Lawrence Technological University

College of Management

An Assessment of the U.S. Army Tank Automotive Research, Development and Engineering Center's Utilization of the Processes, and Availability of Tools and Physical Environments that Promote Innovation

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Abstract

A perception exists in the Army that the research and development laboratories are not innovative. The purpose of this study is to determine whether the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) utilizes the processes, and has the tools and physical environments that effectively promote innovation. Note, having the tools and physical environments that promote innovation does not mean that they are effectively utilized. Personnel in TARDEC were surveyed with questions that ask if the organization utilizes innovation best practice processes, if individuals utilize innovation best practice processes, if the tools are available to individuals to innovate, and if physical environments that promote innovation are available to individuals. In addition, survey participants were asked how important these processes, tools and physical environments are to innovation at TARDEC. Survey participants consisted of 118 people who work for TARDEC. The analyses consist of descriptive statistics for the demographics, one-sample t-tests to test the hypotheses, Cronbach's α to determine the reliability of the data, and Pearson's correlation to compare the importance of the innovation factors to the utilization and availability of the processes, tools and physical environment.

The research found that, with the exception of strategic planning, the TARDEC organization is not utilizing best innovation processes. Second, individuals are using opportunity analysis and cross-functional teams to generate and mature ideas even though these activities are not happening at the organizational level. Activity at the individual level, however, is not sustainable for the organization. Third, TARDEC associates do not have access to the tools needed to promote innovation. Finally, the data imply that TARDEC does appear to have a

physical environment conducive to innovation. These results suggest that improvements in processes and tools will promote innovation in the organization.

Table of Contents

List of Tables

List of Figures

Chapter 1- Introduction

Background

A perception exists in the Army that the research and development laboratories are not innovative. The lack of innovation is cited in the Army Science Board Fiscal Year 2012 Study titled *The Strategic Direction for Army Science and Technology*, and in the *Report of the Defense Science Board Task Force on Basic Research,* (Army Science Board, 2013) (Defense Science Board, 2012). Specifically, the Army Science Board study states, "the study found that the Army lacks a S&T strategy and investment plan to meet likely future challenges, improve the transition of technology and advanced capabilities to acquisition, seize valuable technological opportunities, and foster invention and innovation (The Strategic Direction For Army Science and Technology, 2013, p. iii)". The Defense Science Board Task Force found, "that the overall level of innovation within DOD is falling short of what should be possible and what would be desirable (Defense Sciece Board Task Force on Basic Research, 2012, p. xiv)." In addition, the need for innovation was discussed by Army Senior Leaders at the Association of the United States Army (AUSA) annual meeting in October 2013. Specifically, Lieutenant General (LTG) Walker articulated the need to look at rebalancing Army science and technology (S&T) to focus on investing more in innovation so that the Army can do what it needs to do and has the tools it needs in the 2030-2040 timeframe (Association of the United States Army, 2013).

Many different definitions of innovation exist. As such, there is not one standard by which to assess innovation. Some examples follow.

- Innovation is "invention which has reached market introduction in the case of a new product, or first use in a production process, in the case of a process innovation (Utterback, 1971, p. 77)".

- "As P&G's Dr. Mike Addison put it at a Connect and Develop Symposium in February 2003, 'Innovation is all about making new connections. Most breakthrough innovation is about combining known knowledge in new ways or bringing an idea from one domain to another' (Dodgson, Gann, & Salter, 2006, p. 337)".
- Innovation is "breakthrough products, services, and solutions that create growth engines for the future (Cooper, Winning at New Products, 2011, p. 4)".
- The Organization for Economic Co-operation and Development (OECD) says innovation can be defined as "new products, business processes and organic changes that create wealth or social welfare. (Vaitheeswaran, 2007)"
- Richard Lyons, the chief learning officer at Goldman Sachs, an investment bank, offers a more condensed version: "fresh thinking that creates value" (Vaitheeswaran, 2007)."

Respondents to this survey were told that "the act of innovation leads to something original that creates value", which is a common thread in many of these definitions. Regardless of the definition, best practices in innovation processes, tools, and the physical environment are critical to the process of innovation.

The purpose of this study is to determine whether the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) utilizes the processes, and has the tools and physical environments that effectively promote innovation. Note, having the tools and physical environments that promote innovation do not mean that they are effectively utilized.

Conceptual Model

The critical factors that promote innovation in this study are shown in the conceptual model in Figure 1. Processes, tools, and physical environment all affect an individual's ability to innovate. These effects are detailed in Chapter 2.

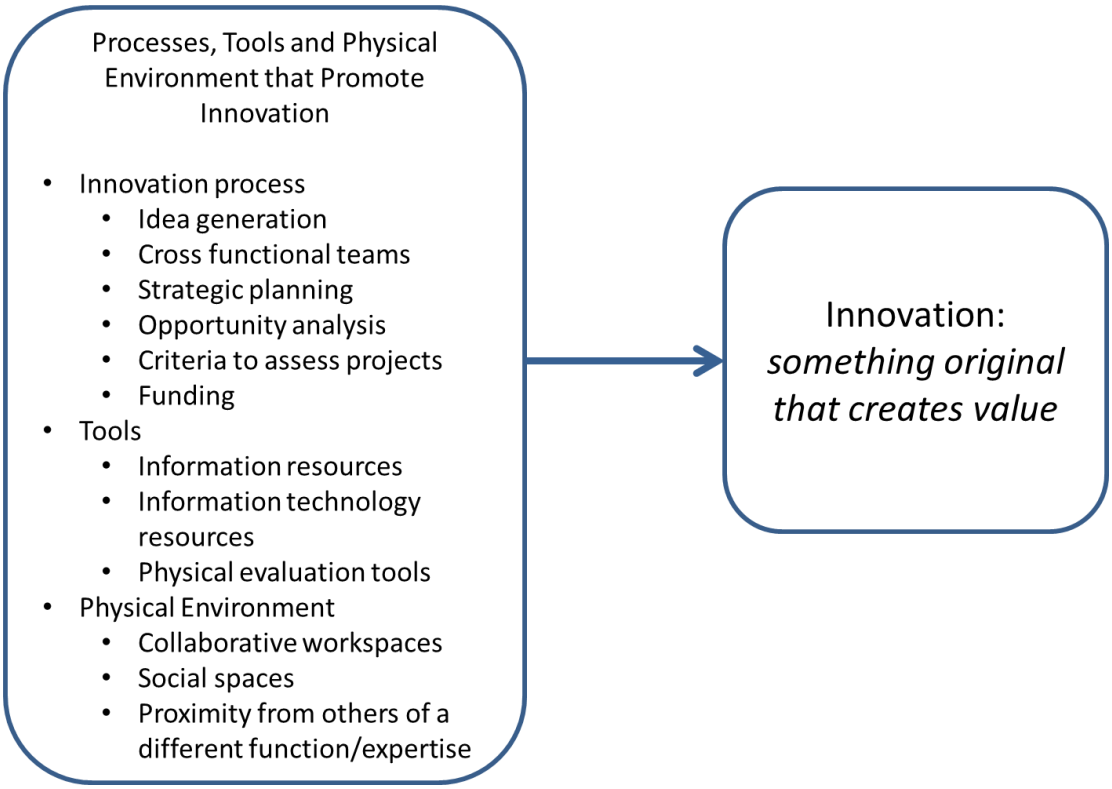

Figure 1 Innovation Processes, Tools and Physical Environment

The extent to which TARDEC utilizes the processes conducive to innovation is measured by the extent to which they engage in the best practices identified in the literature for utilizing these processes. The best practices for the effective utilization of processes include idea generation, cross-functional teams, strategic planning, opportunity analysis, criteria to assess projects, and funding. A brief description of each of these processes follows. More detailed information is included in Chapter 2. Idea generation is the process of generating innovative ideas (Cooper, November-December 2006). Cross-functional teams relate to the use of these

teams to generate and mature innovative ideas (Lauto, Valentin, Hatzack, & Carlsen, July-August 2013) . Strategic planning is planning at the organizational level (Cooper, 2011). Opportunity analysis is the process of understanding where opportunities exist for innovation through understanding technology and the external markets (Nicholas, Ledwith, & Bessant, March-April 2013). Criteria to assess projects and funding are related to portfolio management and how the organization decides what and how much to fund (Cooper, Winning at New Products, 2011).

Tools to promote innovation include information resources, information technology resources, and physical evaluation tools. A brief description of these tools follows. Information resources refer to individuals having access to the information they need to innovate (Utterback, 1971). Also, in order for individuals to innovate they need access to the right information technology resources. Examples are computers, computer aided design (CAD) stations and models or simulations. Physical evaluation tools are important for innovators to be able to physically prove out their ideas. Examples of physical evaluation tools are physical prototyping and laboratory facilities (Jang & Schunn, April 2012).

Finally, with respect to the physical environment, collaborative work spaces, social spaces, and the proximity individuals sit from people with different functions or expertise are critical to promoting innovation. Collaborative work spaces are spaces that are accessible and have the tools that individuals need to innovate (Kelly, 2001). Social spaces are areas where people can meet and talk and where one might typically find drinks or food (Toker & Gray, 2008). Finally, research shows that the closer one is to individuals that perform different functions in the organization or have a different expertise, the more likely innovation will occur (Allen, Winter 2007, Vol. 49, No. 2).

Research Questions

This research paper addresses four fundamental questions related to the utilization of the processes, and the availability of tools and physical environments that promote innovation at TARDEC. Note, having the tools and physical environments that promote innovation does not mean that they are effectively utilized.

The research questions are as follows.

- Are the processes that promote innovation utilized at TARDEC organizationally?
- Are the processes that promote innovation utilized at TARDEC individually?
- Are the tools that promote innovation available to individuals at TARDEC?
- Are the physical environments that promote innovation available to individuals at TARDEC?

Research Hypotheses

The thirteen hypotheses tested as part of this research are depicted in the following table. Hypotheses related to innovation processes were tested both at the organizational and the individual levels.

Table 1 *Innovation Processes, Tools and Physical Environment Hypotheses*

Variable	Null Hypotheses- H_0
Innovation Processes (Org)	
Cross-functional teams	H_{01}: TARDEC does not utilize cross-functional teams innovation best practices
Strategic Planning	H_{02}: TARDEC does not utilize strategic planning innovation best practices
Idea Generation	H_{03}: TARDEC does not utilize idea generation innovation best practices
Opportunity Analysis	H_{04}: TARDEC does not utilize opportunity analysis innovation best practices
Criteria	H_{05}: TARDEC does not utilize innovation best practices criteria to assess projects
Funding	H_{06}: TARDEC does not have separate funding for innovation projects
Innovation Processes (Ind)	
Opportunity Analysis	H_{07}: Individuals at TARDEC do not use opportunity analysis innovation best practices
Cross-functional teams	H_{08}: Individuals at TARDEC do not use cross-functional team innovation best practices
Innovation Tools	
Physical Eval Tools	H_{09}: TARDEC does not have available innovation best practice physical evaluation tools
Info Resources	H_{10}: TARDEC does not have available innovation best practice information resources
Info Technology	H_{11}: TARDEC does not have available innovation best practice information technology
Innovation Physical Environment	
Collaborative Workspace	H_{12}: TARDEC does not have available innovation best practice collaborative workspaces
Proximity	H_{13}: TARDEC associates do not sit near other associates with different functional expertise

Objective

The objective of this research is to evaluate TARDEC against critical best practices for the use of processes that promote innovation, and the availability of the tools and physical environments that promote innovation identified in the literature.

Significance of This Research

Results will provide insight into whether TARDEC utilizes the processes that promote innovation organizationally and individually; has the tools that promote innovation available to individuals; and has the physical environments that promote innovation available to individuals. TARDEC will be able to utilize this information to improve specific elements of their processes, make available to individuals the required tools and modify the physical environment in order for individuals to be more innovative.

Overview of the Research Methodology

This research employs a quantitative approach. Personnel in TARDEC were surveyed with questions that ask whether the organization utilizes innovation best practice processes, individuals utilize innovation best practice processes, if the tools are available to individuals to innovate, and if physical environments that promote innovation are available to individuals. In addition, survey participants were asked how important these processes, tools and physical environments are to innovation at TARDEC.

Survey questions were posed to respondents using a Likert scale. For example, with respect to processes, survey participants were asked to indicate the degree with which they agree with the following statement: "My organization utilizes cross-functional teams to generate innovative ideas". Participants had the following response choices: strongly agree, agree, undecided, disagree, strongly disagree, and don't know. Following is a sample question from the innovation tools section of the survey: "Do you have access to the information technology (IT) resources you need to be innovative? Some examples of information technology resources are computers, CAD stations, and modeling tools". Participants were asked to assess the frequency with which they have access to the tools. Their response choices were: very frequently,

frequently, occasionally, rarely, never, and non-existent. In addition to questions on innovation processes, tools and physical environment, questions related to culture, behavior and climate were also asked. The culture, behavior and climate questions are addressed in Marta Tomkiw's Senior Service College Fellowship (SSCF) thesis (Tomkiw, 2014). The full survey instrument is included in Appendix B.

Analyses were performed on 118 responses from TARDEC employees to the survey instrument. The majority of TARDEC employees are engineers and scientists. The analyses performed consist of descriptive statistics for the demographics, one-sample t-tests to test the hypotheses, Cronbach's α to determine the reliability of the data, and Pearson's correlation to compare the importance of the innovation factors to the utilization and availability of the processes, tools and physical environment.

Survey recipients were asked one qualitative question: "What do you think is the most important factor that enables your ability to innovate?" Answers from this open-ended question are used to explore the most important factors to innovation at TARDEC. An analysis was performed to determine areas for further research.

Limitations of the Study

The research included in this study is only applicable to TARDEC. The original intent of this research was to survey the entire U.S. Army Research Development and Engineering Command (RDECOM). TARDEC is one of eight organizations under RDECOM. Surveying all of RDECOM was not possible at this time due to additional requirements required to survey all RDECOM personnel and the time frame in which data was required for this study.

Chapter 2 – Literature Review

Introduction

Purpose of this Study

The purpose of this study is to determine whether the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) utilizes the processes, and has the tools and the physical environments that effectively promote innovation. Note, having the tools and physical environments that promote innovation do not mean that they are effectively utilized.

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- Are the physical environments that promote innovation available to individuals at TARDEC?

Innovation Definition

Many different definitions of innovation exist. As such, there is not one standard by which to assess innovation. Respondents to this survey were told that "the act of innovation leads to something original that creates value", which is a common thread in many of these

definitions. Regardless of the definition, best practices in innovation processes, tools, and the physical environment are critical to the process of innovation.

Innovation Best Practices

Innovation best practices cross many different functions. This research will review and evaluate best practices in the area of processes, tools and physical environment.

Processes

Key elements of the processes that promote innovation are strategic planning, idea generation, opportunity analysis, utilization of cross-functional teams, criteria to assess projects and dedicated funding.

Prior to any innovation activity, organizations must have a product innovation and technology strategy that focuses the organization toward the areas of innovative growth. The strategy must also be clearly defined, robust and well communicated (Cooper, 2011). It's not enough to have a strategy; organizations must also incorporate innovation into the strategy as a significant element. The strategy should explicitly value innovation, welcome initiative, and reward creative problem solvers (Dougherty & Hardy, 1996, Vol. 39, No. 5).

The trigger for the innovation process begins with idea generation. Idea generation may come as a result of a strategic planning exercise, future forecasting, brainstorming sessions, voice-of-the-customer activities or solicitation of ideas from individuals within an organization (Cooper, Managing Technology Development Projects, November-December 2006). An innovative product development effort is the result of game-changing idea generation (Cooper, 2011). Ideas need time to mature and a safe environment in which to do so. The innovative ideas must be protected long enough for them to be documented and evaluated (Koulopoulus, January 2010). Some companies use multiple methods to solicit innovation ideas. Some

examples include ideation workshops, electronic suggestion boxes, and idea competitions (Lauto, Valentin, Hatzack, & Carlsen, July-August 2013). In addition, individuals must be allowed time to generate innovative ideas. Successful innovative companies, like Google, allow their employees time to think about and/or work on innovative ideas. Google allows their employees to spend 20 percent of their time on such projects (Lowe, 2009). 3M has the 15% rule which allows employees to use 15% of their time working on innovative ideas (Brand, September 1998).

At the heart of idea generation is opportunity analysis. Successful innovative organizations utilize search strategies in order to understand where opportunities exist for innovative products. Organizations may deploy scouts to look for new ideas, explore future scenarios, or work with customers to better understand their needs either through formal voice-of –the-customer activities or conversation and observation (Nicholas, Ledwith, & Bessant, March-April 2013). Understanding where opportunities exist and where the needs exist are key to the ability to innovate (Utterback, 1971).

Successful companies utilize cross-functional teams to generate and mature innovative ideas (Lauto, Valentin, Hatzack, & Carlsen, July-August 2013). Cross-functional teams diversify input to innovative ideas. This diversity can aid in the creativity of the team. The size and makeup of the team can, however, be a deterrent to creativeness if the team is too large or has more functional experts than is necessary (Sethi, Smith, & Park, Feb 2001, Vol 38, No. 1).

Finally, organizations must have a way to formally evaluate innovative ideas and be committed to funding them. These are two key elements of portfolio management. Cooper provides numerous types of criteria an organization may use to evaluate innovative ideas. These criteria should be tailored to what is important to the organization. He also recommends

establishing strategic buckets by which an organization establishes portfolio investment goals (Winning at New Products, 2011). If innovation is part of an organization's strategy, then resources need to be dedicated to it.

Novozymes, a Danish industrial biotech company, has an Innovation Office that manages the company's innovation process. The Innovation office solicits ideas, screens and ranks the ideas, and selects the top 5 ideas that will get pitched to management for funding. They use the following criteria for the process: technical feasibility, originality, customer need, resources, sales potential, competitive advantage, and gut feel. Novozymes uses these criteria to determine which projects to pursue and fund (Lauto, Valentin, Hatzack, & Carlsen, July-August 2013). Lockheed Martin uses an Innovation Readiness Level (IRL) structure to guide their investment decisions. Use of IRLs is part of their process and is also considered a key tool (Evans & Johnson, September-October 2013).

Having an office or organization dedicated to an innovation process works. For example, one company that has delivered on complex projects involving delivery of oil and natural gas has an innovation board. The board evaluates innovative ideas and takes them through the maturation process. This board has existed for over 12 years and manages about 50 projects per year. The board has survived because it contributes to the operational and financial success of the company (Markham & Lee, July-August 2013).

Tools

In addition to processes, individuals must also have the proper tools available to innovate. Some of the key tools required are the correct information resources, information technology resources, and physical evaluation tools. Individuals must have access to the technical information they need to innovate and it must be easily accessible (Utterback, 1971). In fact,

Tsai found that any particular unit's capability to innovate was significantly increased by its access to knowledge transfer and information exchange (Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance, 2001, Vol. 44)

Today, having access to information requires that individuals have access to the right information technology tools. These tools might consist of hardware, such as computers or smart boards, or of software, such as specific design or virtual prototyping tools (Jang & Schunn, April 2012) . In a study conducted by Jang and Schunn, they found that the teams most successful at innovating used hardware and software tools that were collaborative in nature (Physical Design Tools Support and Hinder Innovative Engineering Design, April 2012).

Jang and Schunn also found that use of physical evaluation tools led to successful innovation. Use of smart boards to convey conceptual images and physical prototypes were both key to promoting group discussion and the success of the group (Physical Design Tools Support and Hinder Innovative Engineering Design, April 2012).

Procter & Gamble (P&G) makes extensive use of both virtual evaluation tools and physical prototyping to support innovation. For example, P&G utilizes simulation and optimization software to design their supply networks. Use of this software allows their analysts to explore innovative solutions/possibilities that they may not have been able to in the past in a timely fashion. P&G also utilizes both virtual and physical prototypes (through rapid prototyping) extensively to test innovative products and bring them to market quicker (Dodgson, Gann, & Salter, 2006).

Physical Environment

The physical environment also affects innovation. Three factors of physical environment are explored in this research. They are collaborative workspaces, social spaces, and proximity to individuals with different expertise or functions.

IDEO is a design firm that helps other organizations become more creative and innovative (IDEO, 2014). IDEO is well known for its innovation process and has a world-wide client base that includes Hewlett-Packard, AT&T Wireless Services, Nestle, Vodaphone, Samsung, NASA, and the BBC (Nussbaum, 2004). IDEO deliberately designs workspaces that promote collaboration as they see this as essential to successful innovation (Kelly, 2001).

Research has shown that ad-hoc spaces to promote social interaction leads to more information and idea exchange and thus increases innovation (Toker & Gray, 2008). In addition, further research by Toker suggests that the social spaces are more attractive when they are close to amenities such as food and drink (Autumn 2006, Vol 23 Issue 3). Google is a prime example of a company embracing social spaces to create more interaction. Google has laundry, and workout facilities, volleyball courts, swimming pools, and lots of food (Lowe, 2009).

Finally, proximity to others from different functional areas is important to spur creative interaction and thus innovation. Many organizations map the physical location of employees to match their organizational structure. Unfortunately, this is less than optimal when an organization wants to promote creativity (Allen, Winter 2007, Vol. 49, No. 2). Allen's research showed that the probability of weekly communication between individuals decreases to an asymptotic level within 50 meters of separation. In addition, if individuals are separated vertically, the effect on interaction is more severe. This is because if people do not see one

another they don't have the opportunity for the type of communication that spurs creativity (Allen, Winter 2007, Vol. 49, No. 2).

Summary

This chapter presented the information and supporting evidence for the processes, tools and physical environments critical to innovation, which are examined as part of this research paper. The literature reveals the following. Critical parts of the innovation processes include idea generation, using cross functional teams to generate and mature innovative ideas, using strategic planning to guide innovation, assessing where opportunities exist, setting aside funding for innovative projects and utilizing a criteria driven process to assess potential projects for funding. It is also critical that individuals have access to the right tools to effectively innovate. These tools include information resources (i.e. technical reports, sub-system/system data), information technology resources (i.e. CAD stations, smart boards, models) and physical evaluation tools such as rapid or physical prototyping facilities. The processes, tools and physical environments that promote innovation are best used in combination. Innovative companies such as IDEO and Google utilize a combination of the processes, tools and physical environments to promote innovation in their companies. Information and supporting evidence were obtained through reviews of peer-reviewed journal articles, periodicals, web sites, and books.

Chapter 3 – Research Methodology

Purpose

The purpose of this study is to determine whether the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) utilizes the processes, and has the tools and the physical environments that effectively promote innovation. Note, having the tools and physical environments that promote innovation do not mean that they are effectively utilized.

Research Questions

This research paper addresses four fundamental questions related to the utilization of the processes, and the availability of tools and physical environments that promote innovation at TARDEC. The research questions are as follows.

- Are the processes that promote innovation utilized at TARDEC organizationally?
- Are the processes that promote innovation utilized at TARDEC individually?
- Are the tools that promote innovation available to individuals at TARDEC?
- Are the physical environments that promote innovation available to individuals at TARDEC?

Research Hypotheses

The thirteen hypotheses tested, at the 5% level of significance, are depicted in the following table. Hypotheses related to utilization of innovation processes were tested both at the organizational and the individual level.

Table 2 *Innovation Processes, Tools and Physical Environment Hypotheses*

Variable	Null Hypotheses- H_0
Innovation Processes (Org)	
Cross-functional teams	H_{01}: TARDEC does not utilize cross-functional teams innovation best practices
Strategic Planning	H_{02}: TARDEC does not utilize strategic planning innovation best practices
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Info Technology	H_{11}: TARDEC does not have available innovation best practice information technology
Innovation Physical Environment	
Collaborative Workspace	H_{12}: TARDEC does not have available innovation best practice collaborative workspaces
Proximity	H_{13}: TARDEC associates do not sit near other associates with different functional expertise

Conceptual Model

The critical factors that promote innovation linked to the study hypotheses are shown in the conceptual model in Figure 2.

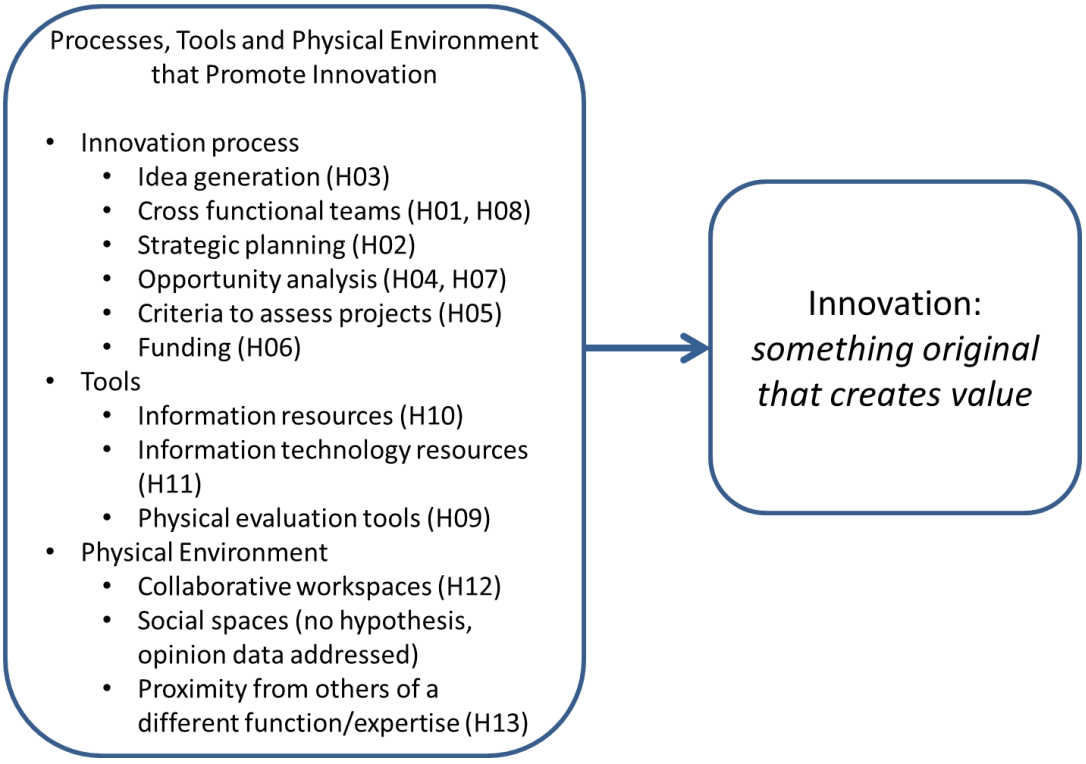

Figure 2 Innovation Processes, Tools and Physical Environment Conceptual Model Link to Hypotheses

Research Design

This research employs a quantitative approach. Personnel in TARDEC were surveyed with questions that ask whether the organization utilizes innovation best practice processes, individuals utilize innovation best practice processes, if the tools are available to individuals to innovate, and if physical environments that promote innovation are available to individuals. In addition, survey participants were asked how important these processes, tools and physical environments are to innovation at TARDEC.

Survey questions were posed to respondents using a Likert scale. For example, with respect to processes, survey participants were asked to indicate the degree with which they agree with the following statement: "My organization utilizes cross-functional teams to generate innovative ideas." Participants had the following response choices: strongly agree, agree, undecided, disagree, strongly disagree, and don't know. Following is a sample question from the innovation tools section of the survey: "Do you have access to the information technology (IT) resources you need to be innovative? Some examples of information technology resources are computers, CAD stations, and modeling tools." Participants were asked to assess the frequency with which they have access to the tools. Their response choices were: very frequently, frequently, occasionally, rarely, never, and non-existent. In addition to questions on innovation processes, tools and physical environment, questions related to culture, behavior and climate were also asked. The culture, behavior and climate questions are related to another researcher's, Marta Tomkiw, thesis work (Tomkiw, 2014). This research only addresses the innovation processes, tools and physical environment. The full survey instrument is included in Appendix B of this research paper.

Survey recipients were asked one qualitative question: "In your opinion, what do you think is the most important factor that enables your ability to innovate? The factor could be a process, a tool, organizational climate, organizational culture, a behavioral element, a particular physical environment or anything else which may not fit in the previous categories. Please be as specific as possible." An analysis was performed to determine areas for further research.

Institutional Review Board

Institutional Review Board (IRB) evaluation is required when conducting research with human participants. Research using human participants that is conducted at or sponsored by Lawrence Technological University (LTU) requires approval by the LTU IRB. The LTU IRB is responsible for fulfilling the guidelines established by the Department of Health and Human Services with respect to the rights and welfare of human participants. The IRB application for this research was submitted on 14 November 2013. IRB approval to conduct research was received on 25 November 2013 and is valid until 25 November 2014. Appendix A contains the IRB approval letter.

Survey Instrument

A survey was distributed to the TARDEC workforce. The original intent of this research was to survey the entire U.S. Army Research Development and Engineering Command (RDECOM). TARDEC is one of eight organizations under RDECOM. Surveying all of RDECOM was not possible at this time due to additional requirements required to survey all RDECOM personnel and the time frame in which data were required for this study.

The survey was administered through the use of SurveyMonkey®. Although the survey was primarily quantitative in nature, qualitative data was also collected as a result of one open-ended question. A copy of the survey instrument utilized may be found at Appendix B.

The survey consisted of twenty-two questions. The survey was jointly sent out by this researcher and another researcher, Marta Tomkiw, conducting research on innovation with respect to innovation climate, culture and behavior. For the purposes of this research paper, only questions one through fourteen and twenty-two will be used for analyses. The questions used in this research were broken into five sections as follows.

The first section included one question. This question was the informed consent. This question described the purpose of the research; let the participant know approximately how much time it would take to complete the survey; and informed the participant that taking the survey is completely voluntary and that they may exit the survey at any time.

The second section asked for demographic data. Included in this section were questions related to pay grade, gender, age, and organization for which the participant works. Organization was included in this section because the original intent was to send out the survey to all of RDECOM which encompasses multiple organizations. Due to the need for additional approvals and time restrictions for the research, the survey was only sent to TARDEC.

The third, fourth and fifth sections contained questions related to innovation processes, innovation tools, and innovation physical environment. In each case the participant was asked to indicate the degree with which they agreed with the statements. In most cases, a 5 point Likert scale was used. The responses indicated the degree to which their organization possessed the best practices associated with innovation processes, tools and physical environment. The participant was then asked how important, using a 5 point Likert scale, those same practices are to their ability to be innovative. The following table depicts the distribution of questions to the aforementioned topic areas.

Table 3 *Distribution of Questions*

Innovation Best Practices	Question Number
Innovation Processes	Q6, Q7, Q8, Q9
Innovation Tools	Q10, Q11,
Innovation Physical Environment	Q12, Q13, Q14

Survey questions were posed to respondents using a Likert scale. Table 4 depicts the Likert scales used for each category of question and the corresponding number used in the data analysis.

Table 4 *Likert Scales Used*

Question Category/ Likert Scale	Number
Processes (org),	
Strongly Agree	1
Agree	2
Undecided	3
Disagree	4
Strongly Disagree	5
Don't know	6
Processes (Ind), Physical Environment	
Strongly Agree	1
Agree	2
Undecided	3
Disagree	4
Strongly Disagree	5
Tools	
Very Frequently	1
Frequently	2
Occasionally	3
Rarely	4
Never	5
Non-existent	6
Physical environment proximity, Q13	
Different expertise, 0-10 feet	1
Different expertise, 10-20 feet	2
Different expertise, more than 20 feet	3
Same expertise	4

In addition to questions on innovation processes, tools and physical environment, questions related to culture, behavior and climate were also asked. The culture, behavior and climate questions are related to another researcher's, Marta Tomkiw, thesis work. The full

survey instrument is included in Appendix B of this research paper. This research only addresses the innovation processes, tools and physical environment.

Survey Participants

Survey participants consisted of people who work for TARDEC. Analyses were performed on 118 responses from TARDEC employees to the survey instrument. The majority of TARDEC employees are engineers and scientists. A link to the survey was distributed on 4 December 2013 to 1571 individuals. Data were collected from 4 December 2013 until 2 January 2014.

Pilot Test Procedure

A pilot survey was sent to current and former Defense Acquisition University (DAU) Senior Service College Fellows (SSCF), Lawrence Technological University (LTU) professors, and to DAU instructors. Survey respondents were asked to assess the written quality of the questions, the question content, and the time it took them to complete the survey. All feedback provided was analyzed and incorporated into the final survey.

Quantitative Data Analysis Methodology

Analyses were performed on 118 responses from TARDEC employees to the survey instrument. The majority of TARDEC employees are engineers and scientists. The analyses performed consist of descriptive statistics for the demographics, one-sample t-tests to test the hypotheses, Cronbach's α to determine the reliability of the data, and Pearson's correlation to compare the importance of the innovation factors to the utilization and availability of the processes, tools and physical environment. Table 5 links the analyses performed with the survey questions.

Table 5 *Analyses link to survey questions*

Analyses	Questions
To test hypotheses: one-sample, one-tail t-test, μ=3 vs.<3	Q6, Q7, Q8, Q10, Q12, Q13
Reliability: Cronbach's α	Q6e, Q8abcd
Compare importance: Pearson's correlation	Q6, Q7, Q8 vs. Q9
	Q10 vs. Q11
	Q12, Q13 vs. Q14

Face validity is represented by examining the measures of a study and determining if the information to be collected appears to measure that which is important to the research (Colorado State University, 2014). Validity of this research is represented in terms of face validity as the questions in the survey were randomized, the questions measure the subject of this research and care was taken not to skew the outcome of the responses.

Summary

The intent of this chapter is to describe the research methodology. In this chapter the research questions, hypotheses, research design, IRB evaluation, survey instrument and participants, pilot test procedures, and the quantitative data analysis methodology were all described. The analysis is quantitative and the results are described in Chapter 4.

Chapter 4 – Findings

Population and Sample Size

Survey participants consisted of people who work for TARDEC. Analyses were performed on 118 responses from TARDEC employees to the survey instrument. The majority of TARDEC employees are engineers and scientists. A link to the survey was distributed on 4 December 2013 to 1571 individuals. Data were collected from 4 December 2013 until 2 January 2014.

Demographics

Of the 153 responses to the survey, 118 TARDEC associates completed the survey. As Table 6 indicates, the dominant demographics in the survey are as follow: 74% of the respondents are male, 33% of respondents are in the age range of 46-55, and 58% of the respondents are in the GS12-13 pay grade.

Table 6 *Innovation survey demographics*

Characteristic	n	%
Sample	118	100.0
Gender		
Male	87	73.7
Female	31	26.3
Age		
18-25	2	1.7
26-35	24	20.3
36-45	25	21.2
46-55	39	33.1
56-65	23	19.5
Over 65	5	4.2
Pay Grade		
GS1-4/E1-E4	0	0.0
GS5-8/E5-E9	2	1.7
GS 9-11/WO1-WO3/01-02	9	7.6
GS12-13/WO4-WO5/03-04	68	57.6
GS14-15/05-06	39	33.1
SES/07-09	0	0.0
Organization		
TARDEC	118	100

Data Reliability and Validity

Data reliability was tested through calculation of Cronbach's α using all questions related to organizational processes. Specifically, the questions used in the analysis are 6e, 8a, 8b, 8c, and 8d. Table 7 contains the omitted variable and overall Cronbach's α statistics for the organizational process questions broken down by category. The omitted variable statistics are used to determine if consistency improves when removing a variable. The Cronbach's α statistic for the organizational processes questions is 0.8729, which exceeds the 0.8 threshold for reliability.

Table 7 *Cronbach's α and omitted variable statistics for process questions*

Omitted Variable	Adj. Total Mean	Adj Total Std Dev	Item Adj. Total Corr	Sq Mult Corr	Cronbach's Alpha
Cross-functional Teams	15.059	5.205	0.719	0.630	0.844
Strategic Planning	15.353	5.388	0.676	0.543	0.853
Idea Generation	15.093	5.231	0.799	0.721	0.834
Opportunity Analysis	14.893	5.200	0.796	0.690	0.833
Criteria	14.805	5.240	0.553	0.351	0.875
Funding	15.051	4.983	0.625	0.450	0.869
Cronbach's α = 0.8729	N=118				

Validity is established by face validity because questions were randomized, measured the item being researched, and care was taken not to skew the outcomes of the responses.

Hypotheses Testing

The thirteen hypotheses tested as part of this research are depicted in Table 8. Hypotheses related to innovation processes were tested both at the organizational and the individual level.

Table 8 *Innovation Processes, Tools and Physical Environment Hypotheses*

Variable	Null Hypotheses- H_0
Innovation Processes (Org)	
Cross-functional teams	H_{01}: TARDEC does not utilize cross-functional teams innovation best practices
Strategic Planning	H_{02}: TARDEC does not utilize strategic planning innovation best practices
Idea Generation	H_{03}: TARDEC does not utilize idea generation innovation best practices
Opportunity Analysis	H_{04}: TARDEC does not utilize opportunity analysis innovation best practices
Criteria	H_{05}: TARDEC does not utilize innovation best practices criteria to assess projects
Funding	H_{06}: TARDEC does not have separate funding for innovation projects
Innovation Processes (Ind)	
Opportunity Analysis	H_{07}: Individuals at TARDEC do not use opportunity analysis innovation best practices
Cross-functional teams	H_{08}: Individuals at TARDEC do not use cross-functional team innovation best practices
Innovation Tools	
Physical Eval Tools	H_{09}: TARDEC does not have available innovation best practice physical evaluation tools
Info Resources	H_{10}: TARDEC does not have available innovation best practice information resources
Info Technology	H_{11}: TARDEC does not have available innovation best practice information technology
Innovation Physical Environment	
Collaborative Workspace	H_{12}: TARDEC does not have available innovation best practice collaborative workspaces
Proximity	H_{13}: TARDEC associates do not sit near other associates with different functional expertise

A one-sample, one-tail t-test was conducted with $\mu=3$ vs. $\mu<3$ and $\alpha=0.05$. Table 9 includes the results of this t-test. The t-test will show, statistically, whether TARDEC utilizes innovation processes and has the tools and physical environment to promote innovation. In order to reject the null hypothesis, the mean must be less than 3 at the 5% level of significance.

Table 9 *One-sample, one-tail t-test of the mean <3 for use of processes and availability of tools and physical environment*

Variable	Mean	SE Mean	T	P
Innovation Processes (Org)				
Cross-functional teams	2.992	0.116	-0.070	0.471
Strategic Planning	2.698	0.100	-3.020	0.002*
Idea Generation	2.958	0.104	-0.410	0.343
Opportunity Analysis	3.158	0.108	1.460	0.927
Criteria	3.246	0.135	1.820	0.964
Funding	3.000	0.155	0.000	0.500
Innovation Processes (Ind)				
Opportunity Analysis	2.542	0.104	-4.400	0.000*
Cross-functional teams	2.631	0.099	-3.740	0.000*
Innovation Tools				
Physical Eval Tools	3.150	0.123	1.230	0.889
Info Resources	2.903	0.110	-0.890	0.188
Info Technology	2.832	0.126	-1.340	0.092
Innovation Physical Environment				
Collaborative Workspace	2.641	0.101	-3.570	0.000*
Proximity	2.764	0.126	-1.870	0.032*

*significant at the .05 level

These results imply that TARDEC is utilizing innovation process best practices only for strategic planning. TARDEC is not utilizing cross-functional teams, idea generation techniques, opportunity analysis, criteria to assess projects, and setting aside funding specifically for innovation projects. However, while opportunity analysis and cross-functional teams are not being utilized at the organizational level, individuals are using these best practices on their own. In addition, the physical evaluation tools, information resources and information technology are not available to TARDEC employees to use to innovate. Finally, the innovation physical environment, collaborative workspaces and proximity with which individuals sit near others of a different functional expertise is available to TARDEC employees.

Correlation

Survey participants were asked whether their organization utilizes processes and has the tools and physical environments identified in this study that promote innovation and how important these processes, tools and physical environment are to their ability to innovate. The Likert scale used, with corresponding numerical values, in assessing importance is as follows: very important (1), important (2), somewhat important (3), of little importance (4), and unimportant (5). In order to imply a factor is important, the mean score must be less than 3.

A one-sample, one-tail t-test was conducted with $\mu=3$ vs. $\mu<3$, and $\alpha=0.05$ to statistically determine whether the survey respondents thought the innovation factors were important. Table 10 includes the results of this t-test.

Table 10 *One-sample, one-tail t-test, mean <3, for importance of processes, tools and physical environments*

Variable	Mean	SE Mean	T	P
Innovation Processes (Org)				
Idea Generation	1.766	0.062	-19.930	0.000*
Cross-functional teams	1.792	0.074	-16.260	0.000*
Strategic Planning	2.195	0.096	-8.410	0.000*
Opportunity Analysis	1.909	0.068	-16.090	0.000*
Criteria	2.017	0.083	-11.790	0.000*
Innovation Tools				
Info Resources	1.274	0.048	-36.370	0.000*
Info Technology	1.478	0.068	-22.450	0.000*
Physical Eval Tools	1.735	0.092	-13.700	0.000*
Innovation Physical Environment				
Collaborative Workspace	1.691	0.069	-18.910	0.000*
Social Spaces	2.082	0.099	-9.250	0.000*
Proximity	2.341	0.080	-8.280	0.000*

*significant at the .05 level

The results in Table 10 imply that survey participants thought that all of the innovation processes, tools, and physical environment best practices are important to very important to innovate.

Pearson's correlation coefficient was calculated to determine if there was a correlation between what the survey respondents thought was important to innovation and what TARDEC utilizes or has available. The sign of the coefficient indicates whether the relationship is positive or negative. The magnitude of the coefficient indicates the strength of the relationship. Values from 0 to .19 indicate no relationship; .20 to .49 indicate a weak relationship; .50-.69 indicate a moderate relationship; .70 or higher indicate a very strong relationship (M. Cole, personal communication, 22 January 2014). Table 11 contains the calculated Pearson's correlation coefficients and a description of the correlation.

Table 11 *Pearson's correlation coefficient utilization of processes and availability of tools and physical environments vs. their importance to innovate*

Variables	Pearson's Correlation Coefficient	Correlation Description
Innovation Processes (Org)		
Idea Generation	0.088	None
Cross Functional Teams	0.074	None
Strategic Planning	0.212	Weak Positive
Opportunity Analysis	0.202	Weak Positive
Criteria	0.074	None
Innovation Tools		
Info Resources	0.213	Weak Positive
Info Technology	0.121	None
Physical Eval Tools	0.303	Weak Positive
Innovation Physical Environment		
Collaborative Workspace	0.251	Weak Positive
Proximity	0.119	None

The results of Table11 clearly show poor correlation (none or weakly positive) between the importance and use or availability of all of the processes, tools, and physical environments conducive to innovation. These results reflect the fact that all of the processes, tools and physical environments were considered important, but few were used or available.

Summary

In this chapter, descriptive statistics for demographics, processes, tools and physical environments were presented. Data reliability was determined through the use of Cronbach's α; validity by face validity. Thirteen hypotheses were tested using a one-sample, one-tail t-test. Five of the thirteen null hypotheses were rejected. Finally, correlation between what the survey participants thought was important to their ability to innovate and what they thought their organization uses or has was tested using Pearson's correlation coefficient.

The results suggest that, with the exception of strategic planning, TARDEC does not utilize innovation process or have available the tools required to innovate. However, the physical environment does appear to be conducive to innovation, and individuals are using opportunity analysis and cross-functional teams on their own. Finally, there is no correlation between what respondents thought was important to innovation, and the processes, tools, and physical environments used and/or available at TARDEC.

Chapter 5 – Conclusions and Recommendations

Findings and Implications

A perception exists in the Army that the research and development laboratories are not innovative. The literature shows that engaging in innovation processes, and having available the tools to innovate and physical environments conducive to innovation all promote innovation in an organization. The extent to which TARDEC utilizes the processes conducive to innovation, has available the tools to innovate, and has the physical environments conducive to innovation is measured by the extent to which they engage in the best practices identified in the literature for each of these three critical areas.

The best practices for the effective utilization of processes include idea generation, use of cross-functional teams, strategic planning, opportunity analysis, criteria to assess projects, and funding. Based on the results of the survey, the only area where the null hypothesis could be rejected is in strategic planning. This implies that TARDEC only utilizes strategic best planning practices such as innovation being part of the strategy, identifying where innovation opportunities exist, having a long term strategy, individuals' understanding the strategy and where innovative ideas fit into the strategy. The data also imply that:

- TARDEC is not utilizing cross-functional teams to generate or mature innovative ideas.
- TARDEC is not utilizing idea generation innovation best practices such as brain storming sessions, actively soliciting innovative ideas, and allowing individuals time to pursue promising ideas.
- TARDEC is not utilizing opportunity analysis best practices such as technology forecasting or road mapping, assessing future scenarios for technological and market

opportunities, using input from customers and conducting market research to understand where opportunities exist.

- TARDEC is not utilizing a criterion driven process to assess innovative proposals.
- TARDEC does not have funding dedicated, specifically set aside, for innovative projects.

The data also imply that individuals at TARDEC are utilizing opportunity analysis best practices, and cross-functional teams to generate and mature innovative ideas even though the organization is not. This is a critical finding because the literature emphasizes that innovation best practices must be incorporated into the organization to be sustained. It is not sustainable at the individual level (Dougherty & Hardy, 1996, Vol. 39, No. 5).

Tools to promote innovation include information resources, information technology resources, and physical evaluation tools. The results show that:

- Individuals at TARDEC do not have access to the information resources they need to be innovative. Examples of these resources are technical reports, system and sub-system information, and outside publications.
- Individuals at TARDEC do not have access to the information technology resources they need to be innovative. Examples of these resources are computers, CAD stations and modeling tools.
- Individuals at TARDEC do not have access to the physical evaluation tools they need to be innovative. Examples of these resources are physical prototyping facilities, laboratories, and physical modeling facilities.

Finally, having access to collaborative work spaces and social spaces are critical to promoting innovation. The proximity of individuals to people with a different function or expertise is also critical to promoting innovation. Based on the results of the survey:

- TARDEC has spaces that are conducive to creative collaboration and these spaces are easily accessible.
- TARDEC associates sit near others with different functional expertise.
- Individuals at TARDEC believe having access to social spaces is important to their ability to innovate.

Recommendations

The data in this research demonstrate that, organizationally, TARDEC is utilizing strategic planning, has collaborative workspaces and has individuals sitting near others with different functional expertise. All of these factors positively affect an individual's ability to innovate. However, the limited use and availability of the critical processes and tools may be a major contributor to problems with innovation at TARDEC. Organizational improvements could be made in numerous areas as follows:

- Utilize cross-functional teams, at the organizational level, to generate and mature innovative ideas.
- Utilize idea generation innovation best practices such as brain storming sessions, actively solicit innovative ideas, and allow individuals time to pursue promising ideas. These should be integrated into the business processes at TARDEC. For example, performance standards could be established related to having time to pursue promising ideas.
- Utilize opportunity analysis best practices such as technology forecasting or road mapping, assessing future scenarios for technological and market opportunities, using

input from customers and conducting market research to understand where opportunities exist. These best practices should be integrated into TARDEC's business processes.

- Utilize a criteria-driven process to assess innovative proposals.
- Dedicate funding for innovative projects.
- Provide individuals access to the information resources they need to be innovative. Examples of these resources are technical reports, system and sub-system information, and outside publications. Possible ways to achieve this is through establishing a knowledge management system and providing employees with access to peer-reviewed articles.
- Provide individuals access to the information technology resources they need to be innovative. Examples of these resources are computers, CAD stations and modeling tools.
- Provide individuals access to the physical evaluation tools they need to be innovative. Examples of these resources are physical prototyping facilities, laboratories, and physical modeling facilities.

Recommendations for Future Research

There are several areas where future research would be of value. First, the rejection of the null hypothesis for the proximity with which individuals sit near others with a different function or expertise needs further exploration. The survey did not clearly define what "different function or expertise" means and is, therefore, highly subject to interpretation. For example, individuals that work on the same team and sit near each other but have different roles on the team may interpret that they sit near someone with a different function or expertise. The intent

was to measure whether individuals sit next to others that have different roles within the entire organization. However, that is not what was measured and is a limitation.

Second, the survey did not ask participants about their access to social spaces. However, participants thought that having access to social spaces is important to their ability to innovate. A research opportunity exists to determine if social spaces are available, if they are utilized and what the most important characteristics are of the space.

Third, survey recipients were asked one question which was open-ended. This question asked survey participants to identify the most important factor that enables their ability to innovate. Eighty-two responses were received to this question. Approximately 21% of these responses identified processes, tools, physical environment, culture, climate and behavior. Thus, there is not much consensus on the single most important factor to innovate. These results, however, could imply a linkage between these elements. Further research could be conducted to explore the potential linkage among these elements and the effect on an individual's ability to innovate. In addition, approximately 30% of the responses indicated that having time to innovate was the single most important factor to their ability to be innovative. Potential follow on research could explore the barriers to time for innovation and how successful innovative companies overcome those barriers.

Finally, further research could be conducted to determine why processes are not used, the obstacles to using the processes, and why the tools important to innovation are not available.

Conclusion

This research paper addressed four fundamental questions related to the utilization of the processes, the availability of tools and the availability of the physical environment that promote innovation at TARDEC.

The results of the research suggest that TARDEC is utilizing only one (strategic planning) of six identified best practices in the area of processes which promote innovation. Opportunity analyses and use of cross-functional teams is happening at the individual level, which helps individuals be innovative. However, this approach is not sustainable as these best practices are not being utilized across the organization. The tools to promote innovation (information resources, information technology, and physical evaluation tools) are not available to individuals at TARDEC to aid in innovation. Finally, the physical environment appears to be conducive to innovation but the proximity with which individuals sit near others with a different function or expertise needs further exploration as noted above. The results of this research suggest that individuals face challenges innovating at TARDEC.

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Appendix A – Institutional Review Board Approval

Lawrence Technological University
Institutional Review Board
Office of the Provost
21000 West Ten Mile Road
Southfield, MI 48075
research.ltu.edu
irb@ltu.edu

November 25, 2013

Dear Debbie DiCesare,

I am pleased to report that your IRB application to conduct research with human participants for your MS Global Leadership and Management thesis, "An assessment of the U.S. Army Research Development and Engineering Command's utilization of the Processes, Tools and Physical Environments that Promote Innovation ", has been approved under the Expedited review path for a period of one year, November 25, 2013 – November 25, 2014.

The IRB is satisfied that the following three ethical concerns regarding the treatment of human participants has been addressed in your research protocol: (1) The research study involves administering an online or paper survey to individuals who work for RDECOM and who provide their voluntary consent to participate 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 participants and/or society and the risk assumed by the participants.

Please contact the IRB if you require an extension to your project after one year. Please note you must contact the IRB if you make 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, Ph.D.
Assistant Professor
Institutional Review Board Chair
Department of Management and Marketing
College of Management
21000 West Ten Mile Road
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The Lawrence Tech IRB is organized and operated according to guidelines of the United States Office for Human

Research Protections and the United States Code of Federal Regulations and operates under Federal Wide Assurance No. FWA00010997 that expires 02/10/2017.

Appendix B – Research Paper Survey

Purpose

The purpose of this research is to determine the extent that the Research, Development and Engineering Command (RDECOM) Research, Development and Engineering Centers (RDECs), Labs and Headquarters (HQ) have the processes, tools, physical environment, organizational climate, behaviors and culture that promote innovation.

Many different definitions of innovation exist and there is no consensus on the exact definition of innovation. However, many definitions have the following in common. The act of innovation leads to something original that creates value.

The survey has 23 questions and will take approximately 15 minutes to complete.

Informed Consent

As an adult 18 years of age or older, I agree to participate in this research about Innovation characteristics within RDECOM. This survey is being conducted to support research efforts being performed by Deborah DiCesare and Marta Tomkiw, College of Management, Lawrence Technological University and a student of the Senior Service College Fellowship Program of the Defense Acquisition University: deborah.dicesare@dau.mil and marta.tomkiw@dau.mil .

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

1. The purpose of this research is to determine the extent that the RDECOM RDECs, Labs and HQ have the processes, tools, physical environment, organizational climate, behaviors and culture that promote innovation.

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 and RDECOM leadership allowing them to be better informed to make organizational changes.

2. If I choose to participate in this research, I will be asked to complete and online questionnaire. The questionnaire will include items relating to use of innovation practices in the area of processes, tools and physical environment. In addition, the questionnaire will include items related to your organizations culture and climate as it relates to innovation. The questionnaire will take approximately 15 minutes to complete.

3. There is no incentive for participation.

4. All items in the questionnaire are important for analysis and my data input will be more meaningful if all questions are answered. However, I do not have to answer any that I prefer not to answer. I can discontinue my participation at anytime 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.

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, 21000 West Ten Mile Road, Southfield, MI 48075, (248) 204-3096.

***1. Have you read the informed consent and do you agree to participate?**

- 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. What is your current pay grade or equivalent level**

- GS 1-4 / E1-E4
- GS 5-8 / E5-E-9
- GS 9-11 / WO1-WO3 / O1-02
- GS 12-13 / WO4-WO5/ O3-04
- GS 14-15 / O5-06
- SES / 07-09

Other (please specify)

***3. Are you male or female?**

- Male
- Female

***4. Which category below includes your age?**

- 18-25
- 26-35
- 36-45
- 46-55
- 56-65
- over 65

***5. For which organization within RDECOM do you work?**

- Aviation and Missile Research, Development and Engineering Center (AMRDEC)
- Armament Research, Development and Engineering Center (ARDEC)
- Army Research Laboratory (ARL)
- Communications, Electronics Research, Development and Engineering Center (CERDEC)
- Edgewood Chemical Biological Center (ECBC)
- Natick Soldier Research, Development and Engineering Center (NSRDEC)
- Tank Automotive Research, Development and Engineering Center (TARDEC)
- RDECOM Headquarters
- Other (please specify)

Innovation Processes

This section is intended to capture data on the innovation processes your organization uses. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***6. Please indicate the degree with which you agree with the following statements.**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Don't Know
My organization utilizes brain storming sessions to generate innovative ideas						
My organization actively solicits innovative ideas						
My organization utilizes cross-functional teams to generate innovative ideas						
My organization utilizes cross-functional teams to mature innovative ideas into projects						
My organization utilizes strategic planning exercises to identify where innovation opportunities exist						
My organization utilizes technology forecasting or technology road mapping to understand where innovation opportunities exist						
My organization assess future scenarios to understand where future innovation opportunities exist based on future technological possibilities						
My organization assess future scenarios to understand where future innovation opportunities exist based on future markets						
My organization utilizes input from customers/users to understand where innovation opportunities exist						
My organization allows individuals time to pursue promising ideas/opportunities						
My organization utilizes a criteria-driven process to assess innovative proposals						

for funding consideration						
My organization conducts external market research to understand where innovation opportunities exist						

***7. Please indicate the degree with which you agree with the following statements.**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
I assess the environment external to my organization (RDEC or Lab) to understand where innovation opportunities exist					
I utilize cross-functional teams to develop new innovative ideas					
I utilize cross-functional teams to mature innovative ideas					

***8. Please indicate the degree with which you agree with the following statements.**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Don't Know
My organization has a long term strategy (beyond 5 years) with which I can align my innovative ideas						
I understand my organization's long term strategy						
I understand where my innovative ideas fit into my organization's long term strategy						
Innovation is part of my organization's long term strategy						
My organization has dedicated funding for innovative projects. Dedicated funding is money specifically set aside for innovative projects.						

***9. In your opinion, please assess the importance to you of each of the processes below as they relate to your ability to innovate.**

	Very Important	Important	Somewhat Important	Of Little Importance	Unimportant
Utilizing brain storming sessions to generate innovative ideas	○	○	○	○	○
Active solicitation of innovative ideas by my organization	○	○	○	○	○
Utilizing cross-functional teams to generate innovative ideas	○	○	○	○	○
Utilizing cross-functional teams to mature innovative ideas	○	○	○	○	○
Utilizing strategic planning exercises to identify where innovation opportunities exist	○	○	○	○	○
Utilizing technology forecasting or technology road mapping to understand where innovation opportunities exist	○	○	○	○	○
Utilizing scenario generation about future markets or technological possibilities to understand where innovation opportunities exist	○	○	○	○	○
Utilizing input from customers/users to understand where innovation opportunities exist	○	○	○	○	○
Having time to pursue promising ideas/opportunities	○	○	○	○	○
Having a criteria-driven process to assess innovative proposal for funding consideration	○	○	○	○	○
Assessing the external environment to understand where innovation opportunities exist	○	○	○	○	○

Innovation Tools

This section is intended to capture data on the innovation tools you use. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***10. Please assess the frequency with which you have access to the following innovation tools. If your organization does not have the tool(s) listed, check "non-existent". If your organization has the tools(s) listed, check "very frequently" if you have access whenever you need it. The other responses "frequently", "occasionally", "rarely", would be used if your organization has the tool(s) but they are not always available to you. Check "never" if your organization has the tool(s) but they are not available for you to use.**

	Very Frequently	Frequently	Occasionally	Rarely	Never	Non-existent
Do you have access to the information resources you need to be innovative? Some examples of information resources are technical reports, technical system/sub-system information, and outside publications/information.	○	○	○	○	○	○
Do you have access to the information technology (IT) resources you need to be innovative? Some examples of information technology resources are computers, CAD stations, and modeling tools.	○	○	○	○	○	○
Do you have access to the physical evaluation tools you would need to be innovative? Some examples of physical resources are physical prototyping facilities, laboratories, and physical modeling facilities.	○	○	○	○	○	○

***11. In your opinion, please assess the importance to you of each of the following tools as they relate to your ability to innovate.**

	Very Important	Important	Somewhat Important	Of Little Importance	Unimportant
Having access to the information you need	○	○	○	○	○
Having access to the IT resources you need	○	○	○	○	○
Having access to the physical evaluation tools	○	○	○	○	○

Innovation Physical Environment

This section is intended to capture data on your physical work environment. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***12. Please assess the degree to which you agree with the following statements**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
The facility in which I work has spaces that, in my opinion, are conducive to creative collaboration. These work spaces include but are not limited to conference rooms.	○	○	○	○	○
Spaces that are conducive to creative collaboration are easily accessible.	○	○	○	○	○

***13. Please select the answer below that best represents your work environment**

- ○ I sit near people from a different functional/expertise area and am approximately 0-10 feet away from them.
- ○ I sit near people from a different functional/expertise area and am approximately 10-20 feet away from them.
- ○ I sit near people from a different functional/expertise area and am more than 20 feet away from them.
- ○ I sit near people from the same functional/expertise area that I work in.

***14. In your opinion, please assess the importance to you of the following physical environment characteristics as they relate to your ability to be innovative.**

	Very Important	Important	Somewhat Important	Of Little Importance	Unimportant
Social spaces. These are non-conference room seating areas and are generally open spaces where people can meet and talk. Examples are break rooms, lobby areas, vending areas, coffee/water cooler areas.	○	○	○	○	○
Availability of collaborative work spaces. These work spaces may be conference rooms, but are not limited to conference rooms.	○	○	○	○	○
Sitting near others from different areas of expertise/functions.	○	○	○	○	○
Sitting near others of the same area of expertise/functions.	○	○	○	○	○

Innovation Climate

This section is intended to collect data on your organization's climate related to innovation. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***15. Which statement best represents how you perceive your organization related to innovation.**

- My Organization sees innovation as critical to our mission. My Organization expects me to participate in programs that use the concepts of innovation.
- My Organization sees innovation as important to our mission. My Organization recommends I participate in programs that use the concepts of innovation.
- My Organization sees innovation as optional . My Organization talks about it as important to our mission.
- My Organization does not see innovation as a discipline to drive growth. My Organizaiton does not see innovation as important to our mission.
- My Organization does not talk about innovation.My Organization does not see inovation as a part of our mission.

***16. Please assess the frequency with which your organization's culture support the following.**

	Very Frequently	Frequently	Occasionally	Rarely	Never
Creativity					
Collaboration					
Open communication					
Learning from failures					
Taking risk in support of innovation					
Independent thinking					
Independent time for creativity					
Cross-functional teaming					
Working independently					

Innovation Behavior

This section is intended to capture data on your behavior within your organization. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***17. Please assess the frequency with which you, personally exhibit the following behaviors**

	Very Frequently	Frequently	Occasionally	Rarely	Never
I pursue training opportunities focused on innovation and creative thinking.	○	○	○	○	○
I strive to share my experience with others within my organization	○	○	○	○	○
I strive to learn from others within my organization	○	○	○	○	○
I am willing to take risk in applying creative approaches when completing my assigned work.	○	○	○	○	○
I am open to making mistakes to learn.	○	○	○	○	○
I look for opportunities to be part of a project team.	○	○	○	○	○
I enjoy solving problems.	○	○	○	○	○
I am motivated by influencing change with in my organization.	○	○	○	○	○
I get frustrated or demotivated by change.	○	○	○	○	○
I enjoy working with others of different disciplines/perspectives to solve problems	○	○	○	○	○

***18. Assess the degree with which you agree with the following statements. For purposes of this survey, "your organization" is the RDECOM organization you designated in question #3.**

A person with intrapreneurial spirit is defined as one with a passion to be entrepreneurial within one's organization.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
I see myself as an intrapreneurial spirited employee.	○	○	○	○	○
I see those around me as having an intrapreneurial spirit.	○	○	○	○	○
I see interapreneurial spirit encouraged with in my organization	○	○	○	○	○

***19. In your opinion, what percentage of your organization's managers are effective in sponsoring intrapreneurial initiatives?**

- ○ 0-5%
- ○ 6-15%
- ○ 16-30%
- ○ 31-50%
- ○ 51-75%
- ○ 76-100%

Innovation Culture

This section is intended to collect data on your organization's culture and practices. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

***20. Please assess the degree with which you agree with the following statements.**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
When asked to join a project team the members of the project team have a similar background to mine.					
When asked to join a project team the members of the project team have a different background from mine.					
My teaming opportunities are limited to my area of expertise/function only.					
I am typically appointed to a project without much concern for whether or not I am passionate about the project.					
When recruited by leadership to join a team I do not have the option to decline.					
I am appointed to a team based on availability and not interest.					
It is difficult for me to get permission to leave my current assignment to join a innovative team.					

***21. Please assess to what degree you agree with the following statements.**

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
My organization's vision helps me in setting priorities.					
My organization's strategy helps me in setting priorities.					
My organization's strategies change so often I believe no one pays much attention to them.					
My organization has made little effort to clarify how the organization's vision is relevant to me.					
My organization has made little effort to clarify how the organization's strategy is relevant to me.					
My organization has made great effort to ensure the vision is understood by all employees.					
My organization has made great effort to ensure strategy is understood by all employees.					
Day to day management decisions often do not fall in line with my organization's vision.					
Day to day management decisions often do not fall in line with my organization's strategies.					

Other

This section is intended to capture what you think is the most important factor which allows you to be innovative. For the purpose of this survey, "your organization" is the HQ, RDEC or Laboratory for which you work.

Answering this question is optional but your input is greatly appreciated.

22. In your opinion, what do you think is the most important factor that enables your ability to innovate? The factor could be a process, a tool, organizational climate, organizational culture, a behavioral element, a particular physical environment or anything else which may not fit in the previous categories. Please be as specific as possible.

Survey Complete

Thank you for participating in this research. You efforts are greatly appreciated.