Effectiveness of Matrix Organizations at the TACOM LCMC

James Scott Baumgartner

April 5 2013

PUBLISHED BY

Lawrence Technological University

Southfield, Michigan

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

Submitted to the Defense Acquisition University (DAU) Midwest Region in partial fulfillment of the requirement of the Senior Service College Fellowship (SSCF)

Title: Effectiveness of Matrix Organizations at the TACOM LCMC

Author: James Scott Baumgartner

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
05 APR 2013	**Masters Thesis**	**10-08-2012 to 01-04-2013**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Effectiveness of Matrix Organizations at the TACOM LCMC	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
James Baumgartner	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Defense Acquisition University (DAU) Midwest Region,38219 Mound Road,Sterling Heights,MI,48310	**; #23734**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
U.S. Army TARDEC, 6501 East Eleven Mile Rd, Warren, Mi, 48397-5000	**TARDEC**
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)
	#23734

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Organizations in the aerospace and defense industries have implemented the matrix structure extensively to reduce resource requirements, and achieve multiple simultaneous goals. The matrix structure is found in most large companies that deal with more than one product or geographic region. The potential for efficiency gains and increased customer satisfaction have made this an attractive organizational structure for most industries. However, implementation of the matrix structure has proven to be difficult and results have been mixed. This paper will identify the characteristics of an effective matrix organizational structure: compare those characteristics with those of matrix organizations at the Tank-Automotive and Armaments Command (TACOM) Life Cycle Management Command (LCMC), and identify opportunities to increase the effectiveness of matrix structures at TACOM LCMC.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Public Release**	**87**	

Effectiveness of Matrix Organizations at the TACOM LCMC J. Scott Baumgartner

Organization: U.S. Army TACOM

Date of Paper:

IRB Approval: Date: 8 DEC 2012

OPSEC Approval: Date: 19 MAR 2013

Approval: Legal Date:

Approval: G2/G3 Date:

Approval: Public Affairs Date:

Submission Date to DAU Library:

Submission Date to Acquisition Research Journal:

Table of Content

List of Figures

List of Tables

Abstract

Organizations in the aerospace and defense industries have implemented the matrix structure extensively to reduce resource requirements, and achieve multiple simultaneous goals. The matrix structure is found in most large companies that deal with more than one product or geographic region. The potential for efficiency gains and increased customer satisfaction have made this an attractive organizational structure for most industries. However, implementation of the matrix structure has proven to be difficult and results have been mixed. This paper will identify the characteristics of an effective matrix organizational structure: compare those characteristics with those of matrix organizations at the Tank-Automotive and Armaments Command (TACOM) Life Cycle Management Command (LCMC), and identify opportunities to increase the effectiveness of matrix structures at TACOM LCMC.

Chapter 1 – Introduction

A matrix organizational structure requires employees to report to two or more supervisors from different units within the organization. The matrix organizational structure originated in the aerospace and defense industry, and exists today in various forms in most large corporations that provide more than one product in multiple geographic locations (Katz & Allen, 1985; Keller, 1986; Poirot, 1991). The matrix organizational structure design is a powerful tool to force interaction among business units and to integrate the diverse components of an organization. Advantages of a matrix organizational structure include increased communication among the functional teams; increased capacity to process information; the flexibility to reallocate resources; increased employee satisfaction; and the retention of technical expertise (Ford & Randolph, 1992). Matrixed organizations leverage manpower and resources across multiple product lines and services to maximize customer satisfaction. Figure 1 depicts a matrix organizational structure supporting four different products supported by four separate functional teams.

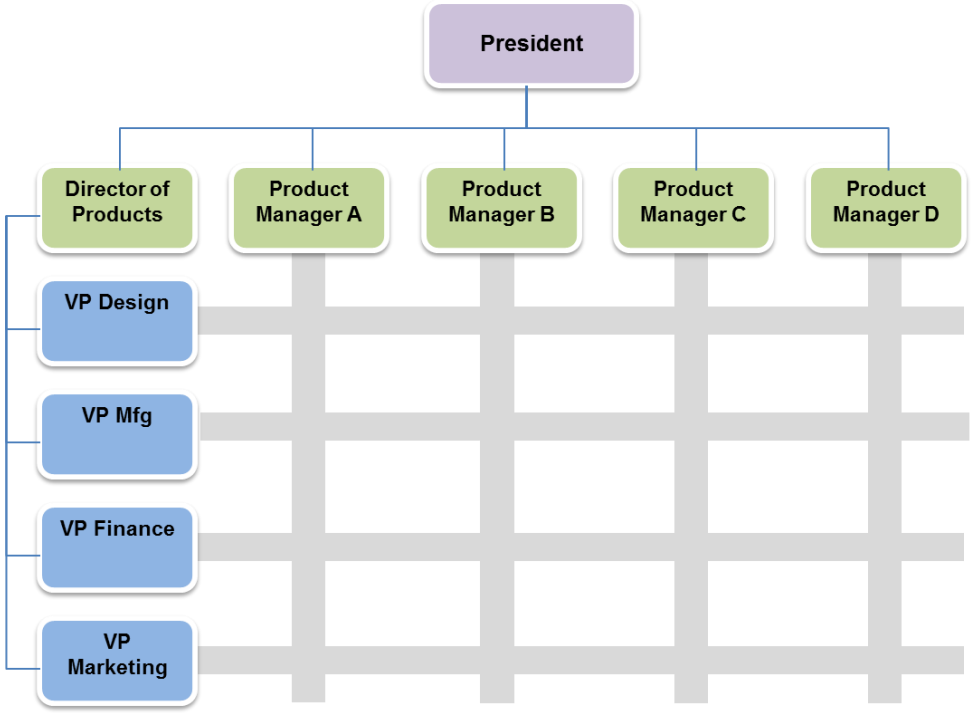

Figure 1 - Matrix Organizational Structure

A matrix organization may enable TACOM LCMC to provide rapid response to changes in two or more environments, encourage more effective exchange of information, increase resource effectiveness, improve employee motivation and encourage managerial competency without creating an overly burdensome organizational structure. This will enable TACOM LCMC to continue to meet the strategic goal of providing warfighters with sustainable, cost- effective weapon systems with strategic advantage on the battlefield.

Strategic reasons to use a matrix organization structure include providing a balanced perspective, workload flexibility, integration and knowledge sharing. When the balanced perspectives of both the functional and the product leads are captured and evaluated, the development effort becomes more robust and the risk is reduced. The matrix organization

structure improves the capture of requirements and ensures they are evaluated by stakeholders. Organizational flexibility is also enhanced by allowing employees with specialized skills to be assigned to projects as required. This allows Program Managers (PMs) to increase or decrease manpower to match the programmatic needs. Matrixed employees can be reassigned to different PMs or returned to the home functional organization in accordance with the manpower requirements. Organizational flexibility supports rapid response to weapon system readiness issues and emerging threats without permanently staffing up a particular PM office or division. Integration is enhanced as the perspectives of the functional teams are identified, evaluated and prioritized to meet the project cost, schedule and performance requirements. The team develops trust by working together and succeeding as they propose, develop and evaluate unique solutions. The knowledge of all the functional team employees is increased as best practices and lessons learned are shared and reported to the functional team management teams. Coupled with learning, the best practices from other business units and functional teams are reinforced and transferred between different PMs. Understanding and deploying the best practices can increase process effectiveness as well as decrease the learning curve as resources are moved within the organization to support changing strategic needs.

There are numerous studies of the advantages and disadvantages of matrix organizations (Andrews, Barker, & Tjosvold, 1988; Cleland D. I., 1968; Davis & Lawrence, 1978; Ford & Randolph, 1992; Peters, 1979). When a matrix organization structure is not effectively designed and implemented, it may result in power struggles, lack of decision making, personal stress, and the need for increased support from leadership. Being responsible for delivering a product that requires resources that are not under the control of the leader can be disconcerting and

problematic. A clear understanding of the team's roles and responsibilities as well as the overall organizational priorities are required in order to balance the workload and deliverables. Without a clear vision, goals and priorities, teams will struggle to strike a balance between competing priorities. This may result in destructive competition, blaming, indecisive and ultimately project delays and waste. Without strong conflict resolution processes, the organization tends to slow or require additional leadership resources to resolve these differences. Dispute resolution draws leadership attention away from focusing on external customers and strategy development, thus making leadership less efficient. These studies reinforce the need for consistent business processes, a clear understanding of responsibilities, and the benefit of conflict resolution training.

Background

TACOM LCMC has implemented the matrix organizational structure extensively throughout the command. Business units located within the command have unique reporting chains and there are numerous strategic initiatives occurring simultaneously. In addition, multiple distinctively different products are being supported even as the defense budget is being reduced.

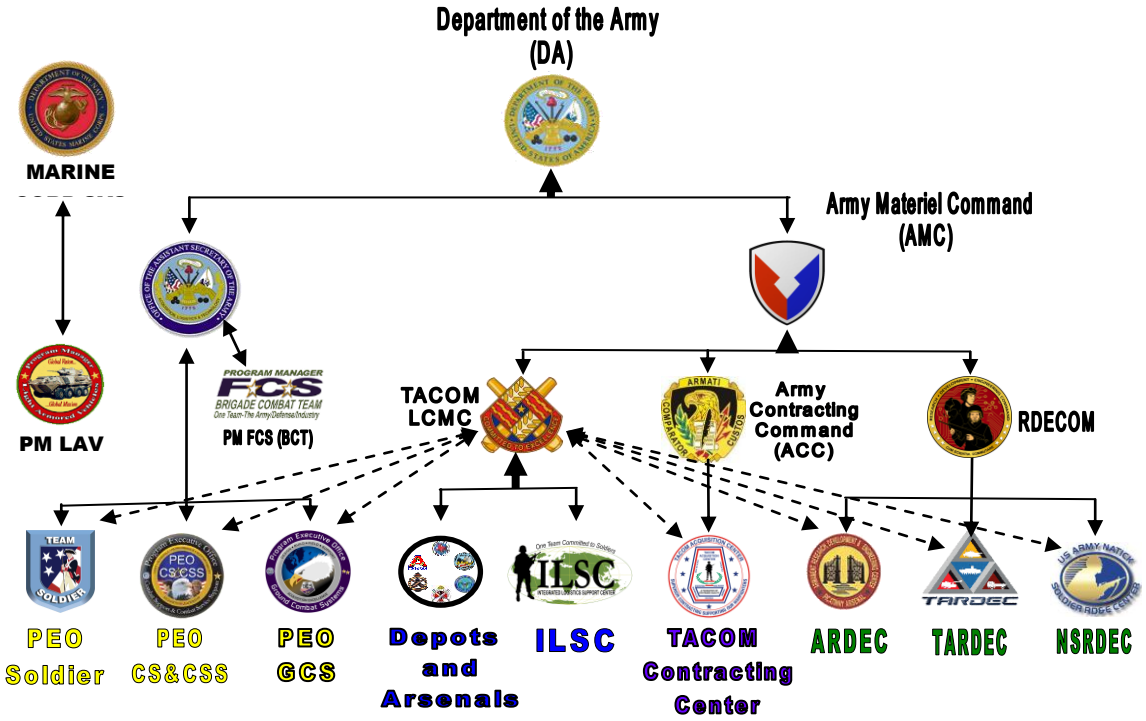

Figure 2 – TACOM LCMC Organizational Chart

Increasing the effectiveness of the matrix organization at the TACOM LCMC could have wide-reaching benefits to the organization. In addition, by reducing the conflict between the PMs and improving communication between and among the functional teams can improve employee satisfaction; reduce the time and cost of solution development and implementation, as well as the robustness of the proposed solutions.

This study intends to identify low-cost improvements to the business relationships among the PMs and the functional teams to reduce conflict and improve effectiveness. This study will also assess the PM's ability to work across multiple functional disciplines to meet program goals, requirements, and longer-term strategic goals. The paper also reviews the adequacy of the policies and processes in place at TACOM to facilitate the efficient use of matrix organizations.

Problem Statement

The TACOM LCMC has a complex organizational structure with separate command chains. The PMs have a small number of 'core' personnel, but the majority of the work performed is completed by personnel matrixed to the PMs. Managing a matrix organizational structure effectively requires a collaborative environment, consistent business processes, a foundation of teamwork, joint accountability, clear communications, and organizational trust. Product and functional team leaders operate in an environment of 'deliberate conflict' balancing the interest of the functional teams and the PMs (Cleland D. I., 1968). It is not known if these team leaders have the training to resolve these conflicts. Additionally, it is unknown if the business processes have been implemented consistently throughout the command to take advantage of the resource allocation flexibility of a matrix structure.

Statement of Purpose

The purpose of this study is to determine the characteristics of an effective matrix organizational structure identified in the literature, and determine the extent to which matrix organizations at the TACOM LCMC exhibit these characteristics. The paper will also determine if organizations within the TACOM LCMC that exhibit higher levels of these characteristics have more effective matrix organizations. The paper will also determine if leadership training impacts the effectiveness of matrix management.

Research Questions

This research paper addresses four questions.

- What are the characteristics of effective matrix organizations?
- Are these characteristics exhibited within the TACOM LCMC organization?
- Do teams that exhibit these characteristics more than others have more effective matrix organizations?
- Does leadership training impact the effectiveness of matrix management?

Research Hypotheses

H_{01}: The TACOM LCMC does not exhibit characteristics of an effective matrix organization

H_{02}: There are no statistically significant differences among the PMs

H_{03}: Leadership training does not impact the effectiveness of matrix organizations

Conceptual Model

A conceptual model of matrix effectiveness is depicted in Figure 3. These characteristics are defined as (1) Conflict Resolution - open communication with integrity and trust, (2) Consistent Business Processes – constant and reliable methods for accomplishing tasks throughout the organization, (3) Knowledge Transfer – transferring lessons learned and best practices throughout the organization, (4) Communications – clear understanding of the vision, goals and objectives of the overall organization, and (5) Appropriate Level – minimize chain of command required to make decisions. Leadership Training is defined as the ACQ 450 series and PMT 401 provided by DAU; the Civilian Education System (CES) Leadership Development Program from the Army Management Staff College; The Covey Series of 7 Habits, 4 Roles Leadership, Focus, Great Leaders Great Teams Great Results, Leading at the Speed of Trust, 5 Choices, Leading across Generations; undergraduate or postgraduate university courses; and

personal study; or mentoring and coaching.

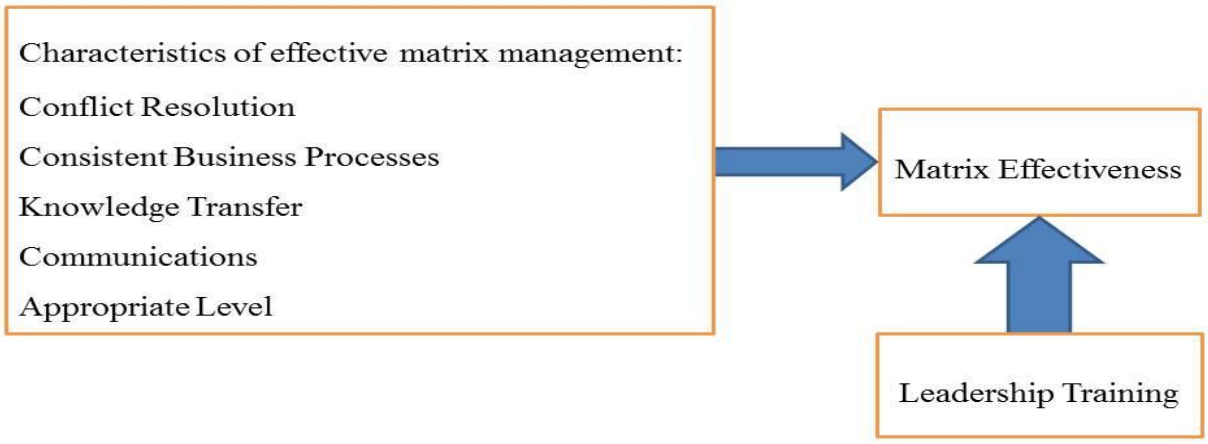

Figure 3 – Conceptual Model

Participants/Stakeholders

The majority of the employees at the TACOM LCMC are in some way involved in the relationship between the PMs and the functional support teams. This study included all the employees of the TACOM LCMC working at the Detroit Arsenal. This includes the support organizations of the Warren – Army Contracting Center (ACC), the Integrated Lifecycle Support Center (ILSC) and the Tank-Automotive Research Design Engineering Center (TARDEC) as well as the command staffs of the TACOM LCMC, PEO Soldier, PEO CS&CSS, and PEO GCS.

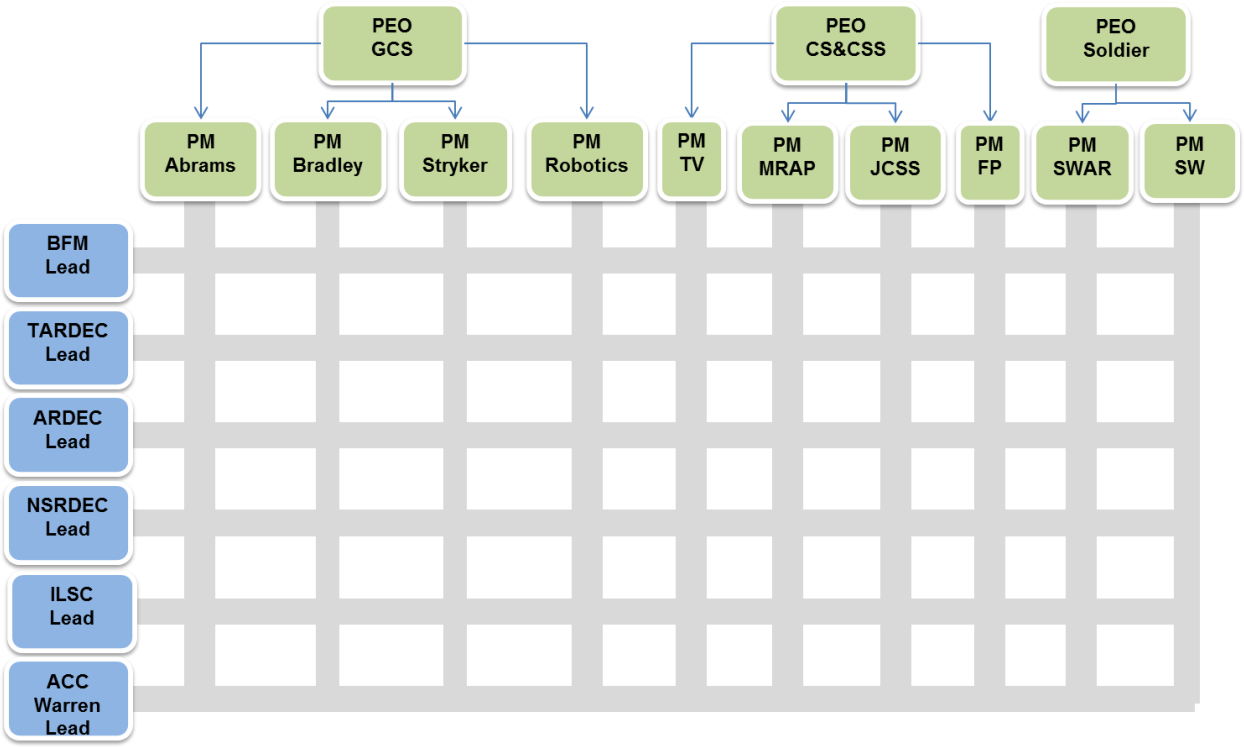

Figure 4 – TACOM Matrix Organizational Structure

Significance of This Research

The business environment at the TACOM LCMC supports the need for a matrix organization structure. The PMs must work across functional disciplines and make trade-offs to reduce overall risk and meet the strategic goals of their particular weapon system. This activity occurs in multiple PMs simultaneously throughout the TACOM LCMC. The Defense budget is forecasted to be reduced by $487B over the next ten years (Londono, 2012). In order to maintain weapon system effectiveness, the functional teams must be able to shift resources throughout each of the PMs to best support the overall TACOM LCMC mission. Improved management of the matrix organization structure is a key to ensuring TACOM LCMC is able to maintain effective weapons systems that provide strategic advantage on the battlefield.

Overview of the Research Methodology

The data to support this research will be mainly quantitative. It will be gathered using an online survey. One open-ended question will be included in the online survey to provide qualitative data. ANOVA and T-tests will be used to analyze the results of the surveys. The participants of this study include 623 employees working in the support organizations of the Warren – Army Contracting Center (ACC), the Integrated Lifecycle Support Center (ILSC) and the Tank-Automotive Research Design Engineering Center (TARDEC) matrixed to the PMs. This study also includes the PEO core personnel directly supporting the PMs, which rely upon the matrixed support for project/program execution.

Limitations of the Study

This study was conducted at the Detroit Arsenal portion of the TACOM LCMC. This study used a list of characteristics based primarily on the work of Amy Kates and Jay Galbraith (Kates & Galbraith, 2007) and does not account for all the variables that may affect the effectiveness of matrixed organizations. The survey instrument used to collect data is a self-assessment tool. Therefore, some bias can be expected about the reported organizational characteristics.

Chapter 2 – Literature Review

Introduction

This chapter presents a review of the literature related to the characteristics of an effective matrix organizational structure as well as the advantages and disadvantages of the structure. The literature review was accomplished through research of books, articles, journals, on-line articles and previously conducted studies.

Description

Much has been written about the challenges being faced in today's business world and the need to meet cost, schedule and performance goals. Organizations are required to manage multiple ongoing projects in different phases of development while simultaneously being responsive to customer feedback. Leaders today must balance the priorities of organizational elements with conflicting objectives in order to meet the strategic goals of the organization. This places the leader in a state of "deliberate conflict" (Cleland D. I., 1968) as the project leaders and functional managers negotiate the what, when who and how of the organizational effort.

Matrix organizational structures existing in various forms in engineering and aerospace firms, research and development, marketing, financial, international organizations, health care providers, MIS organizations as well as manufacturing organizations. The variety of uses and forms makes it difficult to find consensus on a concise and precise definition. Often, matrix management is whatever a company defines it to be or how a researcher defines it for purposes of a study. Project management, likewise has come to mean a variety of things and, when the two terms are used together, the definitional confusion is compounded.

Matrix organizations exist on a continuum between purely functional type organizations and purely project type organizations. On the functional end of the continuum is the traditional hierarchical structure divided along functional, lines such as marketing, production and accounting. On the other end of the continuum is the pure product organization. Here, a separate team is formed, duplicating the functional structure buy organized under a product manager (Larson & Gobeli, 1987). Matrix organizations are somewhere in between these end points. They are temporary in nature, focused on a specific project, and scheduled to be completed within some defined time, cost and performance standards.

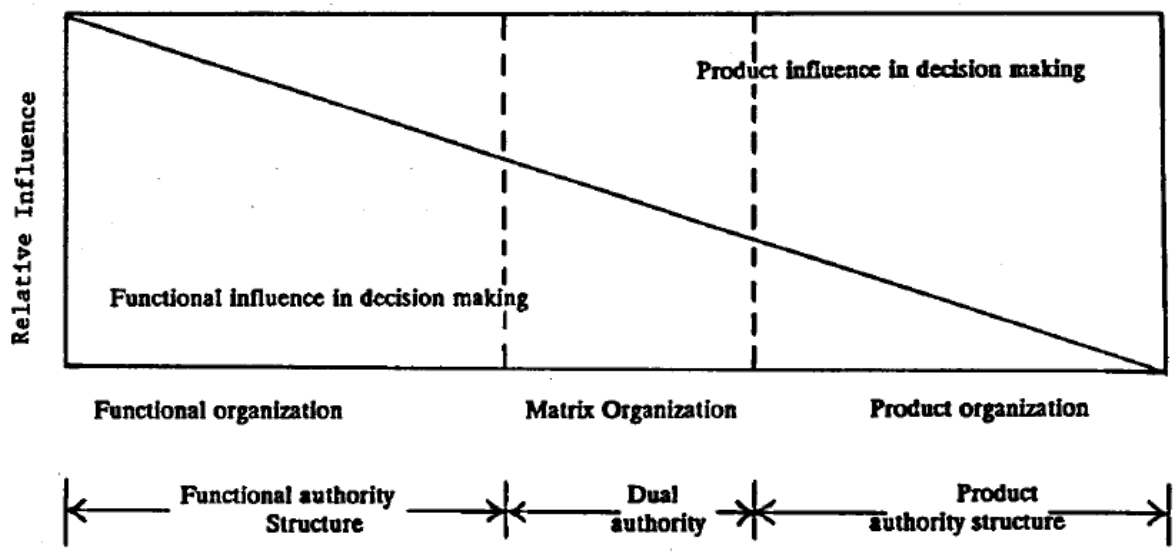

Figure 5 – Matrix Organizational Structure Continuum (Ford & Randolph, 1992)

A purely functional structure enables individuals to remain aware of new technical developments in their respective areas of expertise. This allows the functional groupings to concentrate their efforts and interactions in their functional areas of interest. A cost of the functional structure, however, is the difficulty created in coordinating these distinct functional disciplines, task orientations, and organizations localities.

Conversely, a product structure eliminates or reduces the coordination difficulties by concentrating everyone's attention on the requirements of the product, but at the same time such concentration makes it more difficult to stay current with developments in one's functional expertise and may result in technological obsolescence.

The dilemma is that when one structure is chosen, the benefits of the other structure are lost. Organization developers view matrix as a solution to this dilemma. A matrix combines the benefits of both structures by providing proper project coordination while maintaining a continuing linkage with a functional expertise.

Improved information flow and flexibility of responses by team members in a matrix can allow resources to be quickly and easily disengaged from unproductive uses and applied to new opportunities as they are discovered (Davis & Lawrence, 1977; Jerkovsky, 1983; Kolodny, 1979; Kur, 1982; Larson & Gobeli, 1987). The organization, too, captures response flexibility as it can assign expensive specialists and equipment over a changing array of projects in the form of project teams (Denis, 1986b). At the same time functional expertise is no lost as these specialists typically retain their associations with their functional areas while they are assigned to various projects (Denis, 1986b; Jerkovsky, 1983; Kerzner, 1984).

Related to these advantages for the organization are its advantages for individuals within the organization. In particular, several writers argue that a matrix should positively influence motivations, job satisfaction, commitment, and personal development (Denis, 1986b; Larson & Gobeli, 1987). In the matrix structure, individuals have the opportunity to work on a variety of projects with a variety of individuals from across the organization. In sharing ideas, knowledge, and perspectives, a matrix enlarges an individual's experience and outlook, increases

responsibility and involvement in decision making, and offers a greater opportunity to display capabilities and skills (Randolph & Posner, 1992). Other individual benefits include the development of interpersonal and group skills, problem solving abilities, planning and improved career pathing (Davis & Lawrence, 1977; Kolodny, 1979).

Implementing a matrix is a complex process, involving more than just changing the organizational structure, systems, culture, and behaviors over time (Davis & Lawrence, 1977; Kolodny, 1979). According to (Davis & Lawrence, 1977) choosing a matrix is a serious, top level decision requiring commitment to a thorough implementation. The statement, "Matrix is an exceedingly complex form that is not for everybody. To put it bluntly, if you do not really need it, leave it alone" (7-8). The advantages and disadvantages must be weighed and the process managed if the matrix organization structure is to work. Therefore, it is imperative for organizations to understand what factors facilitate or influence the adoption of a matrix before they choose this complex organizational form. Organizations that implement a matrix organizational structure without ensuring that a strong foundation of teamwork, joint accountability, and collaboration are in place have not been able to meet their goals. The have found the matrix to be complex, confusing and frustrating (Kates & Galbraith, 2007).

Characteristics of an Effective Matrix Organization

The literature review has revealed numerous variables impacting the effectiveness of matrix organizations. This research focused on the following characteristics.

Conflict Resolution

Effective matrix organizations have robust conflict resolution processes. Resolving conflict requires the project and functional teams to communicate openly, with integrity and trust

when problem solving. The team must openly discuss project risks and respect each member's perspective to facilitate trade off analysis between project costs, schedule and performance. The team must be empowered to resolve issues within the team and align priorities of the project in order to support the vision, goals and objectives of the higher organization. Defining the roles and responsibilities of member of the team through a RACI chart is one method of reducing conflict.

Consistent Business Processes

The business processes of the organization must be consistent and reliable throughout the organization. If employees are required to operate in a different manner on each different project team the organization will experience inefficiencies and rework. Learning new processes increases variability into the results of the team.

Knowledge Transfer

Effective matrix organizations transfer lessons learned and best practices throughout the organization. Technical experts from the functional support organizations are utilized by the product teams (Davis & Lawrence, 1977; Galbraith, 1971). According to Knight, "Matrix structures are said to facilitate high quality and innovative solutions to complex technical problems" (Knight, 1976). Projects developed within a matrix organizational structure have the benefit or remaining small and task oriented while maintaining the functional discipline expertise to remain innovative (Davis & Lawrence, 1977).

Communications

The project teams must have a clear understanding of the vision, goals and objectives of the overall organization in order for the team to make appropriate tradeoffs within the scope of

the project. The teams should be capable of making these tradeoffs without relying upon higher management for confirmation. The matrix structure reduces the need for vertical communication by creating self-contained task teams focused on a specific, finite project. It improves communication among different departments and projects by forcing managers to maintain close contact with all organizational groups upon whose support they must rely for project success. This causes an emphasis on developing communications skills as a politically intelligent response for keeping the support of resource providers to ensure resource availability to the cross-functional group (Galbraith, 1971; Joyce, 1986; Larson & Gobeli, 1987; Randolph & Posner, 1992). This increased lateral communications should increase the capability of an organization to process information

Appropriate Level

A matrix works best when the matrixed positions are placed at a fairly high level in the organization. This means that when the matrixed manager has to raise an issue with their two managers, they are in a sufficiently high position of authority and knowledge to resolve the issue. If the product and functional team leads are forced to raise issues up the chain of command another level or two the decision making process is slowed and the matrix becomes a barrier rather than an enabler for progress. When a matrix organizational structure is designed the number of management levels between the decision maker and matrixed managers should be reduced as much as possible.

Chapter 3 – Research Methodology

This chapter describes the research methodology used to explore the research questions and to test the hypotheses. The statement of purpose and research design are presented. The TACOM population being surveyed and the sample are identified. Next the research procedures being used are presented including IRB approval, the survey instrument, and the data collection processes and procedures.

Statement of Purpose

The purpose of this study is to determine the characteristics of an effective matrix organizational structure identified in the literature, and determine the extent to which matrix organizations at the TACOM LCMC exhibit these characteristics. The paper will also determine if organizations within the TACOM LCMC that exhibit higher levels of these characteristics. This will provide the knowledge required to improve effectiveness when implementing organizational changes. The paper will also determine if leadership training impacts the effectiveness of matrix management.

Research Questions

This research paper addresses four questions.

- What are the characteristics of effective matrix organizations?
- Are these characteristics exhibited within the TACOM LCMC organization?
- Do particular teams exhibit more effective characteristics than others?
- Does leadership training impact the effectiveness of matrix management?

Research Hypothesis

The following hypotheses will be tested for this research project:

H_{01}: The TACOM LCMC does not exhibit characteristics of an effective matrix organization

H_{02}: There are no statistically significant differences among the PMs

H_{03}: Leadership training does not impact the effectiveness of matrix organizations

Research Design

This study uses a mixed methods methodology that includes both quantitative and qualitative research methods. The quantitative method was used in this study to conduct the research because it allows the researcher to create a larger data base that is more representative of the population being studies. It also allows the researcher to statistically compare the responses to the survey

IRB Approval

In accordance with federal regulations pertaining to the use of human participants in research, the researcher is required to gain approval from the Institutional Review Board (IRB) at Lawrence Technological University (LTU) prior to the collection of data. These regulations provide guidelines to protect the rights and welfare of individuals as it relates to their voluntary and confidential participation in this research. Completion of the IRB Application for Approval to Conduct Research with Human Participants, the LTU Consent Form, and the LTU Confidentiality Agreement are required for research approval. The IRB application for this research survey was submitted on November 27, 2012. The IRB approved the application for this research on December 08, 2012 for a period of one year. The IRB approval letter is at

Appendix A – Institutional Review Board Approval Letter. The Informed Consent Form on the first page of the survey informed the participants that their participation was completely voluntary, that their responses would be anonymous, they did not have to answer any questions they didn't want to answer, and that they could stop at any time during the survey.

Survey Instrument

The survey questions were developed by the researcher to answer the research questions being studied based on the review of the literature in Chapter 2 – Literature Review and to test the hypotheses. The survey instrument can be found in Appendix B – Research Survey. The survey started with 5 demographic questions. The survey then asked respondents to answer a series of self-assessment questions about the leadership training they had received. The leadership training question required respondents to identify leadership training they had received. The potential training options included specific courses taught by DAU and other sources contracted by the Army to provide leadership training as well as any training provided by academic institutions as part of a Bachelors or Masters Degree program. Additionally, the question provided a place for respondent to identify any other training not listed. The survey asked the respondent to determine if they were a matrixed or a core associate. The respondents were asked a series of questions regarding their position within the organization dependent upon how they responded to the question about being a core or matrixed associate. Finally, the survey included a series of questions about the effectiveness of the matrix organizational structure at the TACOM LCMC using a 6 point Likert scale. For those respondents who indicated they were core associates, the survey asked them to identify which organization they worked for. The potential list of organizations was taken from Figure 2 – TACOM LCMC Organizational Chart

and the TACOM LCMC Command Group and Staff Element were added to the list. The survey asked the respondent a series of questions to determine if they were directly involved in a matrixed organization and if so, their role in the matrixed organization. The survey asked the respondent a series of questions designed to determine if their matrix organization exhibited the characteristics of an effective matrix organization including, Conflict Resolution, Consistent Business Processes, Knowledge Transfer, Communications and Appropriate Level.

For those respondents who indicated they were matrixed associates, the survey first asked them to identify which organization they worked for and then which organization they supported. Again the potential list of organizations was taken from Figure 2 – TACOM LCMC Organizational Chart.

Upon completion of the specific questions for core or matrixed associates, the entire respondent pool was asked a series of questions regarding the effectiveness of the matrix organizational structure at the TACOM LCMC using a 6 point Likert response format. The first question to the respondent was to assess the effectiveness of the matrix organizational structure at the TACOM LCMC. The next several questions were designed to determine how respondent's objectives and priorities were communicated, if they were representative of day to day activities and if the PMs and functional organizations were aligned. The respondents were then asked if the teams they worked on had the consistent involvement from all the necessary stakeholders, if the roles of the stakeholders were defined and if the teams consistently met the program/project objectives. The respondents were asked if the PMs and functional organizations captured all project risks, if the risk mitigation steps were communicated and if they were implemented. The respondent was asked if the teams they worked on frequently needed to

elevated issues more than two levels up for resolution. The survey concluded with one open-ended question requesting the respondent to identify any major obstacles to a more effective matrix organization at the TACOM LCMC.

As shown in Lawrence Technological University
Institutional Review Board
Office of the Provost
21000 West Ten Mile Road
Southfield, MI 48075
research.ltu.edu <http://www.ltu.edu/provosts_office/IRB.asp>
irb@ltu.edu

December 8, 2012

Dear James Baumgartner,

I am pleased to report that your IRB application to conduct research with human participants for the project, "Characteristics of Effective Matrix Organizations Displayed at TACOM LCMC", has been approved under the Expedited review path for a period of one year, November 27, 2012 – November 27, 2013.

The IRB is satisfied that the following three ethical concerns regarding the treatment of your human participants have been addressed in your research protocol: (1) The research involves administering a survey to participants who will voluntarily consent to complete the survey and who are free to withdraw from the study at any time; (2) You have identified potential risks to you and the participants; and (3) You have assured that a balance exists between potential benefits of the research to the participant 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 any changes to your research protocol that impact the ethical treatment of your research participants. Please do not hesitate to contact the IRB if you have any questions.

Sincerely, Matthew Cole

Matthew Cole, Ph.D.
Assistant Professor of Management
IRB Chair
Lawrence Technological University
College of Management

21000 West Ten Mile Road

Southfield, MI 48075

o. 248.204.3096 f. 248.204.3099 irb@ltu.edu

Appendix B – Research Survey, the survey has 30 questions, which were used to identify where the respondent fit within the TACOM LCMC organizational structure, whether the businesses processes where consistent between the respondents, and the assessment of the teams the respondent worked on.

The Survey Monkey web site was used to administer the survey using an email invitation. This method allowed the researcher to track the total number of responses as well as determine the total number of valid responses. A response was considered valid if the respondent answered all of the mandatory questions. The mandatory questions were the informed consent form, 5 demographic questions (experience, grade, education, gender, generation and certification), the core or matrixed associate question and the respondent's organization question. The Survey Monkey emails provided a hyperlink for the recipients to access the survey. This method allowed the researcher to track if a recipient completed the survey, either partially or fully as well as whether they opted out of completing the survey. All data received from the respondents were kept anonymous from the researcher.

Matrix Organization Characteristics	Question #
Conflict Resolution	Q29d, Q29f, Q29g, Q29k
Consistent Business Processes	Q15, Q16, Q17, Q26, Q28
Knowledge Transfer	Q24
Communications	Q29b, Q29d, Q29e, Q29g, Q29i
Appropriate Level	Q14, Q23, Q29k

Figure 6 – Matrix Organization Characteristics by Question Number

Chapter 4 – Findings

Population & Sample Size

The population surveyed for this study included all associates at the TACOM LCMC Detroit Arsenal. The survey request was distributed from the TACOM LCMC Command Group to all associates working at the base on January14, 2013 and the survey was closed on February 6, 2013. The total population sampled was 5,741, which included associates from the SES level leadership to interns within the organization. In order to obtain a 95% confidence level a total of 190 responses were needed. There were 638 responses received; however, missing values reduced this number to 511 for some questions. The equation used to determine the valid response requirement can be found in Figure 7 (Stat Trek, 2013). 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 7 – Sample size equation (Stat Trek, 2013)

Table 1 – Values used for the sample size equation

Variable	Value
n	190 (Sample size needed)
Z	1.96 (for 95% confidence)
p	.85 (portion of the population surveyed)
q	1-p
ME	0.05 (margin of error)
N	5741 (total population)

Descriptive Statistical Analysis

Descriptive statistics were used to describe the respondents and provide data on the sample surveyed. The demographic categories are experience, grade, education, gender, generation and certification.

Demographic Statistics

The distribution of the respondents based upon the years worked at the TACOM LCMC can be seen in Figure 8. The largest population of respondents, 39%, has been at TACOM between 1 and 5 years. The second largest population, 25%, has been at TACOM for more than 20 years.

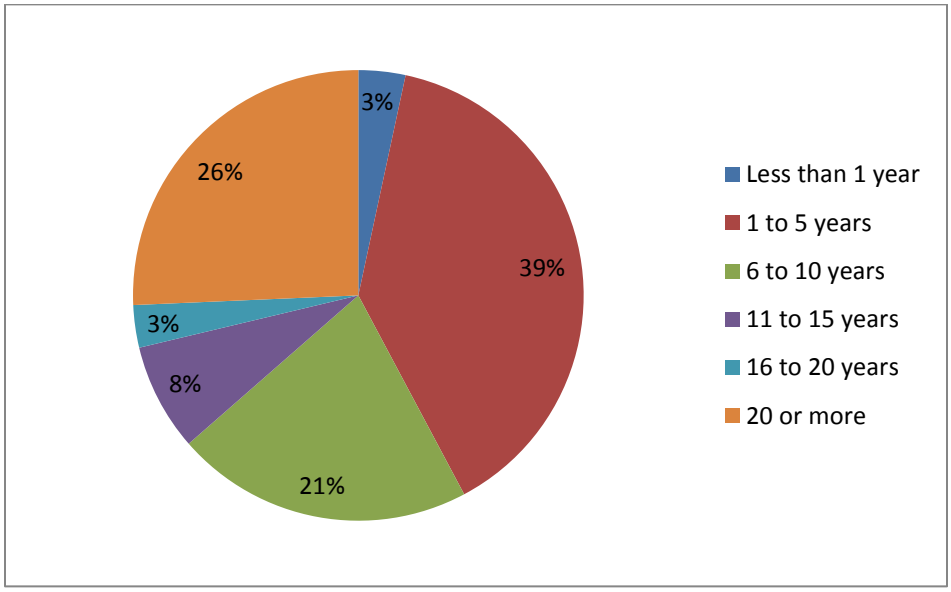

Figure 8 – Years at TACOM LCMC

The distribution of the respondents based upon their grade can be seen in Figure 9. The largest population of respondents, 58%, is GS 12-13 or equivalent. The second largest population, 20%, is GS 14-15 or equivalent.

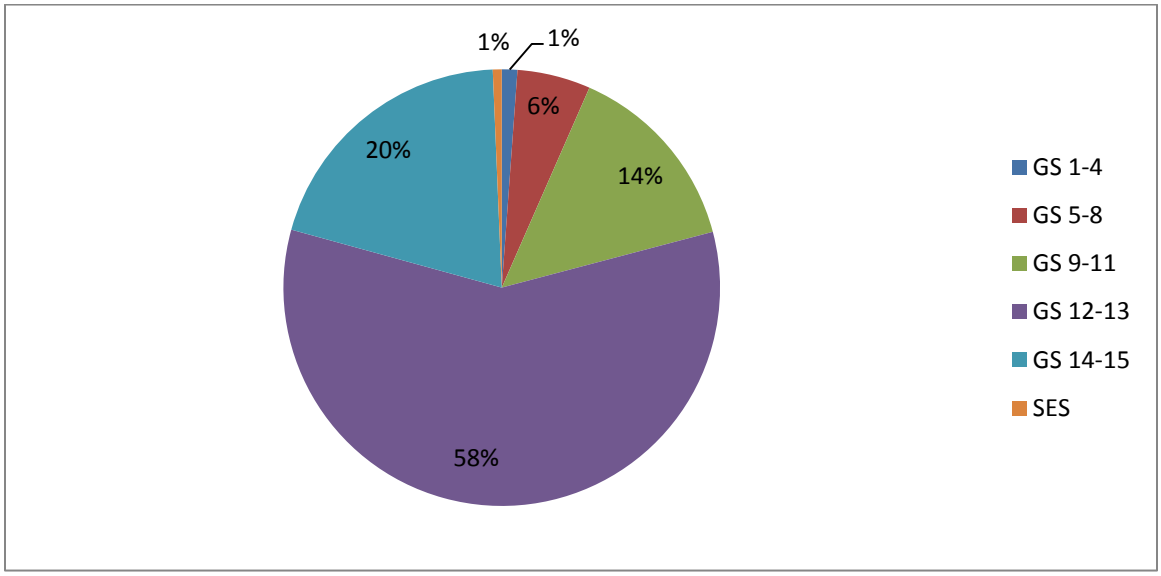

Figure 9 – Service Grade

The distribution of the respondents based upon their education can be seen in Figure **10**. The two largest populations each at 39% were Bachelors Degree and Masters Degree.

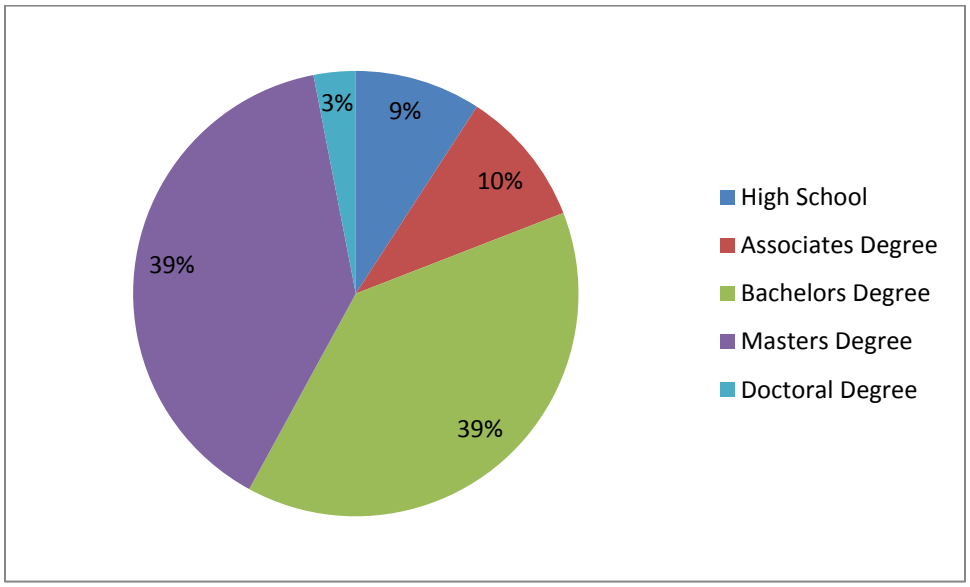

Figure 10 – Education Distribution

The gender distribution of the respondents was 40% female and 60% male Figure 11.

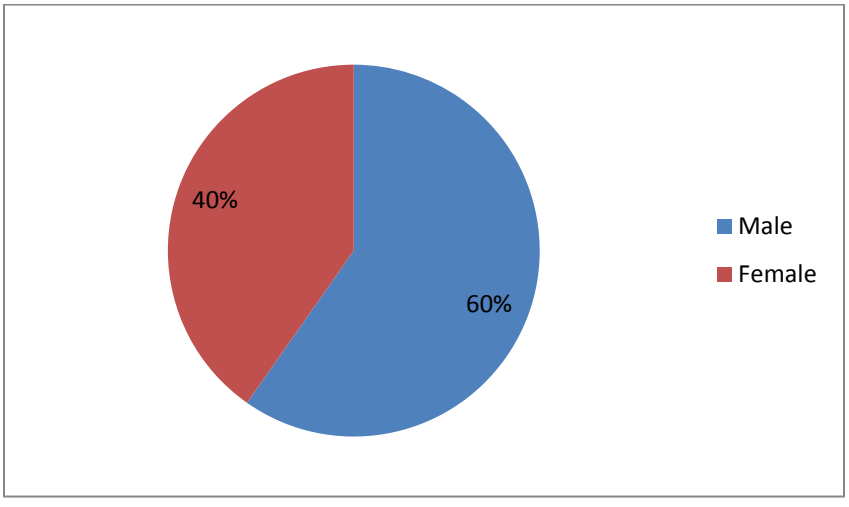

Figure 11 – Gender Distribution

The distribution of the respondents by age can be found in Figure 12. The largest population of respondents, 46%, was born between 1947 and 1964. The second largest population of respondents, 37%, was born between 1965 and 1980.

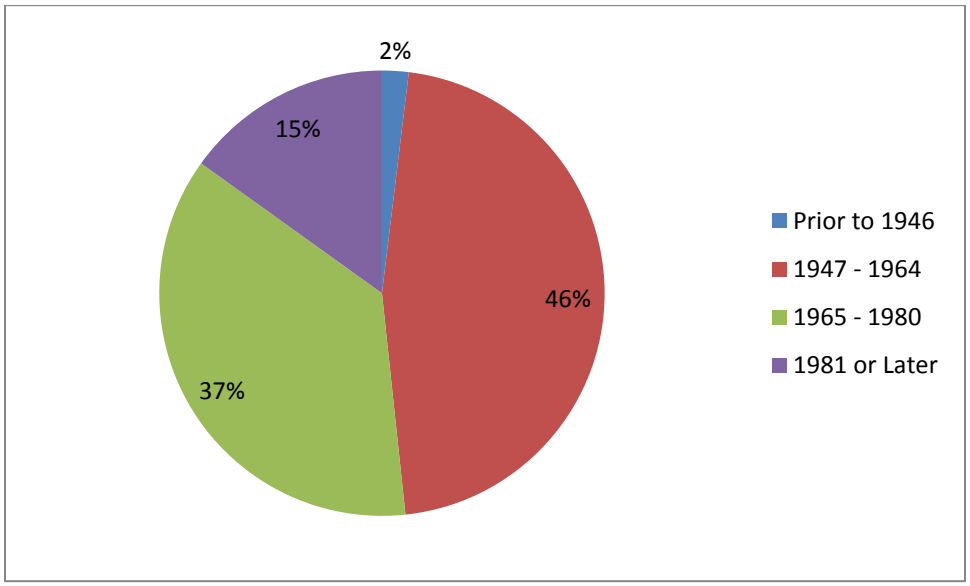

Figure 12 – Generation Distribution

The respondents indicated that 54% were Certified Level 3 in their career field Figure 13.

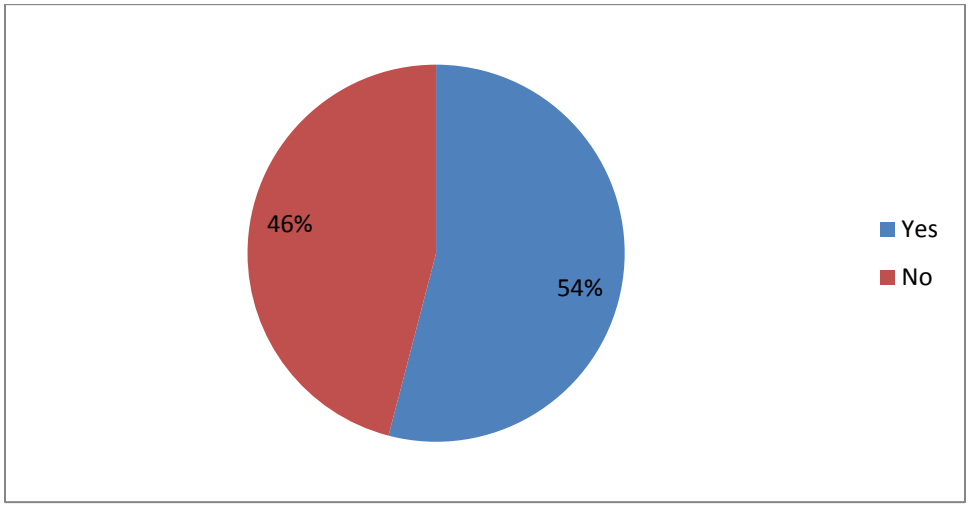

Figure 13 – Certified Level 3 in Career Field Distribution

Descriptive Statistics Characteristics of an Effective Matrix Organization

Conflict Resolution

The characteristic of conflict resolution was determined by averaging the respondent's answers to questions 29d, 29f, 29g and 29k. A T-test was conducted on the data and it was determined there is no statistical difference between responses from core and matrixed associates in Figure 14. An ANOVA analysis was completed on the data and determined that there was a statistical difference between the LCMC, PEOs and TARDEC. A T-test was then completed to compare the PEOs and TARDEC against the LCMC and it was determined that there is a 99% probability that they are statistically different. The respondents from the LCMC felt the matrix is more effective at conflict resolution than TARDEC and the PEOs.

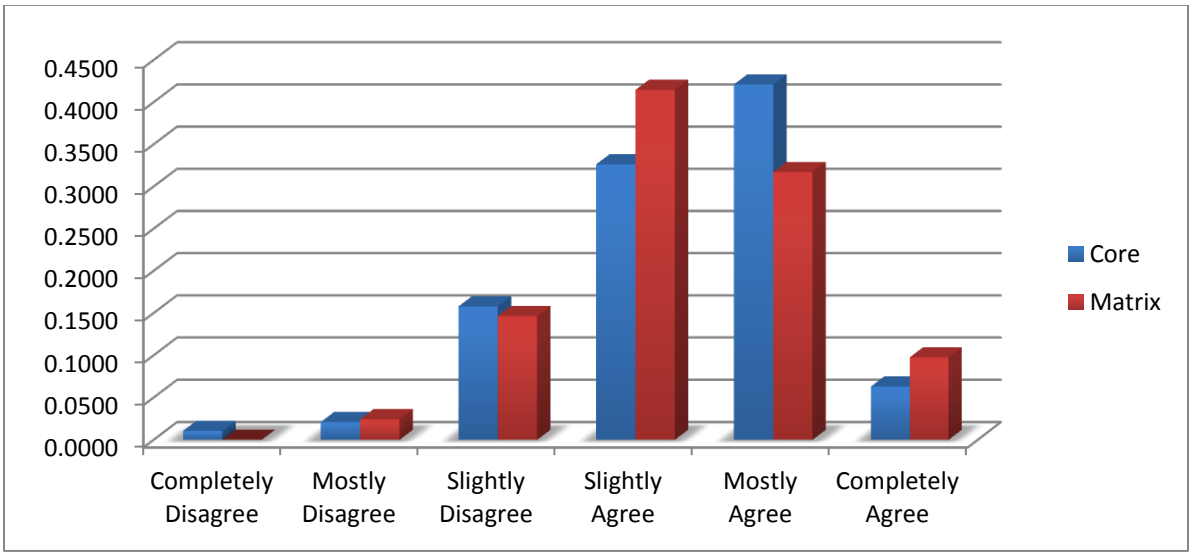

Figure 14 – Matrixed or Core vs. Conflict Resolution

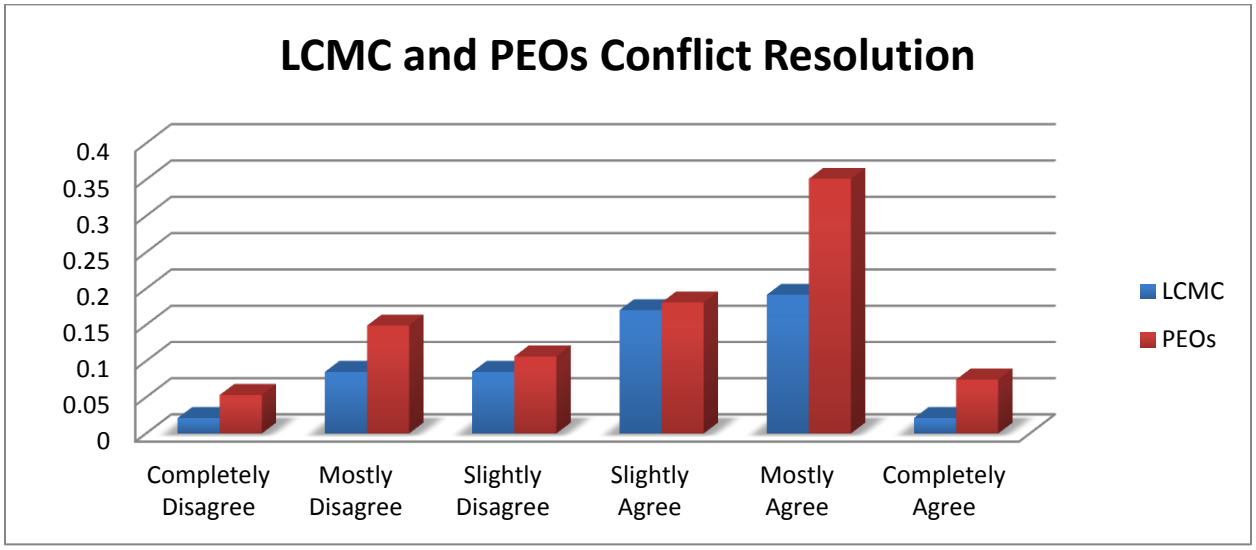

Figure 15 – LCMC and PEOs vs. Conflict Resolution

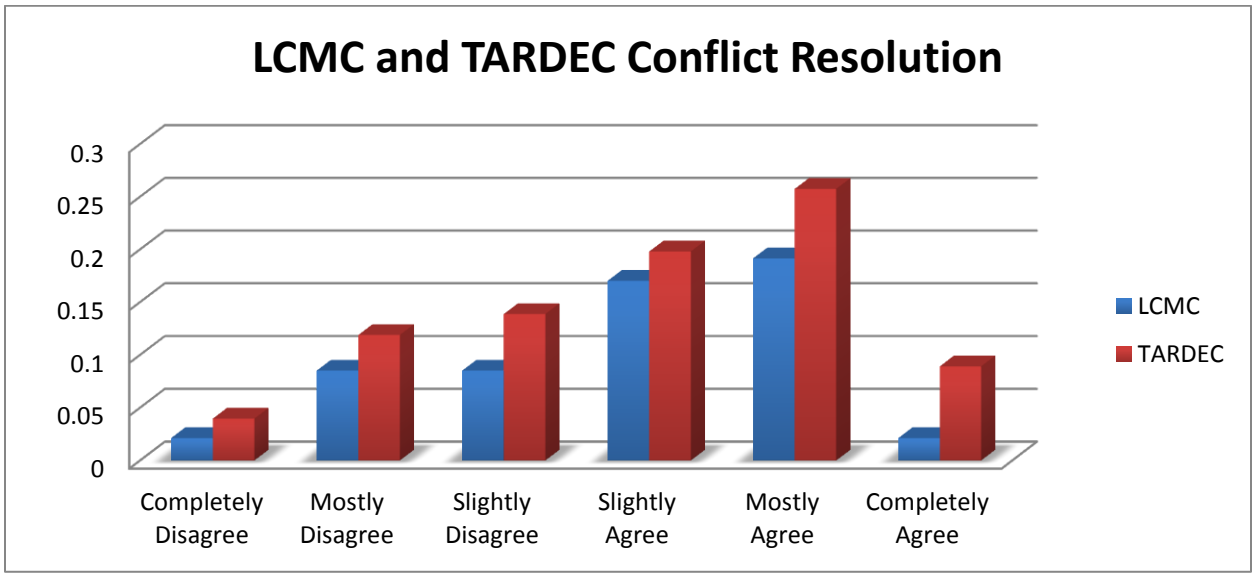

Figure 16 – LCMC and TARDEC vs. Conflict Resolution

Consistent Business Processes

The characteristic of consistent business processes was determined by averaging the respondent's answers to questions Q15, Q16, Q17, Q26 and Q28. The data collected indicates

that there is a large amount of variation in the methods in which the PMs manage the matrixed associates. Thirty-five percent of core associate respondents indicated that they were responsible for providing day to day direction only. The second most significant portion of respondents (twenty-three percent) was responsible for directing, rating, timecards and the travel and leave requests for the matrixed associates.

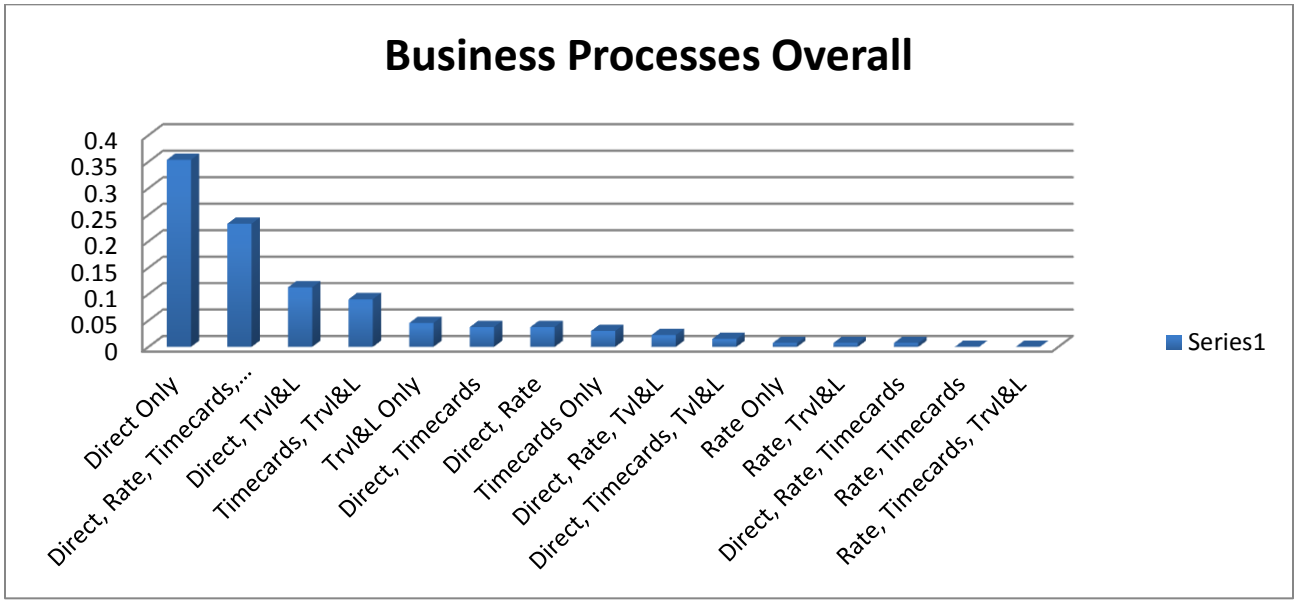

Figure 17 – Business Processes Overall

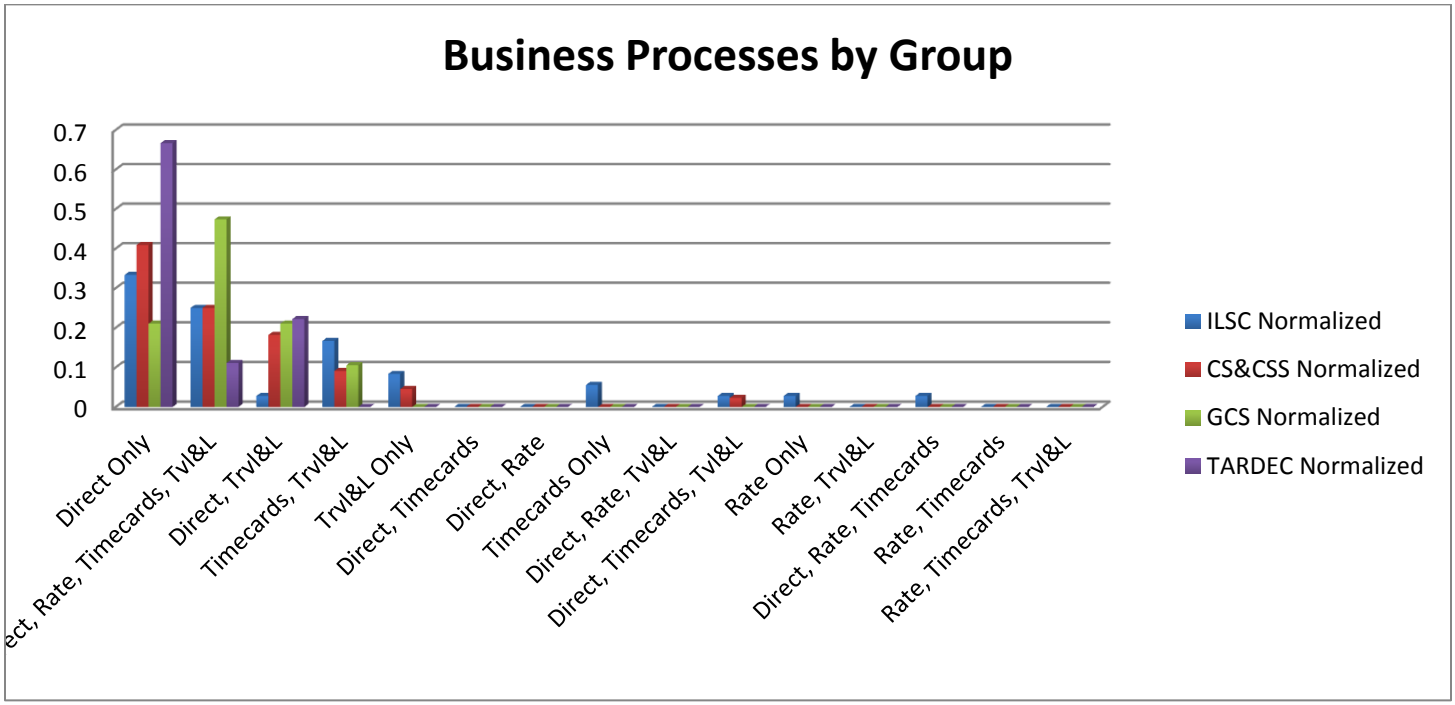

Figure 18 – Business Processes by Group

ACC – Warren 56 of 59 (95%) did not have any responsibility for matrixed associates. Of the remaining 3, one provided day to day direction only, one provided direction and rated the matrixed associates and the last respondent approved matrixed associates timecards only.

Of the ILSC associates twenty-five percent had some responsibility for matrixed associates. Of the 36 that had some responsibility for matrixed associates, one provided day to day direction only, one provided direction and rated the matrixed associates and the last respondent approved matrixed associates timecards only.

Six members of the LCMC Command Group have some level of responsibility for matrixed associates four provided direction only. One had responsibility for timecards only and the last had responsible for travel and leave only.

Forty-four respondents from PEO CS&CSS had some responsibility for matrixed associates. Eighteen of those were responsible for providing direction only. The second largest group (eleven), provided direction, ratings, travel, leave and timecard approvals.

Of the respondents from PEO GCS with responsibility for matrixed employees, the largest percentage (35) provided direction, ratings, travel, leave, and timecard approvals.

Knowledge Transfer

In order for matrixed associates to transfer knowledge they need to meet with functional leadership. Of the respondents that are matrixed associates, 25% of them do not meet with their home organizations. The second highest grouping of respondents, 24% indicated that they met with their home organization weekly. The number of respondents from ACC-Warren were not sufficient to prove statistical significance. Therefore, a T-test was completed to compare the ILSC and TARDEC matrixed associates. The T-test determined that there is a 99% probability that they are statistically different. The respondents from the ILSC met with functional leadership more than those from TARDEC.

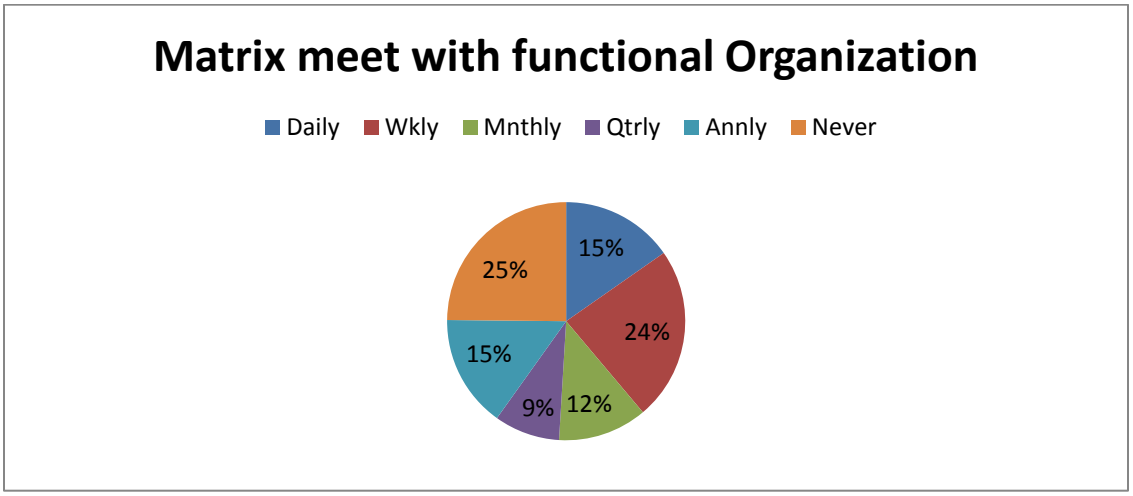

Figure 19 – Matrix Associates meet with Functional Organization

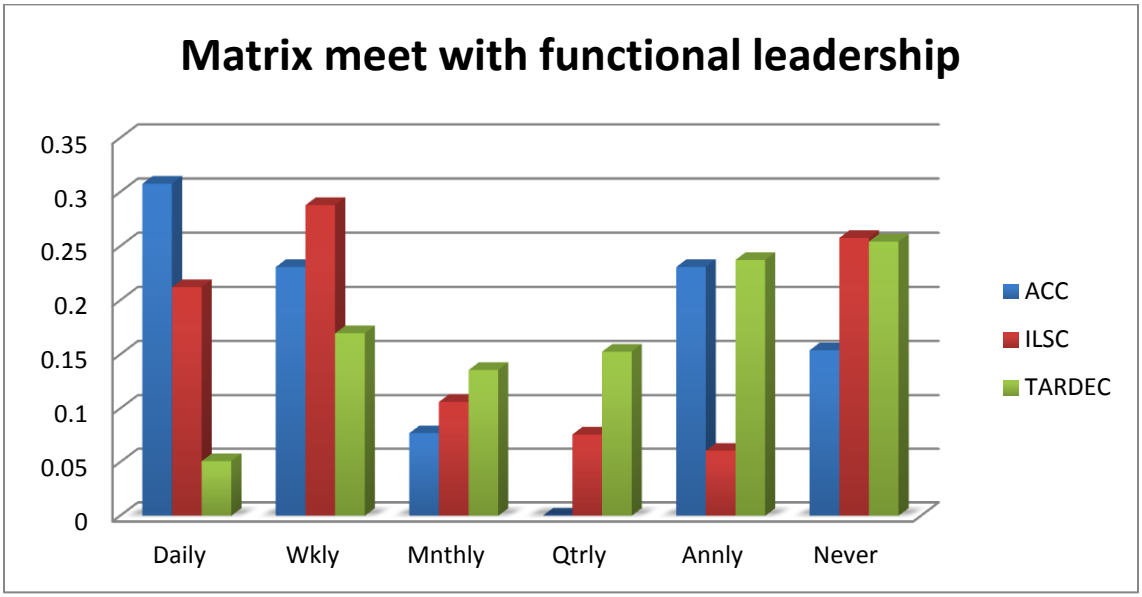

Figure 20 – TACOM Matrix Associates meet with Functional Organization

Communications

The characteristic of effective communications processes was determined by averaging the respondent's answers Q29b, Q29d, Q29e, Q29g, and Q29i. An ANOVA statistical analysis determined that there were statistically significant differences of opinion of the effectiveness of the matrix organizational structure at the TACOM LCMC. The p value was .005, the F was 3.714 and the F-critical was 2.385. Completing the Tuckey analysis determined to a 95% confidence that:

The LCMC exhibited better communications that the ILSC.

The LCMC exhibited better communications that the PEOs

The LCMC exhibited better communications than TARDEC.

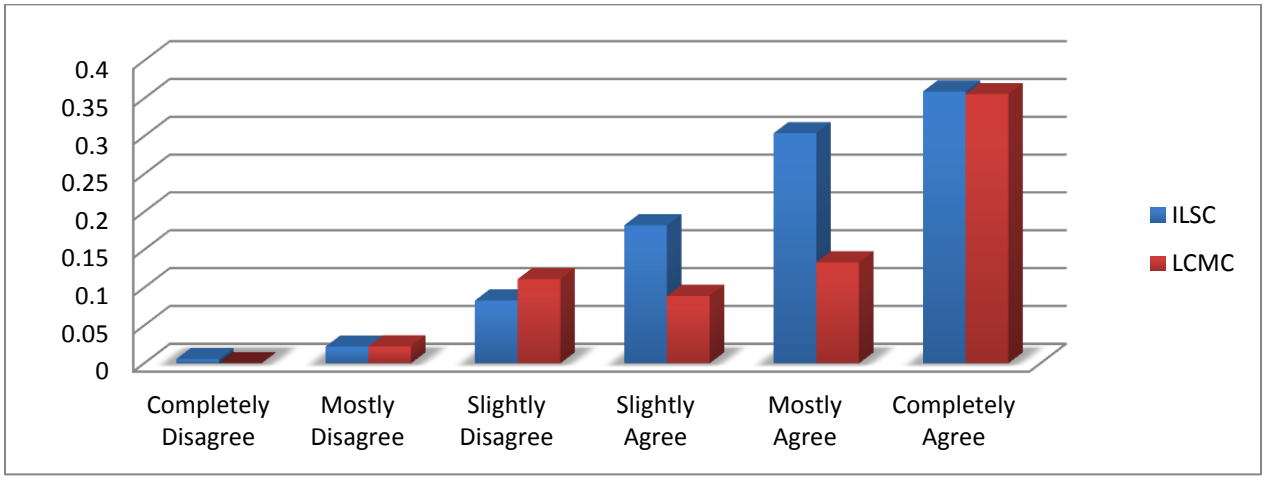

Figure 21 – ILSC vs. LCMC communication

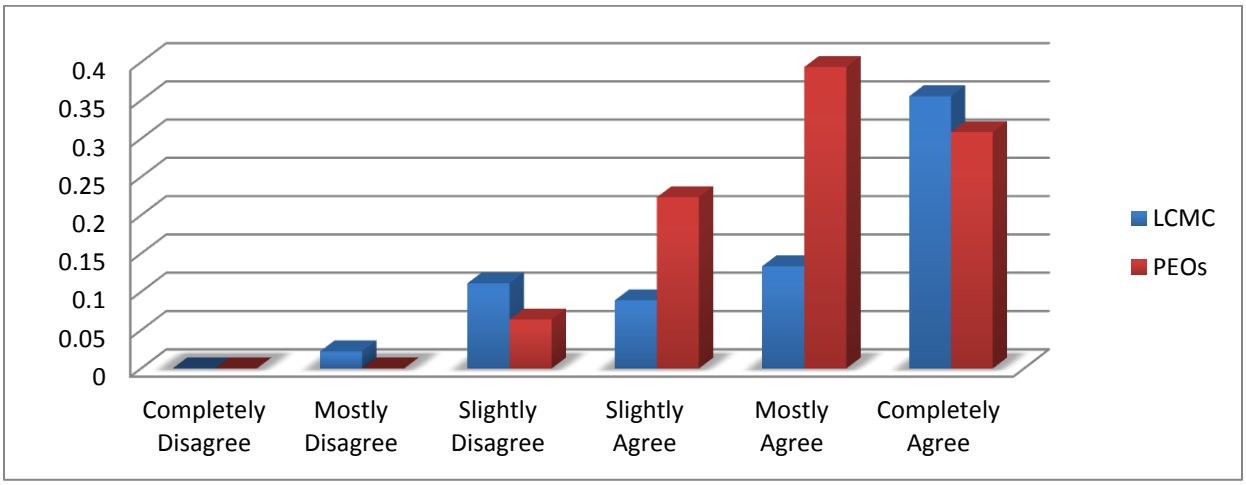

Figure 22 – PEOs vs. LCMC communication

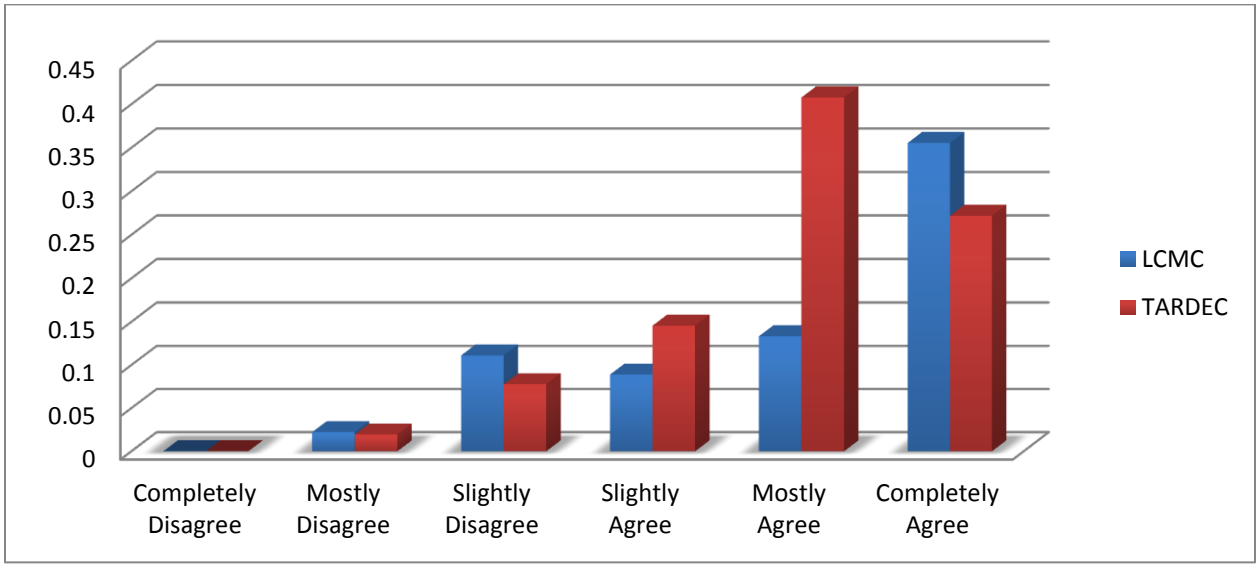

Figure 23 – TARDEC vs. LCMC communication

Appropriate Level

The characteristic of implementation at the appropriate level was determined by reviewing the responses to answers Q14, Q23, Q29k. The researcher completed analysis to determine the distribution of whether core employees felt empowered to resolve issues. Of those respondents that were core associates providing direction to matrix associates 62% of them felt empowered to resolve issues at their level. The results of the survey indicate that 29% did not feel they were empowered. This implies that management needs to intercede with resolution of these issues when the associates are capable of resolving the issues independently. Conversely, of the respondents that indicated they were matrixed associates, 91% of matrixed employees felt their Supervisor was able to resolve issues at their level. There were not sufficient responses to complete a statistical analysis between the groups for associates that provided day to day direction for matrix associates, but the response from each team is presented.

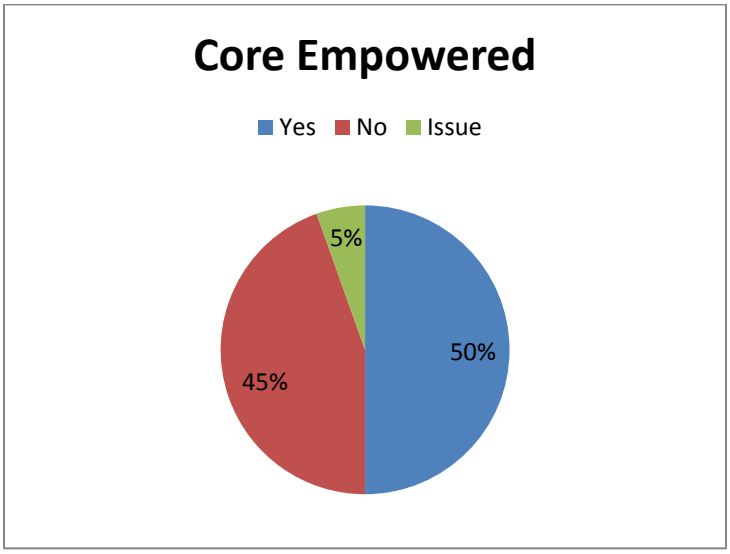

Figure 24 – Core Associates Empowered

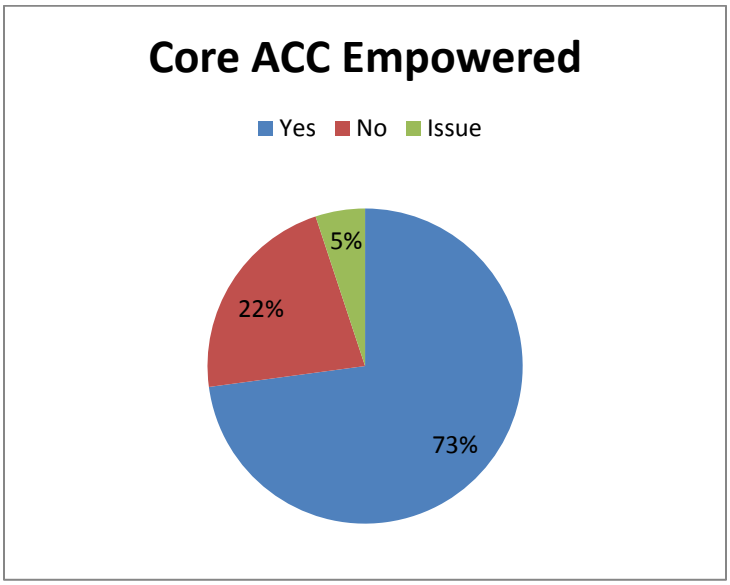

Figure 25 – Core ACC Associates Empowered

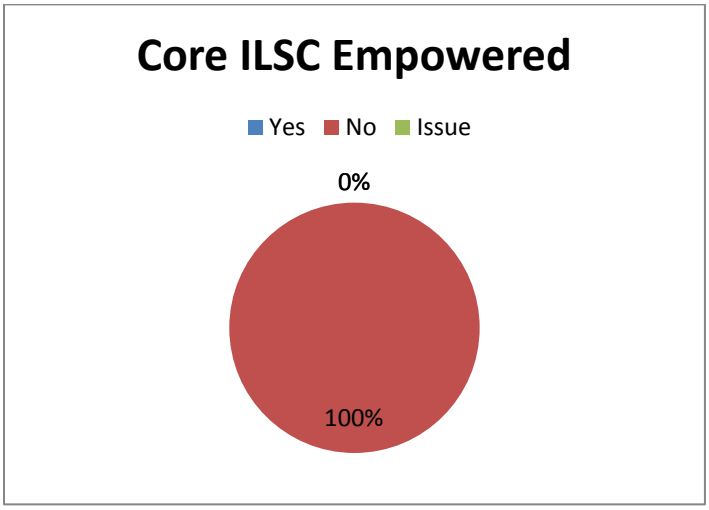

Figure 26 – Core ILSC Associates Empowered

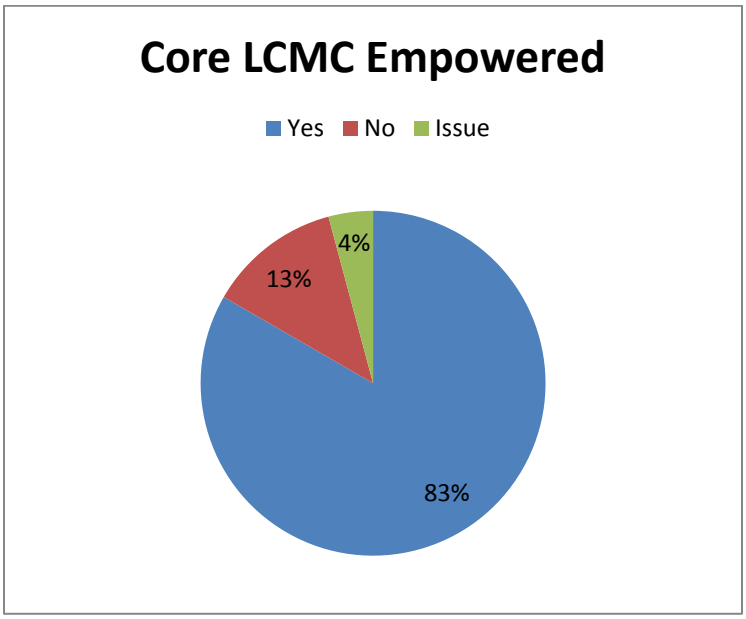

Figure 27 – Core LCMC Associates Empowered

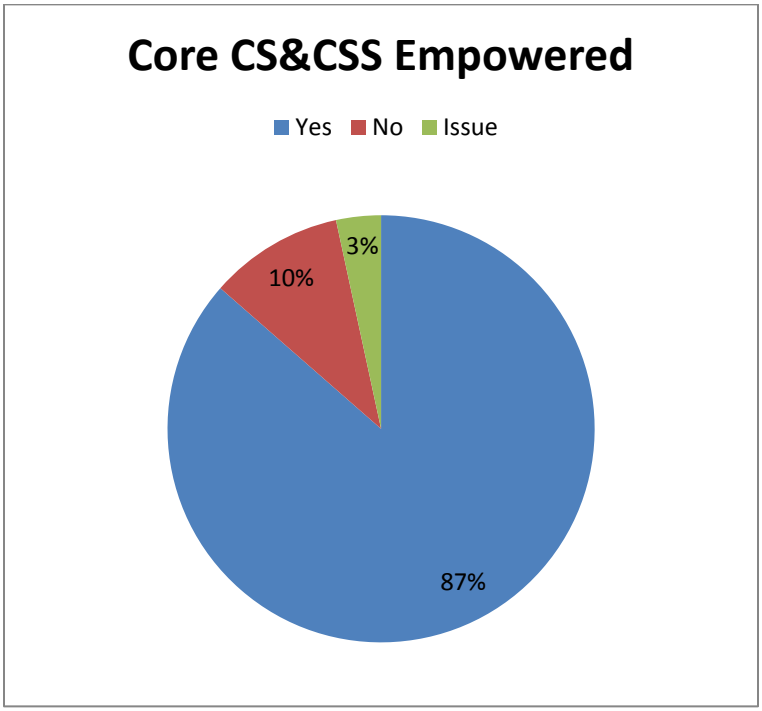

Figure 28 – Core PEO CS&CSS Associates Empowered

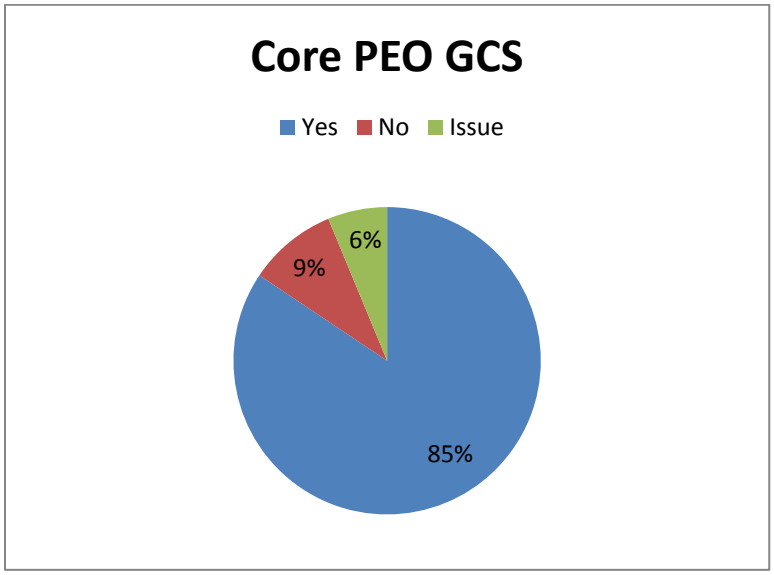

Figure 29 – Core PEO GCS Associates Empowered

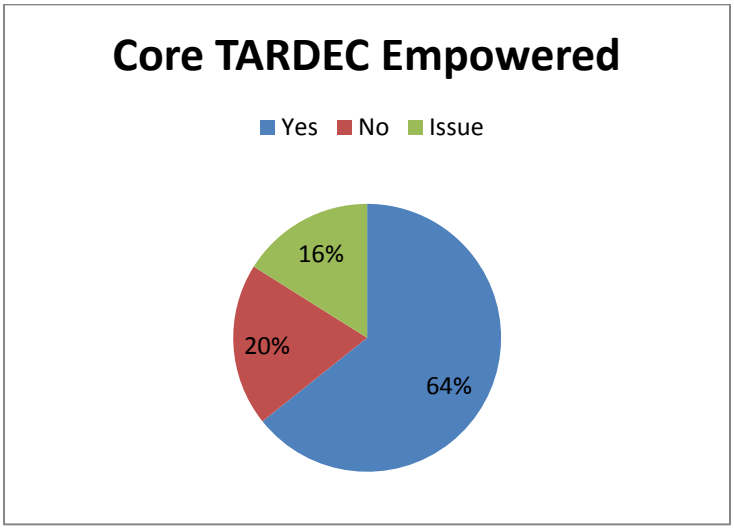

Figure 30 – Core TARDEC Associates Empowered

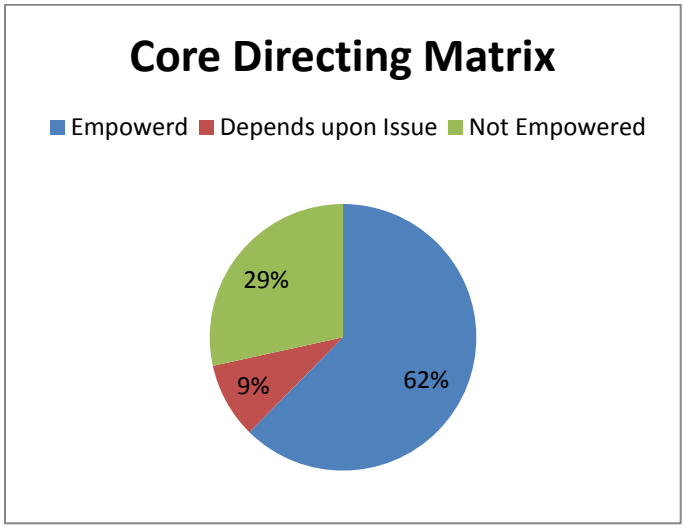

Figure 31 – Core Associates Directing Matrix Empowered

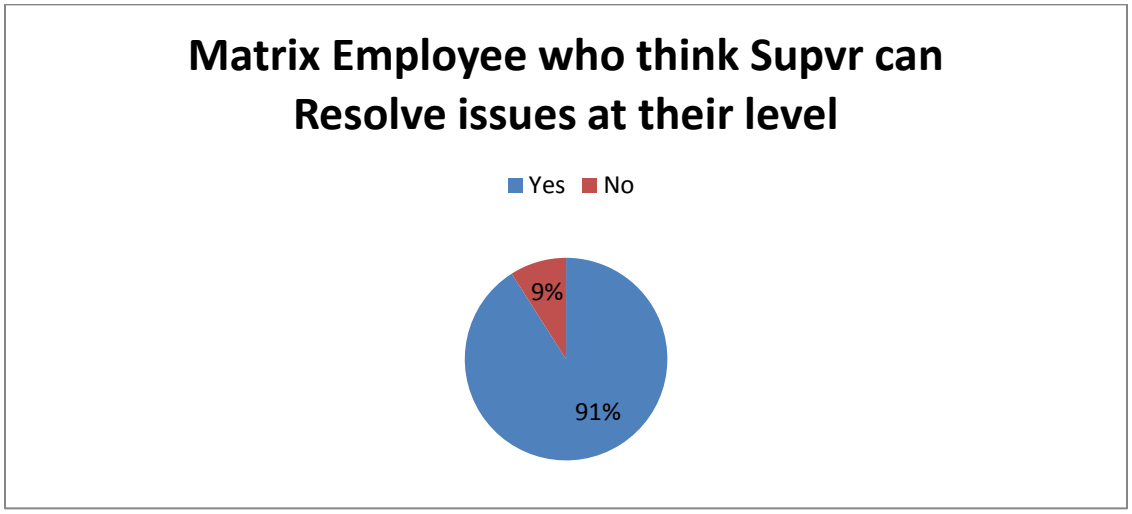

Figure 32 – Do Matrix Associates believe their Team Leader is empowered

Descriptive Statistics Elevating Issues

An additional indicator for setting the matrix at the appropriate level is if the team must elevate issues more than two levels for resolution. An ANOVA statistical analysis on Q29k determined that there were statistically significant differences between groups elevating issues for resolution. The p value was .005, the F was 3.749 and the F-critical was 2.391. Completing the Tuckey analysis determined to a 95% confidence that:

The ACC-Warren elevate issues more often than those in the LCMC

The LCMC elevate issues more often than those in the PEOs

The LCMC elevate issues more often than those in the TARDEC

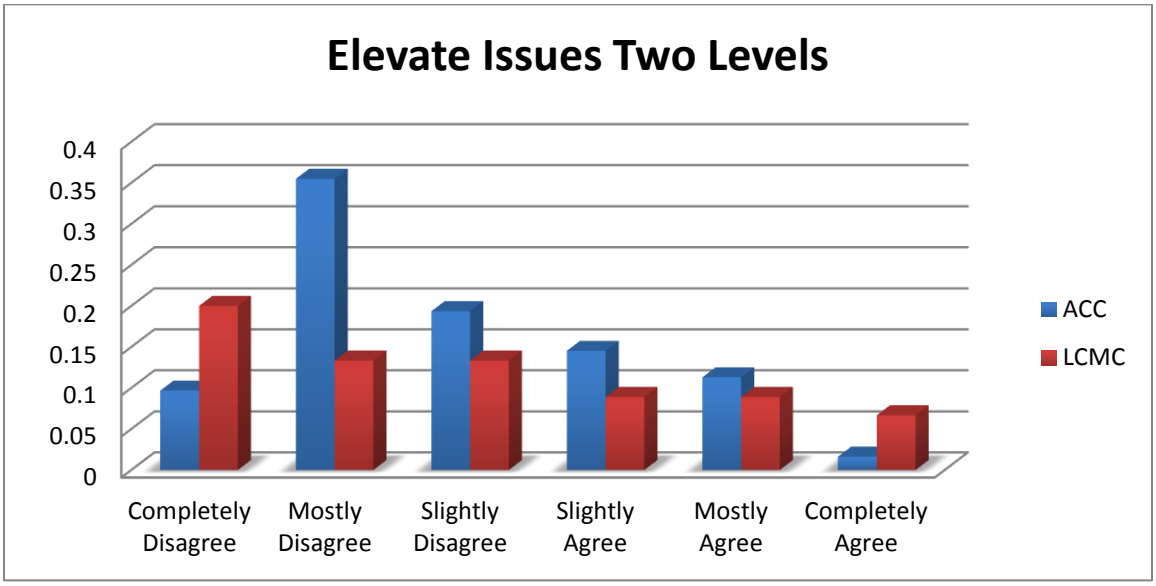

Figure 33 – ACC vs. LCMC Elevate Issues Two Levels for Resolution

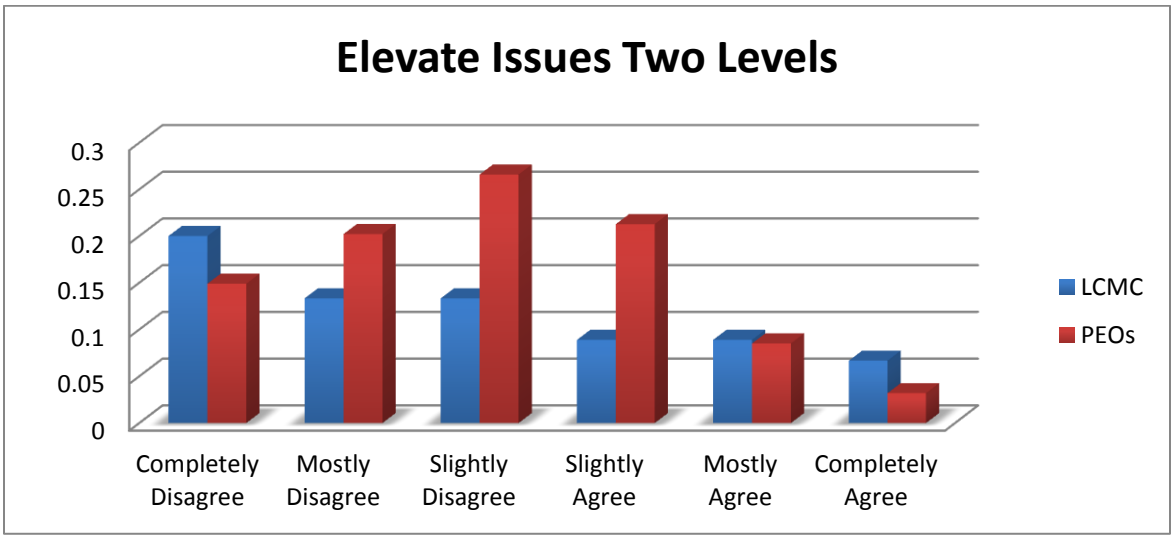

Figure 34 – LCMC vs. PEOs Elevate Issues Two Levels for Resolution

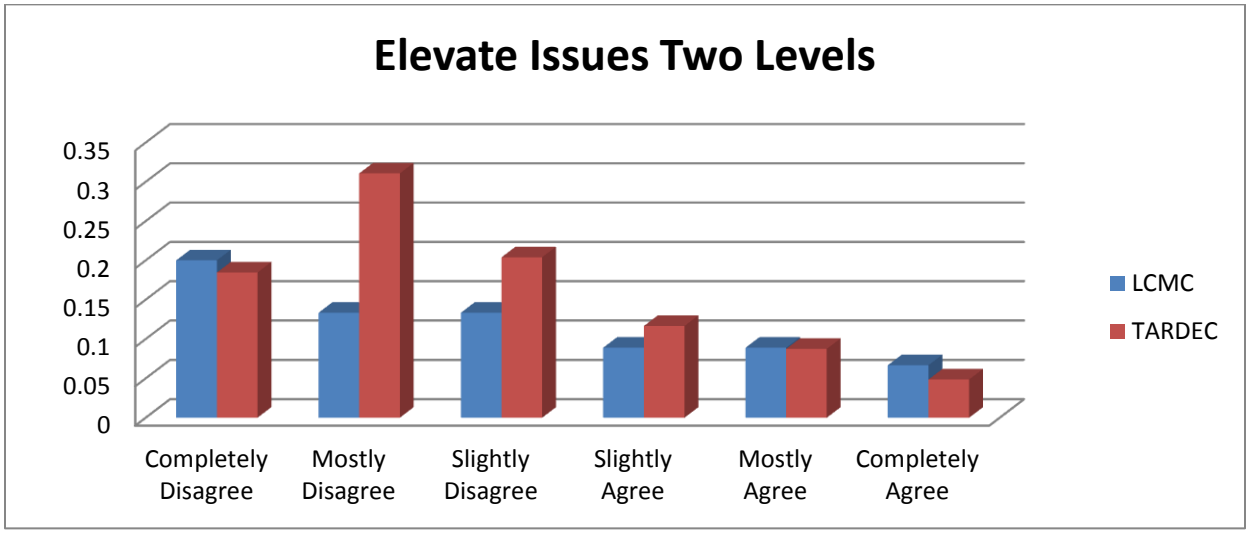

Figure 35 – LCMC vs. TARDEC Elevate Issues Two Levels for Resolution

Descriptive Statistics Leadership Training vs. Matrix Effectiveness

The respondents indicated that 62% had taken leadership training (Figure 36). A T-Test was conducted on the data and it was determined with 99% probability that those respondents with leadership training did not feel that matrix organizations were as effective as those who did not have leadership training (Figure 38). The researcher was not able to isolate which leadership training course had a more significant impact upon matrix effectiveness.

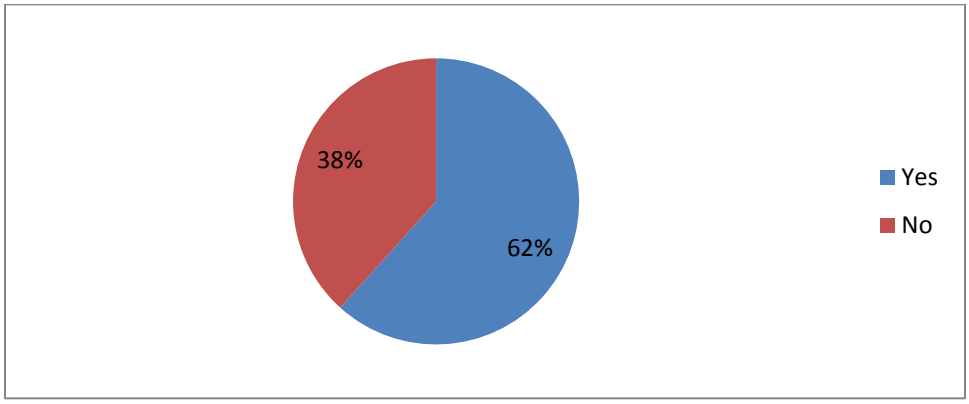

Figure 36 – Leadership Training Distribution

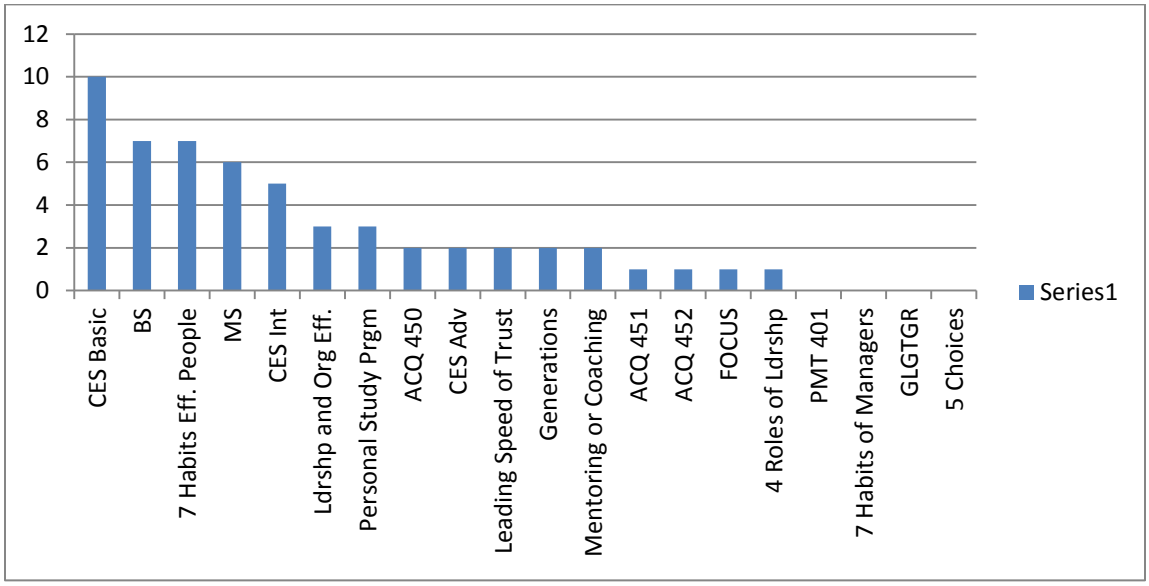

Figure 37 – Leadership Training Identified

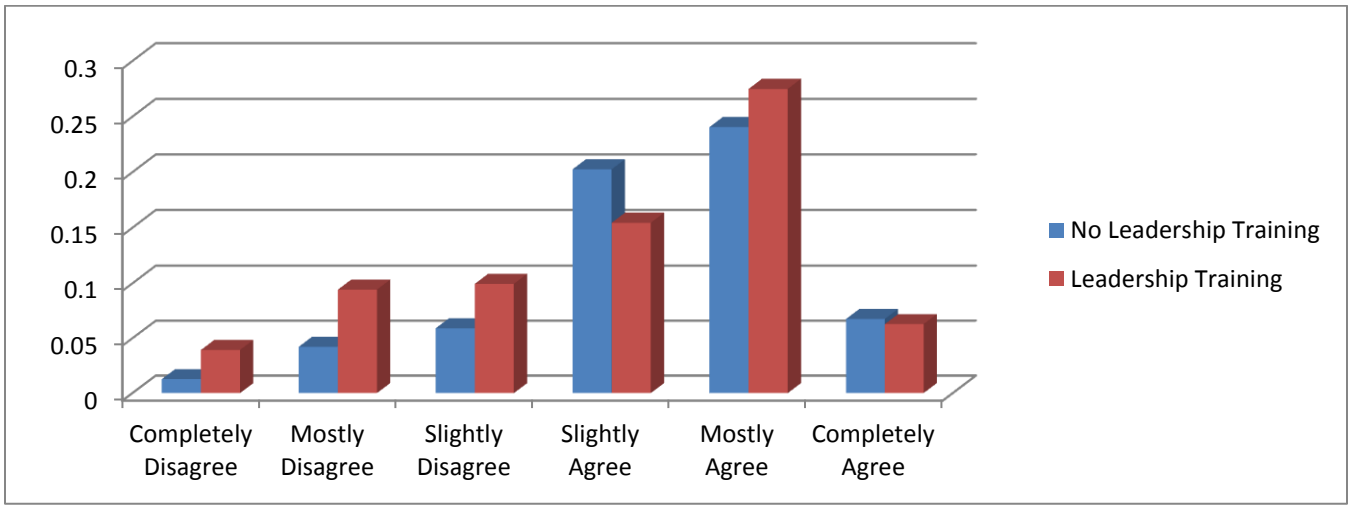

Figure 38 – Leadership Training vs. Matrix Effectiveness

The respondents indicated that 54% were level 3 certified in their career field. A T-Test was conducted on the data and it was determined with 98% probability that those respondents

that were not level 3 certified believe the Matrix Strategy at TACOM is more effective than those who are level 3 certified Figure 39.

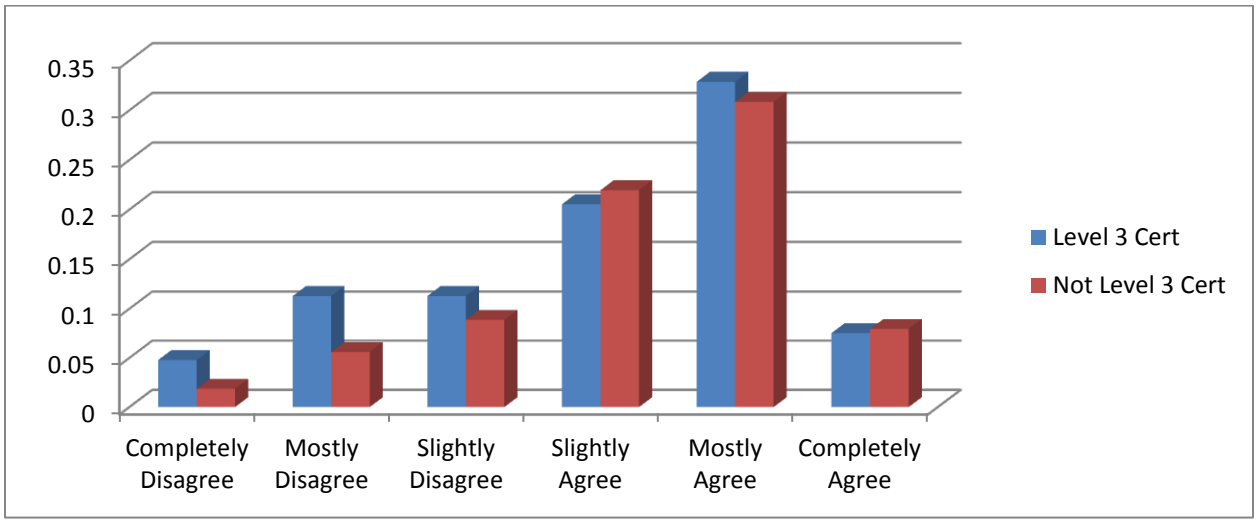

Figure 39 – Level 3 Certified vs. Matrix Effectiveness

Descriptive Analysis Gender vs. Matrix Effectiveness

A T-test was conducted on the data and it was determined with 99% probability that female respondents believed the Matrix Strategy at TACOM is more effective than male respondents Figure 40.

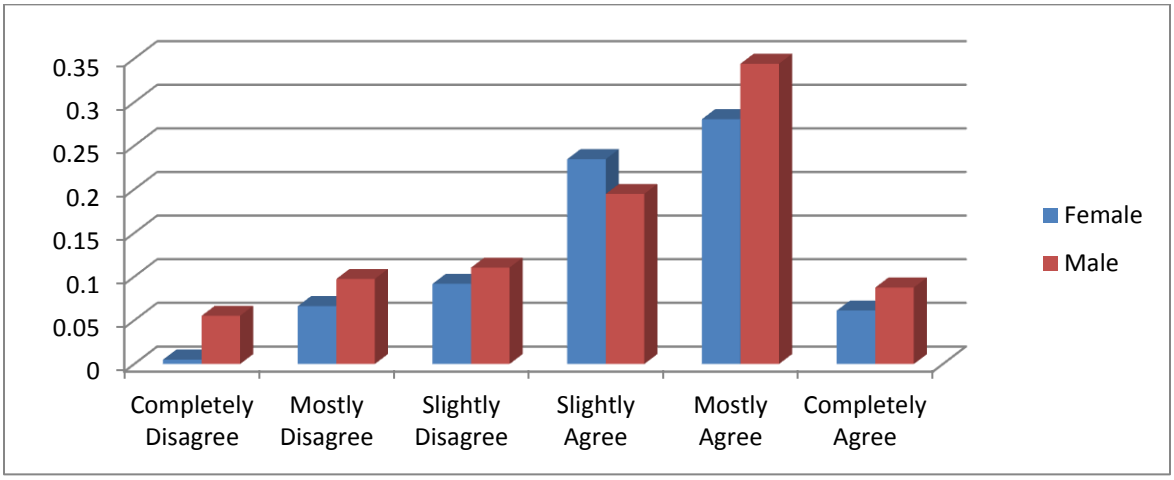

Figure 40 – Gender vs. Matrix Effectiveness

A T-test was conducted on the data and it was determined there is no statistical difference between responses from core and matrixed associates Figure 41.

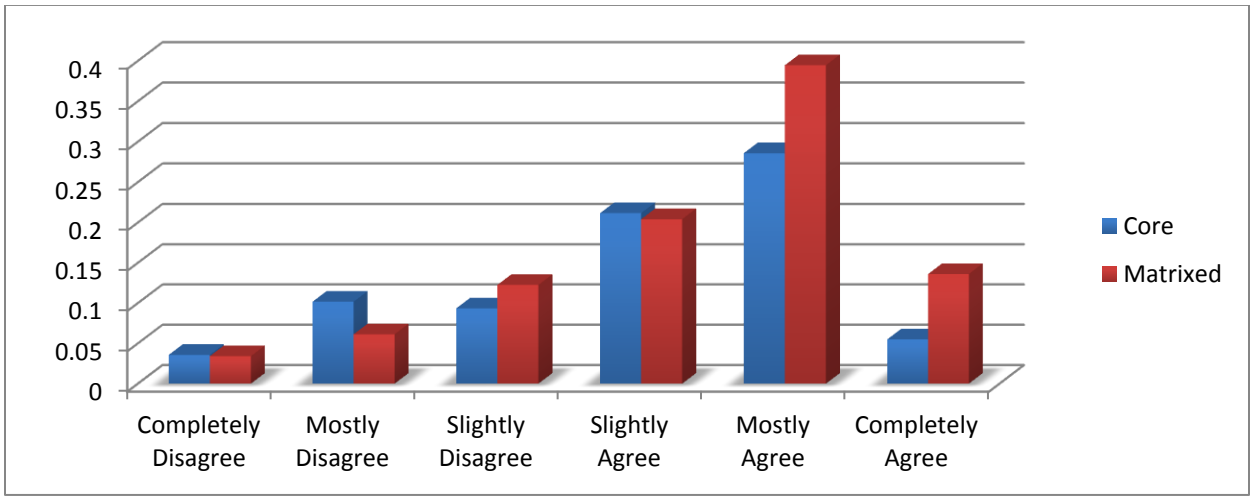

Figure 41 – Matrixed or Core vs. Matrix Effectiveness

Descriptive Statistics Organization vs. Matrix Effectiveness

An ANOVA statistical analysis determined that organization that the respondents were from was statistically significant to their opinion of the effectiveness of the matrix organizational structure

at the TACOM LCMC. The p value was .001, the F was 4.59 and the F-critical was 2.39. Completing the Tuckey analysis determined to a 95% confidence level that LCMC believed the Matrix Organizational structure was more effective than the PEOs, and also that the LCMC believed the Matrix Organizational structure was more effective than TARDEC.

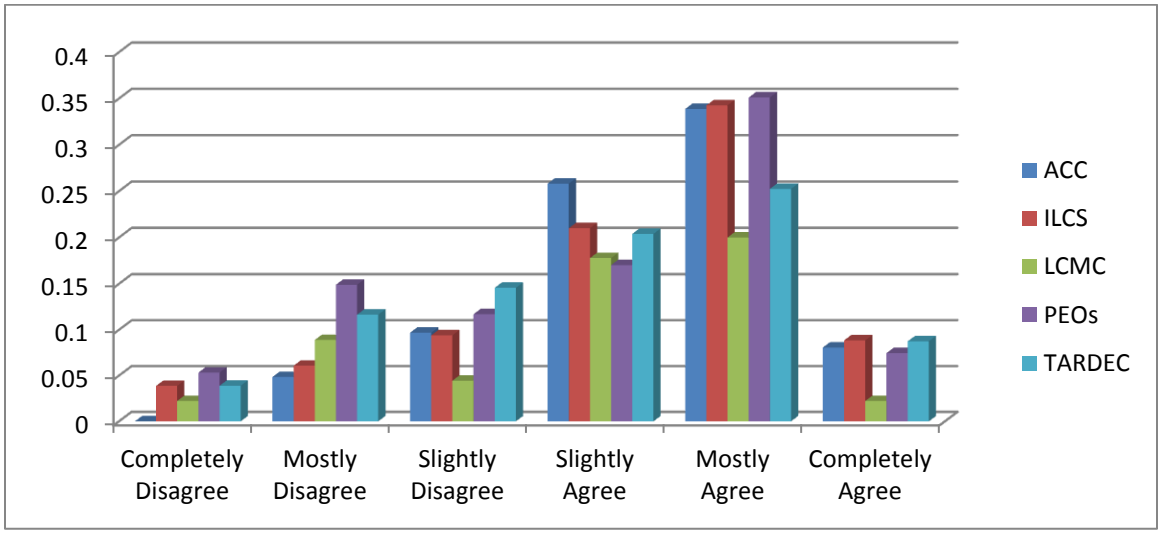

Figure 42 – Respondents Organization vs. Matrix Effectiveness

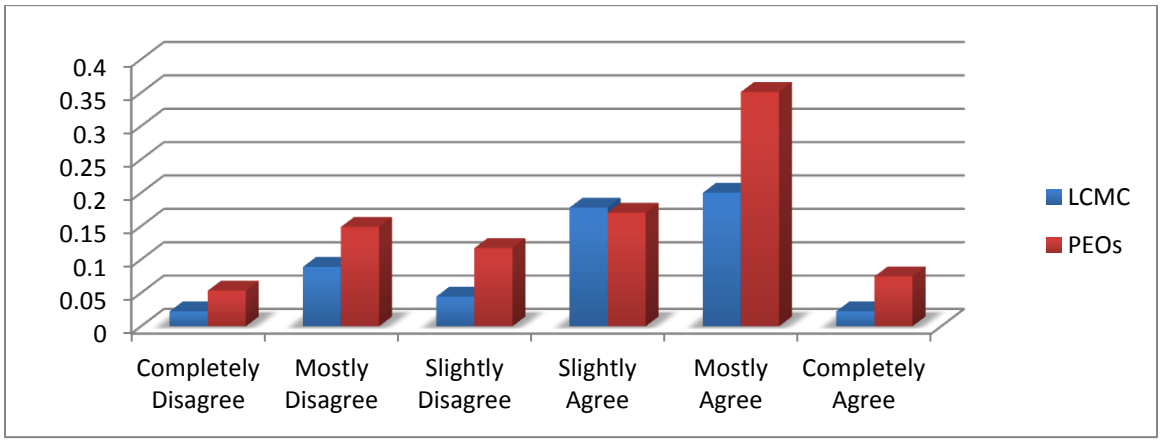

Figure 43 – LCMC vs. PEOs Matrix Effectiveness

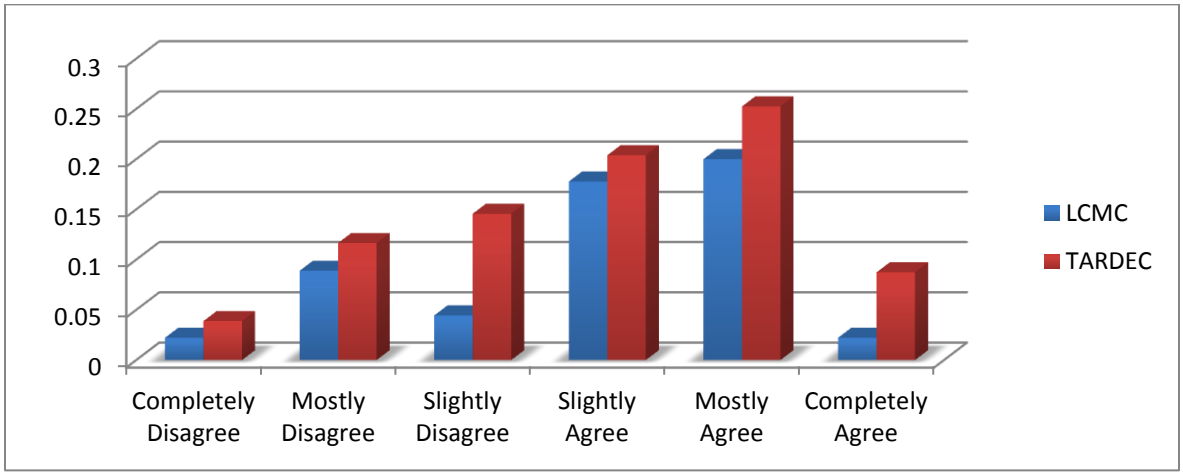

Figure 44 – LCMC vs. TARDEC Matrix Effectiveness

Descriptive Statistics Grade vs. Matrix Effectiveness

An ANOVA statistical analysis determined that the service grade of the respondent was statistically significant to their opinion of the effectiveness of the matrix organizational structure at the TACOM LCMC. The p value was .001, the F was 5.25 and the F-critical was 2.63. Completing the Tuckey analysis determined to a 95% confidence that:

GS5-8 believed the Matrix Organizational structure was more effective than GS12-13

GS5-8 believed the Matrix Organizational structure was more effective than GS14-15

GS9-11 believed the Matrix Organizational structure was more effective than GS12-13

GS9-11 believed the Matrix Organizational structure was more effective than GS14-15

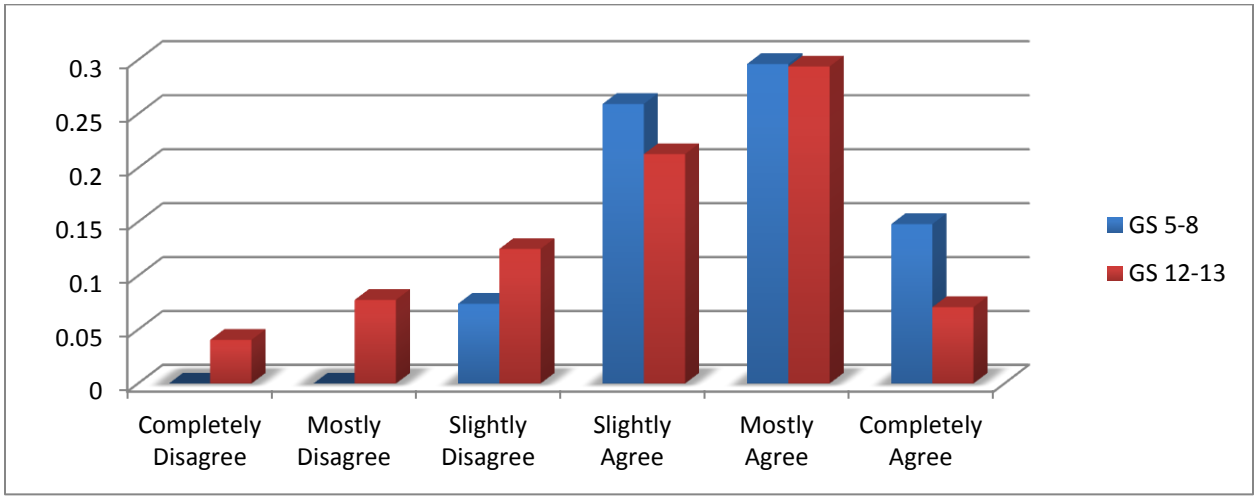

Figure 45 – GS5-8 and GS12-13 vs. Matrix Effectiveness

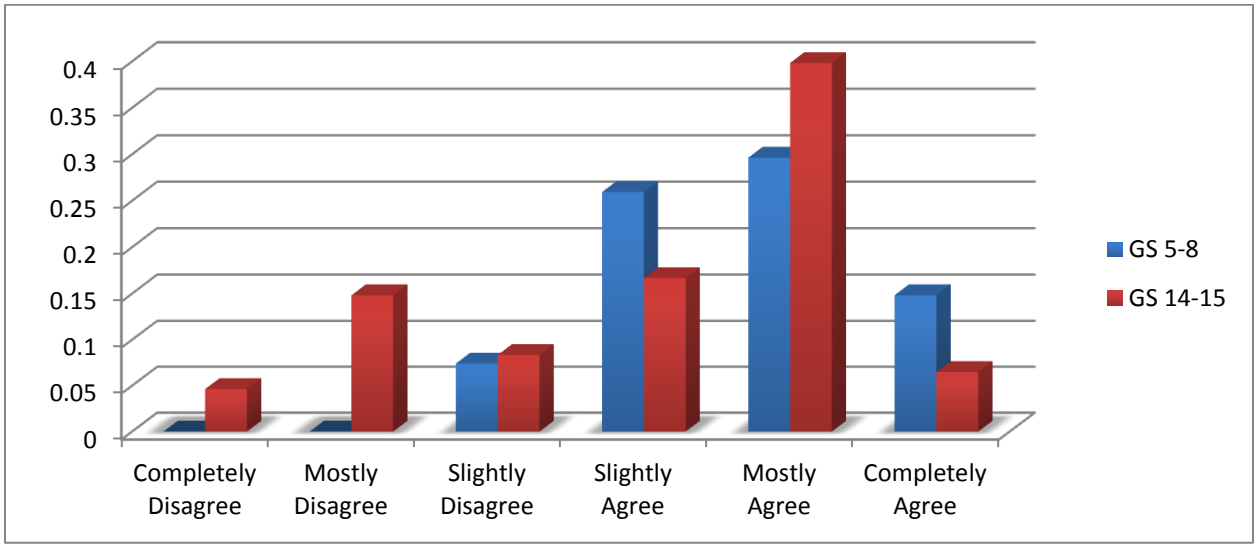

Figure 46 – GS5-8 and GS14-15 vs. Matrix Effectiveness

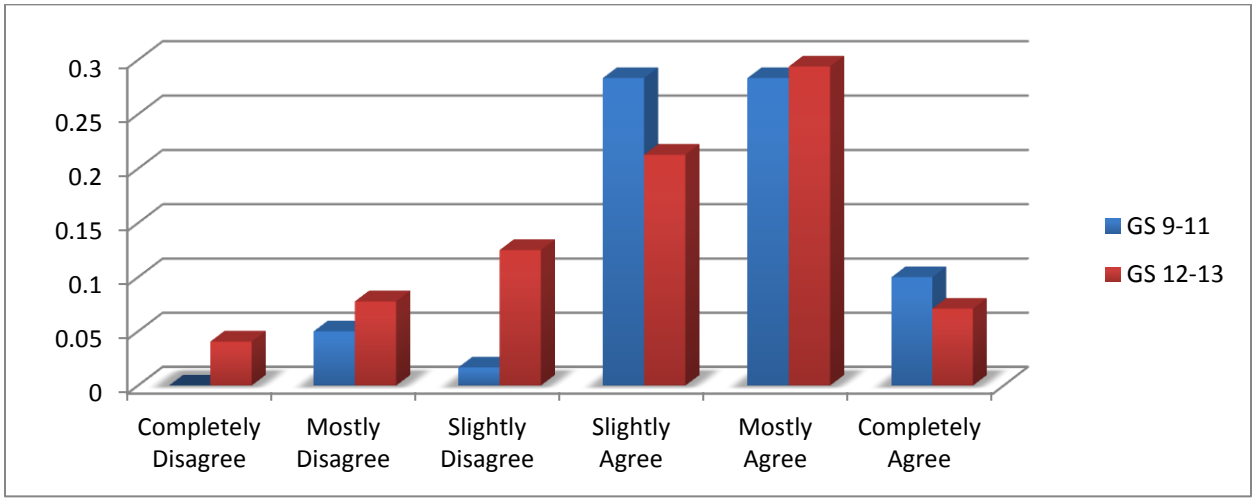

Figure 47 – GS9-11 and GS12-13 vs. Matrix Effectiveness

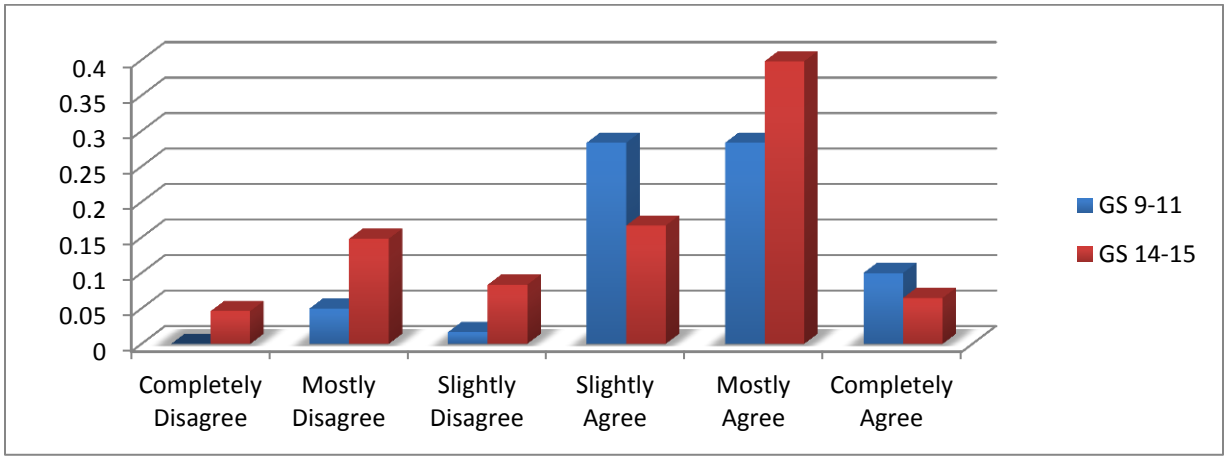

Figure 48 – GS9-11 and GS14-15 vs. Matrix Effectiveness

Chapter 5 – Conclusions and Recommendations

The matrix organizational structure design is a powerful tool to force interaction and integration of diverse organizational units (Katz et al, 1985). The potential for increases in communications, information processing, flexibility, employee satisfaction and technical expertise have prompted many corporations to reorganize in order to take advantage of its benefits (Ford et al, 1992). When a matrix organization structure is not effectively designed and implemented, it may result in power struggles, lack of decision making, personal stress, and the need for increased support from leadership (Andrews et al, 1988). It has also proven to be difficult to implement and disruptive if implemented without the prior establishment of a highly collaborative culture. Choosing to implement a matrix organizational structure is a serious top level decision requiring commitment to a thorough implementation (Davis et al, 1977).

The purpose of this study is to determine the characteristics of an effective matrix organizational structure identified in the literature, and determine the extent to which matrix organizations at the TACOM LCMC exhibit these characteristics. The paper will also determine if organizations within the TACOM LCMC that exhibit higher levels of these characteristics have more effective matrix organizations.. The paper will also determine if leadership training impacts the effectiveness of matrix management.

Findings and Implications

The findings for each hypothesis and the implications for management are discussed in this section. There were four research questions related to the matrix organizational structure in this study:

- What are the characteristics of effective matrix organizations?
- Are these characteristics exhibited within the TACOM LCMC organization?
- Do teams that exhibit these characteristics more than others have more effective matrix organizations?
- Does leadership training impact the effectiveness of matrix management?

The three hypotheses tested in this research study are:

H_{01}: The TACOM LCMC does not exhibit characteristics of an effective matrix organization

H_{02}: There are no statistically significant differences among the PMs

H_{03}: Leadership training does not impact the effectiveness of matrix organizations

The first research question is addressed by the literature review. Research questions 2 and 3 are addressed by hypotheses H_{01} and H_{02} review. Research question 4 is addressed by hypotheses H_{03}. The findings for each of the hypotheses are discussed below.

(H_{01}) The TACOM LCMC does not exhibit characteristics of an effective matrix organization. For the purposes of this study the characteristics of an effective matrix organization are conflict resolution, consistent business processes, knowledge transfer, communications and appropriate level (Kates et al., 2007).

(H_{02}) There are not statistically significant variations among the PMs.

In order to test the hypothesis H_{02}, a regression analysis was conducted on each of the characteristics of an effective matrix organization as indicated in Figure 6 (above).

Conflict Resolution - The Tukey-Kramer Post Hoc test showed statistically significant differences between Group 3 and Groups 4 & 5. Respondents in Group 3 comprised the LCMC. Respondents in Group 4 comprised PEO CS&CSS and PEO GCS. The respondents in Group 5 were comprised of TARDEC. Among these groups the LCMC had a mean score of 5.19, the

PEOs had a mean score of 4.19, and TARDEC had a mean score of 4.42. Therefore, one can conclude that the LCMC exhibits more ability to resolve conflict.

Consistent Business Processes – In order to test H_{02}, a review of the data collected revealed that there was little consistency in business processes at the TACOM LCMC. The largest group of core associates managing matrix associates (35 percent) reported that they were responsible for providing daily direction only. The second largest group (23 percent) reported that they were responsible for all the daily direction, rating, travel and leave request and timecard approvals for matrix associates reporting to them. This indicates that there is a large amount of variation in business processes within the TACOM LCMC command. This impacts the ability of matrix associates to transfer between PMs, and increases the time required for them to become contributing members to a team.

Knowledge Transfer – In order to test H_{02}, a regression analysis was conducted. It was confirmed that there was statistical difference in the frequency that TARDEC and ILSC matrix associates meet with their functional leadership. Across the TACOM LCMC 25 percent of matrix associated reported that they never meet with their functional leadership. This indicates that the organization is not transferring knowledge and best practices.

Communications – In order to test H_{02}, a regression analysis was conducted. The Tukey-Kramer Post Hoc test showed statistically significant differences between Group 2 and Group 3 as well as between Group 3 and Groups 4 & 5. Respondents in Group 2 comprised the ILSC, Group 3 comprised LCMC Command Group, Group 4 comprised the combined PEOs and Group 5 comprised TARDEC. Among these groups the LCMC had a mean score of 5.32, TARDEC had a mean score of 4.71, the PEOs had a mean score of 4.71, the ILSC had a means score of

4.64. Therefore, one can conclude that the LCMC exhibits more effective communication and the ILSC exhibits the least.

Appropriate Level – In order to determine if the matrix was implemented at the appropriate level, the respondents who indicated they were core associated were asked if they were empowered to resolve issues at their level. The respondents who indicated they were matrix associates were asked if their supervisors were empowered to resolve issues. The number of responses was insufficient to complete a statistical analysis comparing the various groups of the TACOM LCMC. A second aspect to determining if the matrix is set at the appropriate level is whether groups must elevate issues more than two levels for resolution. The Tukey-Kramer Post Hoc test showed statistically significant differences between the LCMC Staff and ACC-Warren, the PEO and TARDEC. The p value was .005, the F was 3.749 and the F-critical was 2.391. Completing the Tuckey analysis determined to a 95% confidence that the LCMC staff elevated issues more than two levels for resolution more often than the ACC, PEOs and TARDEC.

(H_{03}) Leadership training does not impact the effectiveness of matrix organizations. In order to test hypotheses H_{03}, a one-sample t-test was conducted on the results of question 9 and it was determined with 99% probability that those respondents with no leadership training believe the matrix organization is more effective than those with leadership training. One can conclude that those with leadership training have higher expectations for the effectiveness of the matrix implementation at the TACOM LCMC.

Recommendations

The literature review in this research paper presented the characteristics of an effective matrix organization. The research completed did not receive adequate responses for the PMs to statistically determine if specific PMs exhibited more characteristics of an effective matrix organization.

Those associates whot had completed leadership training felt the matrix organization was less effective than those whot had not received leadership training. This indicates that those with leadership training have higher expectations for the effectiveness of the matrix implementation at the TACOM LCMC.

The review of business processes within TACOM LCMC indicates there is a large amount of variation. This variation increases the time required for matrix associates to become acclimated to working in a new organization. Consistently applying roles and responsibilities for providing associate's ratings, travel requests, leave request, timecard approvals and daily direction will increase the effectiveness of associates moving between PMs within the TACOM LCMC.

The research presented in this study shows that 24 percent of matrixed employees never meet with their functional leadership. This does not allow lessons learned and best practices to be implemented throughout the command. This communication link is valuable to matrix organizations in reinforcing priorities, improving processes and ensuring the professional development of matrix associates.

Of those respondents who were matrixed associates, only 1 had been assigned to more than two PMs in the previous 24 months. This indicates that the TACOM LCMC is not fully utilizing the flexible nature of matrix organization.

Suggestions and Implications for Future Research

The business processes reviewed as part of this research revealed variation that impacts the effectiveness of matrix associates moving into new assignments. Commonizing the processes would reduce the amount of time required for associates to contribute to the goals and objectives of the organizations they are supporting.

Those associates at the TACOM LCMC who have taken leadership training as well as those who are Level 3 Certified believe the matrix structure is less effective than those that have not taken leadership training. Follow- up research would be interesting to confirm that this is indeed the case. The researcher estimates that respondents with leadership training and level 3 certification may be in positions that require superior communication and collaboration skills.

The respondents from the ILSC all responded that they were not empowered to resolve issues at their level. Further investigation would be valuable to confirm the results obtained from this research.

Conclusion

This research examined the characteristics of matrix organizational structures and compared those characteristics with those of matrix organizations at the Tank-Automotive and Armaments Command (TACOM) Life Cycle Management Command (LCMC), and identified opportunities to increase the effectiveness of matrix structures at TACOM LCMC.

Significant findings from the study show that effective matrix organizations are able to resolve conflict, have consistent business processes, transfer knowledge, communicate well and implement the matrix at the appropriate level. The business processes utilized to manage matrix associates vary significantly across the TACOM LCMC. The knowledge transfer of matrix associates back to their functional leadership is limited since only forty five percent of matrix associates meet with their functional leadership on more than an annual basis. Half of the core associates who provide day- to- day direction to matrix associates felt they were not empowered to resolve issues at their level. PEO CS&CSS had the best response with eighty seven being empowered; ILSC had the worst response reporting zero percent being empowered. As associates at the TACOM LCMC progress in rank, receive leadership training and become level 3 certified in their fields, their opinion of the effectiveness of the matrix organization decreases.

Recommendations from the findings include completing an analysis of the business processes utilized across the TACOM LCMC and commonizing their implementation to the greatest extent possible. This will reinforce the roles and responsibilities of both the core associates leading matrixed teams as well as the roles and responsibilities of the functional leadership which support matrix associates. TACOM should establish a minimum cadence and a standard agenda for matrix associates to report back to the leadership of their functional organization. The meeting objectives should be focused on gathering lessons learned, and ensuring that matrix associates are receiving the development support required for their advancement.

References

Alexander, J. W., & Randolph, W. A. (1985). The fit between tecnology and structure as a predictor of performance in nursing subunits. *Academy of Management*, 844-859.

Andrews, R., Barker, J., & Tjosvold, D. (1988). Conflict approaches of effective and ineffective project managers: A field study in a matrix organization. *Journal of Management Studies*, 25(2), 167-178.

Armandi, B. R., Ford, R. C., & Heaton, C. P. (1988). *Organization theory: An integrative approach.* New York: Harper & Row.

Cleland, D. I. (1968). The deliberate conflict. *Business Horizons*, 11(1), 78.

Cleland, D. I. (1981). The cultural abience of the matrix organization. *Management Review*, 24-39.

Daniels, J. D., & Pitts, R. A. (1984). Aftermath of the Matrix Mania. *Columbia Journal of World Business*, 48.

David, F. R., Pearce, J. A., & Randolph, W. A. (1989). Linking technology and structure to enhance group performance. *Journal of Applied Psychology*, 233-241.

Davis, S. M., & Lawrence, P. R. (1977). *Matrix.* Reading: Addison-Wesley.

Davis, S., & Lawrence, P. (1978). Problems of matrix organizations. *Harvard Business Review*, 56(3), 131-142.

Denis, H. (1986a). Is the matrix organization a cumbersome structure for engineering projects. *Project Management Journal*, 49-55.

Denis, H. (1986b, Auguest). Matrix Structures, quality of working life, and engineering productivity. *IEEE Transactions on Engineering Management*, 148-156.

Dill, D. D., & Pearson, A. W. (1984). The effectivness of project managers: implications of a plitical model of influence. *IEEE Transactions on Engineering Management*, 138-146.

Dimarco, N., Goodson, J. R., & Houser, H. F. (1989). Situational leadership in a project/matrix environment. *Project Management Journal*, 11-18.

Elmes, M., & Wilemon, D. (1988). Organizational culture and project leader effectiveness. *Project Management Journal*, 54-62.

Fielder, F. (1967). *A Theory of leadership Effectiveness.* New York: McGrawHill.

Ford, R. C., & Randolph, W. A. (1992). Cross-functional structures: A review and integration of matrix organization and project management. *Journal of Management*, 18(2), 267-294.

Ford, R. C., Armandi, B. R., & Heaton, C. P. (1988). *Organization theory: An integrative approach.* New York: Harper & Row.

Galbraith, J. R. (1971). Matrix Organization Designs. *Business Horizons*, 29-40.

Galbraith, J. R. (1973). *Designing Complex Organizations.* Boston: Addison-Wesley Longman Publishing Co.

Greiner, L. E., & Schein, V. E. (1981). The paradox of managing a project-oriented matrix: establishing coherence within chaos. *Sloan Management Review*, 17-22.

Guterl, F. V. (1989). Goodbye, old matrix. *Business Month*, 32-38.

Jerkovsky, W. (1983). Functional Management in Matrix Organizations. *IEEE Transactions on Engineering Management*, 89-97.

Joyce, W. F. (1986). Matrix Organization: A Social Experiment. *Academy of Management Journal*, 536-561.

Kates, A., & Galbraith, J. R. (2007). *Designing your organization. Using the star model to solve 5 critical design challenges.* San Francisco: Jossey-Bass.

Katz, R., & Allen, T. (1985). Project performance and the locus on influence in the r&d matrix. *Academy of Management Journal*, 28(1), 67-87.

Keller, R. (1986). Predictors of the performance of project groups in r&d organizations. *Academy of Management Journal*, 29:4 715-726;.

Kerzner, H. (1984). *Project management a systems approach to planning, scheduling and controlling.* Hoboken: John Wiley & Sons.

Kezsbom, D. S. (1988). Leadership and influence: The challenge of project management. *American Associatoin of Cost Engineers*, 1-2.

Knight, K. (1976). Matrix organization: A review. *Journal of Management Studies*, 111-130.

Kolodny, H. F. (1979). Evolution to a Matrix Organization. *Academy of Management Review*, 543-553.

Kur, E. C. (1982). Making Matrix Management Work. *Supervisory Management*, 37-43.

Larson, E. W., & Gobeli, D. H. (1987). Matrix Management: Contradictions and Insights. *California Management Review*, 126-138.

Londono, E. (2012, October 13). *DOD Early Bird*.

Mantel, S. J., & Meredith, J. R. (2011). *Project Management.* New York: John Wiley & Sons.

Marquis, D. G., & Straight, D. M. (1965). *Organizational factors in project performance.* Retrieved from DSpace@MIT: http://hdl.handle.net/1721.1/48632

Mee, J. F. (1969). IDEAtional Items--a collection. *Business Horizons*, 53-61.

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

Morton, David H & Project Management Institute. (1975). *Project manager, catalyst to constant change: A behavioral analysis.* Drexel Hill: Project Management Institute.

Peters, T. J. (1979). Beyond the matrix organization. *McKinsey Quarterly*, (3), 10-28.

Petterson, N. (1991). Selecting project managers: An integrated list of predictions. *Project Management Journal*, 21-25.

Poirot, J. W. (1991). Organizing for quality: Matrix organization. *Journal of Management in Engineering*, 7(2), 178-186.

Posner, B. Z. (1986). What's all the fighting about? Conflicts in project management. *IEEE Transactions on Engineering Management*, 207-211.

Posner, B. Z. (1987). What it takes to be a good project manager. *Project Management Journal*, 51-54.

Randolph, W. A., & Blackburn, R. S. (1989). *Managing organizational behavior.* Homewood: Irwin.

Randolph, W. A., & Dess, G. G. (1984). RANDOLPH, W., & DESS, G. The congruence perspective of organizational design. *Academy of Management Review*, 114-127.

Randolph, W. A., & Posner, B. Z. (1992). *Getting the job done: Managing project teams and taks forces for success.* Englewood Cliffs: Prentice-Hall.

Stat Trek. (2013, April 2). *Stat Trek/sample-size*. Retrieved from Stat Trek: http://www.stattrek.com/sample-size/simple-random-sample.aspx

Struckenbruck, L. (1989). *The implementation of project management.* Reading: Addison-Weslcy.

Thamhain, H., & Wilemon, D. (1987). Building high performing engineering project teams. *IEEE Transactions on Engineering Management*, 130-137.

Wall, W. C. (1984). Integrated management in matrix organization. *IEEE Transactions on Engineering Management*, 30-36.

Glossary of Acronyms and Terms

ACC .....Army Contracting Center

AMC .....Army Materiel Command

ANOVA .....Analysis of Variance

ARDEC.....Army Armament Research, Development and Engineering Center

BCT.....Brigade Combat Team

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

DA.....Department of the Army

DAU.....Defense Acquisition University

FCS .....Future Combat System

FP .....Force Projection

G2.....Military Intelligence

G3.....Military Plans, Operations and Training

GCS.....Ground Combat Systems

GS .....General Schedule

ILSC.....Integrated Lifecycle Sustainment Command

IRB.....Institutional Review Board

JCSS.....Joint Combat Support Systems

LAV .....Light Armored Vehicle

LCMC .....Life Cycle Management Command

LTU.....Lawrence Technological University

MRAP .....Mine Resistant Ambush Protected Vehicles

NSRDEC.....Natick Soldier RD&E Center

OPSEC.....Operations Security

PEO.....Program Executive Office

PM.....Program Manager

RACI.....Responsible Accountable Consulted Informed

RDECOM .....Research Design Engineering Command

SES.....Senior Executive Service

SSCF .....Senior Service College Fellowship

SW.....Soldier Weapons

SWAR.....Soldier Warrior

TACOM.....Tank – Automotive and Armaments Command

TARDEC.....Tank Automotive Research Design Engineering Center

TV .....Tactical Vehicles

Appendix A – Institutional Review Board Approval Letter

Lawrence Technological University
Institutional Review Board
Office of the Provost
21000 West Ten Mile Road
Southfield, MI 48075
research.ltu.edu <http://www.ltu.edu/provosts_office/IRB.asp>
irb@ltu.edu

December 8, 2012

Dear James Baumgartner,

I am pleased to report that your IRB application to conduct research with human participants for the project, "Characteristics of Effective Matrix Organizations Displayed at TACOM LCMC", has been approved under the Expedited review path for a period of one year, November 27, 2012 – November 27, 2013.

The IRB is satisfied that the following three ethical concerns regarding the treatment of your human participants have been addressed in your research protocol: (1) The research involves administering a survey to participants who will voluntarily consent to complete the survey and who are free to withdraw from the study at any time; (2) You have identified potential risks to you and the participants; and (3) You have assured that a balance exists between potential benefits of the research to the participant 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 any changes to your research protocol that impact the ethical treatment of your research participants. Please do not hesitate to contact the IRB if you have any questions.

Sincerely, Matthew Cole

Matthew Cole, Ph.D.
Assistant Professor of Management
IRB Chair
Lawrence Technological University
College of Management

21000 West Ten Mile Road

Southfield, MI 48075
o. 248.204.3096 f. 248.204.3099 irb@ltu.edu

Appendix B – Research Survey

Consent Question

***1. As an adult 18 years of age or older, I agree to participate in this research about Matrix Organization Effectiveness within the TACOM LCMC in Warren, Michigan. The research is being conducted by J. Scott Baumgartner, Department of Management, Lawrence Technological University and the Senior Service Executive Fellowship (SSCF) Program of Defense Acquisition University (DAU), James.Baumgartner@dau.mil**

I understand that my participation is entirely voluntary; I can withdraw my consent at any time. By agreeing to participate in this study, I indicate that I understand the following:

1. The purpose of this research project is to determine the degree to which the characteristics of an effective maxtrix organization are exhibited within the TACOM LCMC. Should I choose to participate in the survey, I am aware that my feedback will be consolidated with my peers and the outcome will be briefed to TACOM LCMC leadership allowing them to be better informed to make organizational enterprise changes.

2. If I choose to participate in this research, I will be asked to complete an online questionnaire. The questionnaire will include questions about the characteristics of a matrix organization structure at the TACOM LCMC. The questionnaire will take approximately 10 minutes to complete.

3. There will be no incentive for participation.

4. All items in the questionnaire are important for analysis, and my data will be more meaningful if all questions are answered. However, I do not have to answer any question that I prefer not to. I can discontinue my participation at any time without penalty by exiting out of the survey.

5. This research will not expose me to any discomfort or stress beyond that which might normally occur during a typical day. There are no right or wrong answers; thus, I need not be stressed about finding a correct answer.

6. There are no known risks associated with my participating in this study.

7. Data collected will be handled in a confidential manner. The data collected will remain anonymous. The purpose of this research has been explained and my participation is entirely voluntary. I understand that the research entails no known risks and by completing this survey, I am agreeing to participate in this research project.

YOU MAY PRINT THIS PAGE FOR YOUR RECORDS.

Research at Lawrence Technological University that involves human participants is carried out under the oversight of the Institutional Review Board. Questions or problems regarding these activities should be addressed to Dr. Matthew Cole, Chairperson of the Institutional Review Board, at irb@ltu.edu, Lawrence Technological University, 2100 West Ten Mile Road, Southfield, MI 48075, (248) 204-3541.

◯ I have read this informed consent and I AGREE to participate

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

Demographic Data

***2. How many years have you worked at the TACOM LCMC?**

- ◯ <1 yr
- ◯ 1-5
- ◯ 6-10
- ◯ 11-15
- ◯ 16-20
- ◯ >20

***3. What is your current pay grade or equivalent GS level?**

◯ GS 1-4 ◯ GS 5-8 ◯ GS 9-11 ◯ GS 12-13 ◯ GS 14-15 ◯ SES

Other (please specify)

***4. What is the highest level of education you have completed?**

- ◯ High School
- ◯ Associate's Degree
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Doctoral Degree

Other (please specify)

5. What is your gender

- ◯ Male
- ◯ Female

***6. What year were you born?**

◯ Prior to 1946 ◯ 1946 – 1964 ◯ 1965 – 1980 ◯ 1981 or after

7. Are you level 3 Certified in your Primary Career Field?

- ◯ Yes
- ◯ No

8. Have you taken Leadership Training?

- ◯ Yes
- ◯ No

Leadership Training

9. What leadership training have you received? Please identify training received during and prior to government service. Select all that apply.

- [ ] Undergraduate academic course in leadership
- [ ] Graduate academic course in leadership
- [ ] ACQ 450
- [ ] ACQ 451
- [ ] ACQ 452
- [ ] PMT 401
- [ ] CES Basic
- [ ] CES Intermediate
- [ ] CES Advanced
- [ ] Focus: Achieving Your Highest Priorities (Time Management)
- [ ] 7 Habits of Highly Effective People
- [ ] 7 Habits for Managers
- [ ] 4 Roles of Leadership
- [ ] Great Leaders Great Teams Great Results
- [ ] Leading at the Speed of Trust
- [ ] Five Choices
- [ ] Generations
- [ ] Leadership and Organizational Effectiveness
- [ ] Personal study program
- [ ] Mentoring or Coaching program
- [ ] None

Other (please specify)

***10. Are you Core or a Matrixed associate?**

- ◯ Core
- ◯ Matrixed

Core Associates Questions

***11. What Organization do you work for?**

- ◯ LCMC Command Group
- ◯ LCMC Staff Element
- ◯ TARDEC
- ◯ PEO GCS
- ◯ PEO CS & CSS
- ◯ PEO Solider
- ◯ ILSC
- ◯ Army Contracting Center - Warren
- ◯ IMCOM
- ◯ Other (please specify)

12. Who provides your missions objectives and priorities?

- ☐ Your Rater
- ☐ Team Lead/Supervisor
- ☐ Both

Other (please specify)

13. Do you provide day to day direction to associates matrixed from another organization?

- ◯ Yes
- ◯ No

14. Are you empowered to resolve issues at your level or do you need to elevate them for resolution?

- ◯ Yes
- ◯ No

Other (please specify)

15. Are you responsible for rating the matrixed associates working for you?

- ◯ Yes
- ◯ No

Other (please specify)

16. Do you review matrixed associates' timecards?

- ◯ Yes
- ◯ No

17. Do you review matrixed associates' travel and leave requests?

- ◯ Yes
- ◯ No

Matrixed Associates Questions

***18. What Support Organization do you work for?**

- ◯ ARDEC
- ◯ Army Contracting Center - Warren
- ◯ ILSC
- ◯ IMCOM
- ◯ NSRDEC
- ◯ TARDEC
- ◯ Other (please specify)

19. Which PM do you support?

- ◯ PM Abrams
- ◯ PM Bradley
- ◯ PM Stryker
- ◯ PM Robotics
- ◯ PM Ground Combat Vehicle
- ◯ PM Tactical Vehicles
- ◯ PM Mine Resistant Ambush Protected Vehicles
- ◯ PM force Projection
- ◯ PM Mobile Electric Power
- ◯ PM JLTV
- ◯ PM LAV

Other (please specify)

20. Who provides your mission objectives and priorities?

- ◯ Your Rater
- ◯ Team Lead/Supervisor
- ◯ Both

Other (please specify)

21. Who provides your day to day direction?

- ◯ Your Rater
- ◯ Team Lead/Supervisor
- ◯ Both

Other (please specify)

22. Is the person who provides your day to day direction from?

- ◯ PEO Core
- ◯ The same Support Organization
- ◯ A different Support Organization

Other (please specify)

23. Is your Team Lead/Supervisor able to resolve issues at his/her level?

- ◯ Yes
- ◯ No

24. How often do you meet with leadership from your Support Organization?

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Quarterly
- ◯ Annually
- ◯ Never

25. Does your Rater review your timecards?

- ◯ Yes
- ◯ No

26. Does your Rater review your travel requests?

- ◯ Yes
- ◯ No

27. Have you been matrixed to more than one PM in the last 24 months?

- ◯ Yes
- ◯ No

28. Are you loacted with the PM you support?

- ◯ Yes
- ◯ No

Common Questions for all associates

***29. On a scale from 1 to 6 (1 = Completely Disagree, 2 = Mostly Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Mostly Agree, 6 = Completely Agree) please rate the following statements.**

	1 - Completely Disagree	2 - Mostly Disagree	3 - Slightly Disagree	4 - Slightly Agree	5 - Mostly Agree	6 - Completely Agree
The Organizational Matrix Strategy at the TACOM LCMC is effective	◯	◯	◯	◯	◯	◯
The objectives and priorities used for my annual rating are clearly communicated to me	◯	◯	◯	◯	◯	◯
The objectives and priorities used for my annual rating reflect my day to day activities	◯	◯	◯	◯	◯	◯
The objectives and priorities of the PMs are consistent with those of the matrix support organizations (ACC/ARDEC/ILSC/NSRDEC/TARDEC/etc..)	◯	◯	◯	◯	◯	◯
The teams I work with have consistent involvement from the necessary stakeholders	◯	◯	◯	◯	◯	◯
The teams I work with have clearly documented roles and responsibilities (RACI Chart)	◯	◯	◯	◯	◯	◯
The teams I work with consistently meet program/project objectives	◯	◯	◯	◯	◯	◯
The PMs and the matrix support organizations work closely to ensure all risks are addresses	◯	◯	◯	◯	◯	◯
The PMs and the matrix support organizations ensure all risk mitigations steps are communicated to stakeholders	◯	◯	◯	◯	◯	◯
The PMs and the matrix support oranizations' leadership ensure all risk mitigation steps are implemented.	◯	◯	◯	◯	◯	◯
My team's issues frequently need to be elevated more than two levels above for resolution	◯	◯	◯	◯	◯	◯

30. What do you see as the major obstacles to a more effective use of matrix organizations at the TACOM LCMC?

Conclusion

Thank you for participating in this survey.

Biography

SENIOR SERVICE COLLEGE FELLOWSHIP

J. Scott Baumgartner

Scott Baumgartner was born and raised in the Metro Detroit area and graduated from Michigan State University with a Bachelor of Science in Electrical Engineering (BSEE) in 1992. His first engineering position was at an engineering consulting firm in Lansing, MI. General Motors (GM) hired him in 1994 as a Controls Engineer supporting General Assembly Manufacturing in GM truck plants. In 2000, he transitioned to GM Product Engineering where he was responsible for the cost, schedule and performance of multiple electrical components within several GM vehicles. Civil service began in 2006 at the US Army Tank Automotive Research, Development and Engineering Center (TARDEC) where he resolved cases related to Diminishing Manufacturing Sources and Material Shortages (DMSMS). Prior to his appointment to the Senior Service College Fellowship (SSCF), he was selected for the Mine Resistant Ambush Protected (MRAP) Vehicle Program (2007) and held various roles as a Pre-Production Assessment Team Lead, Vehicle Systems Engineer and Vehicle Platform Assistant Program Manager (APM) and Lead Systems Engineer. Scott guided the execution of more than $8B in base and supplemental funding that resulted in the production of more than 8,000 vehicles and capability improvements for warfighters in combat.

CAREER CHRONOLOGY:

- 2012 – 2013: Senior Service College Fellow, Defense Acquisition University
- 2009 – 2012: Lead Systems Engineer, MRAP, Program Executive Office Combat Support & Combat Service Support (PEO CS&CSS)
- 2008 – 2009: Acting APM, MRAP, PEO CS&CSS
- 2007 – 2008: Systems Engineer, MRAP, Program Executive Office Ground Combat Systems (PEO GCS)
- 2007 – 2007: Pre-Production Assessment Team Lead, MRAP, PEO GCS
- 2006 – 2007: DMSMS Engineer, TARDEC
- 2000 - 2006: General Motors Electrical Architecture Group, Warren MI
- 1994 – 2000: General Motors Manufacturing, Pontiac MI
- 1992 – 1994: Clark Trombley Randers Group Incorporated, Lansing MI

EDUCATION:

- Bachelor of Science Electrical Engineering, Michigan State University 1992

CERTIFICATIONS:

- Army Acquisition Corps Member
- Level III Certification in Systems Planning, Research, and Development - Systems Engineering
- Level II Certification in Systems Planning, Research, and Development – Program Systems Engineering
- Level I Certification in Program Management

HONORS:

- Meritorious Civilian Service Award
- Commanders Award for Civilian Service
- David Packard Excellence in Acquisition Award
- Patents (2) related to the use of turbo systems to improve diesel engine performance.

PERSONAL:

- Golf, Skiing, Fatherhood (two boys Jordan and Simon), Spouse Anne