Army or other organizations. The literature that is available on the topic of T2S as a whole limited to articles in periodicals that discuss changes coming to the military and industry as budgets decline (Parsons, 2014) and commissioned reports that were prepared describing how T2S was needing to be reassessed in the early 2000's (Peltz E. , 2003)

Policy and Army Regulations that were studied to evaluate guidance about T2S yielded little information other than direction about when T2S was to occur. The only item of guidance that was found, (70-68 DETAR) was guidance pertinent to the Detroit Arsenal that was written in 1994 (USA TACOM, 1994). The DETAR 70-68 regulation references Army

Regulation 70-1, but the reference is outdated. A July 2011 revision to AR 70-1 redefined Total Life Cycle Systems Management in Chapter 1-5, Tenets of Army Acquisition changing how T2S is to be managed.

Documentation that references policy such as DETAR 70-68 becomes obsolete unless it is also updated when the policies that are referenced within them change. The copy of 1994 guidance that was found, was not updated based on the 2011 change to AR 70-1, and it was not signed. The researcher was unable to verify whether the DETAR 70-68 guidance, was ever formalized as policy.

The 2011 update to AR 70-1 states “PM’s are responsible and accountable for the life cycle management of their assigned programs from program initiation through demilitarization and disposal. This is known as Total Life Cycle Systems Management (TLSCM)”. The next sentence states “There is no transition of life cycle management responsibility away from the PM”. They will manage assigned programs in a manner consistent with the policies and principles articulated in governing regulations and in Chapter 2, below (USD AT&L, 2011).

The prohibitory statement “There is no transition of life cycle management responsibility away from the PM” eliminates the practice of transitioning a system from a Program Manager to be managed by a Sustainment Manager and directs that sustainment management remain the PM’s responsibility. The researcher performed an additional literature review for guidance or policy that would prohibit a PM from managing sustainment as a coordinated process with an SM, none was found.

The literature review revealed that T2S does not receive much attention within the Army or other services, and none on the part of industry. The researcher found that industry

does not regularly sustain most equipment for a potential future use the way the military services do. Maintenance in an industry such as trucking is done to keep equipment operating efficiently and profitable (Ryder Corp, 2016). Sustainment for military systems includes maintenance, but it also includes periodic updating, long term storage, and a multitude of other processes that are not normally maintenance activities. Industry limits itself to maintaining systems that are producing profit, disposing of equipment of those that are not (DoD OSD Cape, 2014).

Data Analyses Findings and conclusions

The findings and conclusions for the two research questions and the survey ranking questions are discussed in this section. The researcher sought to determine the differences between PMs and SMs regarding the importance of workplace factors that have an impact on the efficient management of the T2S of a ground system by addressing these two questions.

RQ1: Are the organizations that make up the TACOM working together efficiently when T2S of ground systems occur and sustainment activities are managed by a sustainment management organization?

RQ2: Are transition to sustainment processes and procedures being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes at TACOM?

The workplace factors studied to address the research questions were the importance of: 1) the processes and procedures that are followed when a T2S is being planned and when they occur; 2) the management of obstacles that can have an impact on the success of a T2S; 3) the roles and responsibilities that PMs and SMs share while planning and managing a T2S; 4) the clarity of leadership and guidance that is provided during a T2S; and 5) the adequacy

and effectiveness of communication between PMs, SMs, and their stakeholders, to PMs and SMs.

Data Analyses

The researcher was unable to perform a strictly quantitative analyses that provided conclusive answers to the research questions so a qualitative analysis was performed using participant response data that was collected using the survey.

Data analyses indicated that there were six items in the survey that were either slightly above or below the composite mean indicating that each item was significant to the sample of participants. The six items were: T2S is managed as an MMD with exit and Entry Criteria (Q7), T2S is managed efficiently between PMs and SMs (Q17), PM provided SME services end at T2S (Q12), SMs and PMs Coordinate during EMD and production (Q22), There are established Base processes for T2S (Q18), and PMs and SMs communicate in planning T2S (Q23).

The analyses of the six items indicated that there were three recurring themes. The three themes were: 1) the management of T2S needs guidance and clarity, 2) there is a need of technical services during and after T2S occurs, and 3), communication across the TACOM LCMC organizations is not as effective as it could be.

Data collected in the survey found that participants view management of a T2S to be inefficient and poorly defined. This was found in response to a specific survey question, and in responses to multiple questions about the communication and participant understanding of T2S management and guidance. The data indicates that participants view T2S to be complex and that it needs to be managed using a structured approach such as used in managing other program events but they are not experiencing it in the work they do.

One reason for this may be that T2S is not a task that is described in the management of a systems life cycle. T2S is directed as an event that is expected to occur at a point in time during the system lifecycle. T2S is not described in overarching guidance as being a structured process that needs to be intensively managed.

The conclusion is that teams need to be formed to use accepted IPT practices to address and manage T2S the same as IPTs are used to manage other major programmatic events.

The availability of technical services was noted in the quantitative analyses and in the survey data as an obstacle that affects the management of T2S and sustainment. The successful management of any activity including the management of T2S depends on resources including access to personnel with the requisite skills to analyze problems and developing potential solutions. Program Managers have historically been provided with resources to develop and produce ground systems that require the expertise in the multiple fields of engineering and science (DAU-PA, 2015).

The structure of program management funding is centered on four main tasks design, develop, deliver, and produce that are related to developing and producing systems with new state of the art technologies. Sustainment funding has historically been limited to maintaining the status quo of a system that is used in the field. As a result sustainment is limited to acquiring one-for-one replacement items, when they are needed. Updates are not allowed in sustainment unless they are approved as a specific exception (DAU-O&M, 2015).

The conclusion from the literature review and survey is that sustainment has become increasingly complex while the wars in Iraq and Afghanistan have been fought as the technical complexity of ground systems has grown. The growth in technology of ground

systems has therefore created a need to consider ways to allocate funds for technical personnel during T2S and afterwards in sustainment.

The composite statistics data, and analyses of participant responses to individual survey questions found that communications are not consistent across the TACOM LCMC organizations or between PMs and SMs. The findings from the research are that there is a need to develop and encourage cross organization communication to improve the management of T2S and sustainment after T2S occurs.

Ranking Questions

Quantitative and qualitative analyses of the two ranking questions 26 and 27 that asked participants to rate items from most to least important resulted in data that supports the quantitative analyses performed on the survey's workforce factor elements. Question 26 asked participants to rank the six items below in order from 1 to 6 indicating the items that they felt were most important "1" to least important "6" to successfully manage the transition from production to sustainment process. The outcome of the rankings in order of importance for question 26 are:

- T2S Managed as a Formal Process
- Empowered Effective IPTs
- Resources - Planned Budget
- PM has a Complete Approved Transition Plan
- Completed Technical Manuals
- SM has an Integrated T2S Management Process

The highest ranked answer for question 26 was "T2S Managed as a Formal Process". This indicates that the majority of participants believe that formalizing the transfer of the day

to day management of a system with a clear transfer of authority would improve its management in sustainment. The level of importance given to managing T2S as a formal process supports the evaluation and conclusion for research question one. The conclusion for research question one is that a need exists for teams to be formed following accepted IPT practices to address and manage T2S the same as IPTs are used to manage other major programmatic events.

Question 27 asked participants to rank the six items below in order from 1 to 6 with the most important "1" to least important "6" to indicate what they felt might help solve issues that occur with systems after they were transitioned to sustainment. The outcome of the rankings in order of importance for question 27 are:

- SME's Embedded within Sustainment Mgt. Offices
- Formal MOUs or Agreements between PM & SM
- Resources - Planned Budget
- Empowered Effective IPTs
- Guidance that defines elements of LCSP
- Completed Technical Manuals

The highest ranked answer to question 27 was, SME's Embedded within Sustainment Management offices. This indicates that there is a need to recognize the complexity of systems that are being transitioned to sustainment with personnel who understand their complexity and can address technical issues that arise as systems are sustained.

Both ranking questions align with the information from the quantitative analyses. Question 26 indicates that participants need to understand what is occurring during a Transition to Sustainment with their indicating that formalization of the transfer of system

management from a Program Manager to a Sustainment Manager is most important to them during a transition to sustainment. The response to question 27 is also aligned with the quantitative analysis that indicates there is a need during sustainment for system specific system engineering services to properly manage a system.

Recommendations for Future Research

Future research should be considered in the areas of Process and Procedures. The literature review and the responses received from participants in the PMs and SMs indicate that there is a lack of information in this area. The only document found that described the system transition process was an outdated item of policy written in 1994 (TACOM, 1994) at the Detroit Arsenal. The responsibility to sustain ground systems has been officially assigned to the PM in the update that was made to Army Regulation 70-1 in 2011, but there has not been any guidance that the researcher has been able to find that indicates how the PM and SM are to work together to assure a smooth T2S occurs.

To improve the T2S process there needs to be a formalization of the management of T2S between Program Managers and Sustainment Managers using a memorandum of understanding or similar agreement to document the responsibilities of each organization.

It is also recommended that a study be conducted to find methods to provide Systems Engineering services during sustainment. Response to survey question 11 indicates that 59% of participants agree that SMs need some level of technical services during sustainment.

Programs live and die by the budget lines they are assigned to and the estimates of sustainment costs that are made when LCSP's are prepared. The Army's method of managing costs during sustainment utilizes estimates based on the information available at

the time of development with business case analyses of future costs adjusted for inflation and other factors (DoD OSD Cape, 2014). The need to plan and budget for a continuation of Systems Engineering services to be available during sustainment is an area that requires further study and possibly the modification of the way business cases are prepared.

Finally the area of Communication was indicated in data analyses as an area that needs attention and possibly further study. Throughout the study of T2S the researcher has noted that there are differences between the organizations that make up the TACOM LCMC. The PEOs and the LCMC have separate chains of command with missions that are also separate and distinct. These separate but interrelated missions are being negatively affected by the lack of communication between the separate organizations. It is recommended that each organization consider finding ways increase communication through the use of liaison personnel or other means to improve T2S management processes.

Study Limitations

This study had three limitations associated with it in the areas of literature, data collection and measurement:

The first limitation is associated with the amount of available literature to review. There are no articles of a scholarly nature that address Transition to Sustainment as a topic and very little written about the topic otherwise. Discussions and articles about Transition to Sustainment were found in forums such as the National Defense Industrial Association and in publications such as Defense News but those articles generally describe what is expected to occur in the defense industry as a result of moving away for production and toward sustainment. There are reports that have been prepared by organizations like Rand Arroyo that address topics that affect sustainment but that is about all.

The second limitation is that survey results were limited because participant response was not distributed evenly across the career fields. In this study there were significantly more participants with careers in the field of Logistics than any of the other career fields from which data was received. This possible bias might be eliminated if the data were collected from a wider audience that was limited to fewer career fields with a further narrowing of focus limited to Program Management, and the Logistics fields.

A third limitation was the wording of questions that were in the survey instrument. Two questions were eliminated because of the way they were worded which resulted in null data through use of the 5-Point Likert scale.

Summary

This research studied Transition to Sustainment at the TACOM LCMC to evaluate whether the organizations that make up the TACOM LCMC are working together efficiently when T2S of ground systems occur and whether transition to sustainment processes and procedures are being communicated, understood, and followed by the Program Managers and Sustainment Managers who play a role in T2S management processes.

Findings from the study indicate both quantitatively and qualitatively that transitions to sustainment are not being managed as well as they could be. Existing guidance has become outdated and communications across the organizations need to improve to be prepared ready for the influx of work as the number of systems being planned to transition to sustainment increases.

The need for system specific systems engineering services during sustainment was found in the analyses to be in need of further study with a recommendation that it be explored to find ways to increase the availability of this expertise. Lastly, communications

between Program Managers and Sustainment Managers was also found to be in need of further study to find ways to improve how Program Manager and Sustainment managers interact and manage sustainment planning and execution.

References

ASA AL&T. (2015, April 29). *Memo-Operations and Support Review.*

Behn, R. (2006, February 1). *Stovepipe Bureaucracies Live.* Retrieved from Teh Behn Report, Public Management Review: http://www.ksg.harvard.edu/thebehnreport/February2006.pdf

Boyatzis, R. E. (1998). *Thematic Qualitative Information: Thematic Analysis and Code Development.* Thousand Oaks: Sage Publications.

Braun, V. &. (2006, February 18). Using Thematic Analysis in Psychology. Qualitative Research in Psychology, 3(2). *Routledge Taylor & Francis Group* , 77-101. Retrieved from Taylor Francis online: http://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa

Brown, S. (2010, December). *Likert Scale Examples for Surveys*. Retrieved from Iowa State University Extension: http://www.extension.iastate.edu/ag/staff/info/likertscaleexamples.pdf

Charter, R. A. (2001). It Is Time to Bury The Spearman-Brown Prophecy. *Educational and Psychological Measurement*, 690-696.

Cragun Deborah, P. T. (2015). Qualitatiive Conparative Analysis: A Hybrid Method for Identifying Factors Associate with Program Effectiveness. *Journal of Mixed Methods Research*, p.1558689815572023.

Creswell, J. W. (2007). *Qualitative Inquiry and Research Design.* Thousand Oaks CA: Sage Publications.

Cronbach, L. J. (1951). Coefficient Alpha and the internal structure of tests. *Psychometrika*, 16: 297-334.

CS&CSS, U. A. (2016, March 14). *Program Executive Office Combat Support & Combat Service Support*. Retrieved from PEO-CS&CSS : http://www.peocscss.army.mil/

DAU-O&M. (2015, September 18). *ACQuipedia.* Retrieved from Operations & Maintenance Funds : https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=2a9cba84-43bf-43ff-af23-4b6451e7c1bd

DAU-PA. (2015, September 18). *Procurement Funds.* Retrieved from ACQuipedia: https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=9be81897-aae7-4b76-8887-f9334c6d77af

DoD OSD Cape. (2014, March). *OSD Cost Assessment and Program Evaluation Operating and Support Estimating Guide*. Retrieved from OSD Cape: http://www.cape.osd.mil/files/OS/Guide/v9_ March_2014.pdf

DOD, U. (1998, August 1). *DoD Integrated Produce and Process Development Handbook.* Retrieved from Office of Secretary of Defense: http://www.acq.osd.mil/se/docs/DoD-IPPD-Handbook-Aug98.pdf

GCS, U. A. (2016, March 14). *PEO GCS*. Retrieved from Program Excecutive office - Ground Combat Systems: http://www.peogcs.army.mil/about.html

Hinkin, T. R. (1998, March 13). *A brief Tutorial on the development of research methodsnin survey questionnaires*. Retrieved from Cornell University, School of Hotel Administration site: http://scholarship.sha.cornell.edu/articles/521

Lange, T. (2015). *The Role of Relationship Marketing and SOAR in University Recruiting and Retention.* Southfield, MI: Lawrence Technological University.

LCMC, T. (2014, January 24). *TACOM LCMC ILSC*. Retrieved from US Army TACOM Life Cycle Managment Command: https://www.tacom.army.mil/ilsc/

Medlin, J. a. (2011, November 3). *MR LCSP* . Retrieved from Life Cycle Sustainment Plan: http://www.acq.osd.mil/log/mr/psm/16 workshop 1 LCSP outline 3 nove 2011.pdf

MG, Wyche, L.D. (2013, August 30). Globally Responsive Sustainment. *Army Sustainment White Paper*. Ft. Eustis, Virginia, USA: US Army CASCOM.

Morgan, R. V. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, 607-610.

Parsons, D. (2014, July). *Tactical Vehicles*. Retrieved from National Defense Industrial Association: http://wwwnationaldefensemagazine.org/archive/2014/july/pages/armyswitchesfromvehicleproductionto sustainmentmode

Peltz, E. (2003). *Equipment Sustainment Requirements for the Transforming Army.* Santa Monica: Rand .

Peltz, E. L. (2002). *Diagnosing the Army's Equipment Readiness: The Equipment Downtime Analyzer.* Santa Monica: Rand .

Ryder Corp. (2016, March 22). *Ryder Fleet Maintenace.* Retrieved from Fleet Maintenance Solutions: http://www.ryder.com/managed-maintenance.aspx

Santos, J. (1999, April 1). *Cronbach's Alpha: A tool for assessing reliability of scales.* Retrieved from Journal of Extension: http://www.joe.org/joe/

Shah, S. K. (2006). Building Better Theory by Bridging the Quantitative-Qualitative Divide. *Journal of Management Studies*, 1821-1835.

Stat Trek.com. (2016, February 20). *Sample Size ; SWimple Random Samples*. Retrieved from Stat Trek: http://stattrek.com/

TACOM, U. A. (1994, June 1). Detroit Arsenal Regulation. *70-68*. Warren, Michigan, Macomb: US Army TACOM .

Triola, M. F. (2001). *Elementary Statistics, 8th ed.* Boston: Addison Wesley Longman, Inc.

Trochim, W. &. (2007). Qualitative Mixed Methods Design. In W. &. Trochim, *The research methods knowledge base* (p. 183). Mason: Thompson.

USA TACOM. (1994, June 1). Research, Development, and Acquisition Systems Transitioning. *Detroit Arsenal Regulation 70-68*. WArren, Michigan, USA: Detroit Arsenal.

USD AT&L. (2011, August 22). *Army Regulation 70-1*. Retrieved from Army Acquisition Policy: http://www.apd.army.mil/jw2/xmldemo/r70_1/main.asp#ch2

USD AT&L. (2015, January 7). *DoDI 5000.02.* Retrieved from Defense Acquistion Giudebook: http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf

Glossary of Acronyms and Terms

ANOVA .....Analysis of Variance

AT&L.....Acquisition, Technology and Logistics

CS&CSS .....Combat Support & Combat Service Support

DAG.....Defense Acquisition Guidebook

DAU.....Defense Acquisition University

DOD.....Department of Defense

DoDD.....Department of Defense Directive

GCS.....Ground Combat Systems

H_0 .....Null Hypothesis

H_1 .....Alternate Hypothesis

ILSC .....Integrated Logistics Sustainment Center

IPPD .....Integrated Product and Process Development

IPT .....Integrated Product Team

IRB.....Institutional Review Board

LCMC .....Life Cycle Management Command

LCSP .....Life Cycle Sustainment Plan

LTU .....Lawrence Technological University

MRAP .....Mine Resistant Ambush Protected

OPSEC.....Operational Security

PEO.....Program Executive Office

PM .....Program Manager

SME .....Subject Matter Expert

T2S.....Transition To Sustainment

TACOM.....Tank Automotive and Armaments Command

USD(AT&L)..Under Secretary of Defense for Acquisition, Technology and Logistics

Appendix A – Survey Instrument

* 1. Hello,

My name is Patrick Macheske, I am currently enrolled as a graduate student within Lawrence Technological University's College of Management and as a Fellow in the Defense Acquisition University's (DAU's) Senior Service College Fellowship Program. I am conducting research to gain a better understanding of the Transition from Production to Sustainment of Combat and Tactical Vehicle systems and major secondary items that are associated with them and discreetly managed.

I am inviting you to participate in this study because you are at least 18 years of age and a member of the TACOM Life Cycle Management Command working in a career field that may be able to provide insight into this topic.

As an adult 18 years of age or older, you agree to participate in this survey about the Transition to Sustainment process. You understand that your participation is entirely voluntary and that you can withdraw your consent at any time. By agreeing to participate in this study, you indicate that you understand the following:

-- If you choose to participate, you will be asked to complete an on line survey which will take approximately 10-15 minutes to complete.

-- There will be no incentive for participation.

-- All items in the survey are important for analysis, and the data will be more meaningful if all questions are answered. You can discontinue participation at any time without penalty by exiting out of the survey.

-- This survey should not expose you to any discomfort or stress beyond that which might normally occur during a typical day. There are no right or wrong answers; thus, you need not be stressed about finding a correct answer.

-- There are no known risks associated with your participation in this study.

-- Data collected will be handled in a confidential manner and will remain anonymous.

This research is carried out under the oversight of the Institutional Review Board (IRB) of Lawrence Technological University http://www.ltu.edu/provosts_office/irb.asp. If you want to contact the IRB directly, please contact Lawrence Technological University, Institutional Review Board, 21000 West Ten Mile Road, irb@ltu.edu, (248) 204-3096.

This survey is being conducted by Patrick Macheske as part of an independent study activity (patrick.macheske@dau.mil).

- ◯ I have read this informed consent and I AGREE to participate
- ◯ I have read this informed consent and I DO NOT AGREE to participate

Macheske - Transition of Systems from Production to Sustianment Survey v1

Demographic Data

* 2. What is your primary career field?

- ◯ Program Management
- ◯ Engineering
- ◯ Acquisition Management
- ◯ Logistics Sustainment Management
- ◯ Logistics Maintenance Management
- ◯ Contracting
- ◯ Business Management
- ◯ Product Assurance

3. How many years have you worked for the U.S. Government in your primary career field?

◯ 1 - 7 ◯ 8 - 15 ◯ 16 - 23 ◯ 24 - 32 ◯ 32 +

* 4. What is your current career status?

- ◯ U.S. Army Military
- ◯ DoD Civilian
- ◯ Other (please specify)

5. Which of these categories best describes your current position?

- ○ Team Member
- ○ Team Leader
- ○ Branch Chief - Supervisor
- ○ Division Chief - Director
- ○ Deputy Product Manager
- ○ Product Manager
- ○ Deputy Project Manager
- ○ Project Manager

Macheske - Transition of Systems from Production to Sustianment Survey v1

Survey Purpose

This survey is being sent to you to study the effectiveness of the processes and procedures that are followed when the Transition of a system from Production to Sustainment is put into effect.

The questions that follow ask you to consider and indicate your view of the processes and procedures that are followed when a combat or tactical vehicle system or a major component such as a major secondary item such as a transmission, engine, or other item is transferred from the control and oversight of a Product office to a Sustainment organization to be managed for the remainder of its lifecycle.

6. Life Cycle Sustainment Planning that you participate in is conducted within the framework of an Integrated Product Process Team using Integrated Product Teams?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

7. The transition from production to sustainment of a vehicle system is managed in the same way as a major program milestone decision, with predetermined exit and entry criteria for the transition from product management to sustainment management to begin as production of the system ends?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

8. Product Managers develop transition plans that include estimated cost, schedule, and performance parameters for the systems they manage to assure systems are able to successfully transition from production to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

9. Comprehensive forward planning for budgetary and manpower requirements is being conducted prior to the transition from production to sustainment of a vehicle system?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

10. Product Management offices are the primary source of engineering and quality assurance technical expertise for the specific systems they manage?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

11. System specific technical expertise provided by engineering and quality assurance subject matter experts are not staff functions that are maintained by Sustainment Management organizations for systems in sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

12. Technical services from Product Manager engineering staff that are available when a system is in production, end when a system transitions to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

13. Product Managers and Sustainment Managers effectively communicate through their respective chains of command when a system is being transitioned to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

14. The Program Executive Offices and the TACOM LCMC organizations separate missions and objectives, cause them to operate in a stovepipe manner when planning for and managing systems that are transitioning to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

15. Life Cycle Sustainment Plans are prepared with the input and involvement of Sustainment Managers who represent the TACOM LCMC ILSC?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

16. Life Cycle Sustainment Plans are prepared in a Product Management office are prepared with input from stakeholders such as user representatives, the Sustainment Management organization, business management, and senior leadership from each organization affected?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

17. The transition from production to sustainment of a vehicle system is an efficient process with clear definitions of what the Product Management office and Sustainment Management organization is responsible to do and when?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

18. There are established base processes and procedures that are followed when a system is transitioned from production to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

19. Transition plans developed by Integrated Product Teams are required to include estimates of costs, schedule, and readiness performance goals to be met prior to a transition from production to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

20. The processes that are currently followed when a system is transitioned from production to sustainment create obstacles and challenges between Product Managers and Sustainment Managers?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

21. Guidance for the transition from production to sustainment needs to be consistent and provided to all involved in sustainment planning to assure transition occurs successfully?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

22. Sustainment Managers coordinate with Product Managers throughout the development and production phases of the lifecycle?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

23. Product and Sustainment Managers collaborate and communicate effectively in developing transition plans for the transition of systems from production to sustainment?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

24. Systems that transition from production to sustainment are viewed as being effectively at the end of their lifecycle by the Product Management office?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagree
○	○	○	○	○

25. Transition from production to sustainment occurs informally without a memorandum of understanding or other written agreement between a product management office and sustainment management office?

Strongly Agree	Agree	Unknown	Disagree	Strongly Disagre
○	○	○	○	○

26. Rank the items below in order from 1 to 6 indicating the items that you feel are most important "1" to least important "6" to successfully manage the transition of a system from production to sustainment process.

- [ ] Integrated Product Teams that are empowered and effective
- [ ] Complete Sets of Technical Manuals
- [ ] The Product Manager has a coordinated and approved Transition Plan
- [ ] The Sustainment Manager has an integrated transition management process
- [ ] Resources (Adequate funding for personnel, spare parts and services) are planned and a budget is established
- [ ] A formal process to include exit and entry criteria prior to a systems transitioning from production to sustainment

27. Rank the items below in order from 1 to 6 with most important "1" to least important "6" to indicate what you feel may help solve issues that occur with systems after they transition to sustainment.

- [ ] Integrated Product Teams that are empowered and effective
- [ ] Complete sets of Technical Manuals
- [ ] Guidance that assists with defining the detailed elements of a Sustainment plan
- [ ] Formal transition agreements between Sustainment and Product Manager offices
- [ ] Subject Matter Experts embedded within Sustainment Management offices to address technical issues that arise after a transition occurs
- [ ] Resources (Adequate funding for personnel, spare parts and services) are planned and a budget is established

Macheske - Transition of Systems from Production to Sustianment Survey v1

Conclusion

Thank you for participating in this survey.

Appendix B – Institutional Review Board Approval Letter

Institutional Review Board
Office of the Provost
research.ltu.edu irb@ltu.edu

December 9, 2015

Patrick Macheske
Lawrence Technological University
College of Management
Senior Service College Fellowship Program
pmacheske@ltu.edu

Dear Mr. Macheske,

I am pleased to report that the IRB application to conduct research with human participants for your SSCF thesis "Transition of systems from Production to Sustainment" has been approved under the Expedited review path for a period of one year, December 9, 2015 – December 9, 2016.

The IRB is satisfied that the following ethical concerns regarding the treatment of your human participants have been addressed in your research protocol: (1) The research involves administering a web-based survey to an individual who is at least 18 years of age or older in order to investigate respondent understanding and familiarity with the Transition of Army systems from production to sustainment for the remainder of their lifecycle; (2) Participants who will voluntarily consent to complete the survey are free to withdraw from the study at any time; (3) You have identified potential risks to you and the participants; and (4) You have assured that a balance exists between potential benefits of the research to the participants and/or society and the risk assumed by the participants.

Please contact the IRB if you require an extension to your project after one year. Please note you must contact the IRB if you make a change to your research protocol that impacts the ethical treatment of your research participants. Please do not hesitate to contact the IRB if you have any questions.

Sincerely,

Matthew Cole, Ph.D.
Chair, Institutional Review Board (IRB)
Lawrence Technological University
irb@ltu.edu o: 248.204.3096 f: 248.204.3099

Author Biography

SENIOR SERVICE COLLEGE FELLOWSHIP
DEFENSE ACQUISITION UNIVERSITY

PATRICK L MACHESKE

Pat Macheske was born and raised in Detroit, Michigan, and graduated from Central Michigan University with a Bachelor of Applied Arts in Industrial Supervision and Management. He and began his career at TACOM in 1985 as a Contracting Intern. Pat's early assignments included technical analysis of production processes and costs of the Bradley Fighting Vehicle eventually becoming a team leader on the Bradley Should Cost. In 1998 Pat moved to Program Management as a Procurement Analyst in Combat platforms and later Tactical Vehicles. He was the lead Acquisition Manager on the Tactical Vehicle Long Term Armor Strategy and was chosen to develop the initial JLTV Acquisition Strategy. Since then, Pat has been a System Acquisition Manager, Assistant Program Manager and Supervisor. In 2011 Pat accepted a Director of Acquisition Management position in PM ABCT (later reorganized as PM- AFV) where he managed personnel, planning, resources, and acquisition activities to procure and modernize the Tracked Combat vehicles of the Armored Brigade Combat Teams.

CAREER CHRONOLGY:

- 1985 - 1998: Contract Specialist, US Army Tank Automotive Command, contract execution and technical team leader on the Bradley Should Cost.
- 1999 - 2004: Procurement Analyst, Product Manager-M113 and PM-Trailers.
- 2005 -2007: Acquisition Lead for the Long Term Armor Strategy - Tactical Vehicles and JLTV.
- 2008-2010: Procurement Analyst, System Acquisition Manager, Assistant Program Manager for Tactical Trucks managing Armor application and Acquisitions.
- 2011 to 2015: Director of Acquisition Management, PM-ABCT and PM-AFV.

EDUCATION:

- 1985 BAA, Industrial Supervision and Management, CMU, Mt. Pleasant MI

CERTIFICATIONS:

- DAWIA, Level III Contracting, October 1998
- DAWIA, Level III Program Management, September 2003

AWARDS AND HONORS:

- Commanders Award for Civilian Service, Jan 2008, JLTV program.
- Commanders Award for Civilian Service, w/device, April 2011, HMMWV–MECV
- Army Acquisition Corps Member, May 2011