REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
17-04-2016	Master's Thesis	September 2015 - April 2016

4. TITLE AND SUBTITLE
Innovating Army Innovation

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)

Davis, Scott M., Major, USA

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)
Dr. Craig Swanson

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The United States Army must change its force development and force integration practices in order to maintain its current advantage over its adversaries. The role of the U.S. Army is to provide homeland defense, global security, project power, and win decisively. To do this, the U.S. Army must equip itself with the tools it will need to achieve these objectives. Because technology is essentially doubling in capacity and capability once every two years, the U.S. Army needs to adapt its current force development and force integration practices to keep pace with ever-changing threats. Industry best-practices can be applied to Army force development and force integration to allow the U.S. Army to keep pace with evolving technologies.

15. SUBJECT TERMS

Army Innovation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USMC Command and Staff College
Unclass	Unclass	Unclass	UU	27	19b. TELEPHONE NUMBER *(Include area code)* 703-784-3330

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. AFOSR-82-1234.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. 61101A.

5d. PROJECT NUMBER. Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER. Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, J, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER. Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/ monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/ restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

TITLE:
Innovating Army Innovation

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR:
Scott M. Davis

AY 15-16

Mentor and Oral Defense Committee Member: Craig D. Swanson, PhD
Approved: _____
Date: 15 April 2016

Oral Defense Committee Member: LtCol William D. Chegarek Jr
Approved: _____
Date: 15 April 2016

Executive Summary

Title: Innovating Army Innovation

Author: Major Scott M. Davis, United States Army

Thesis: The United States Army must change its force development and force integration practices in order to maintain its current advantage over its adversaries.

Discussion: The role of the U.S. Army is to provide homeland defense, global security, project power, and win decisively. To do this, the U.S. Army must equip itself with the tools it will need to achieve these objectives. Because technology is essentially doubling in capacity and capability once every two years, the U.S. Army needs to adapt its current force development and force integration practices to keep pace with ever-changing threats. Industry best-practices can be applied to Army force development and force integration to allow the U.S. Army to keep pace with evolving technologies.

Conclusion: Bureaucracy within the military helps to provide input into commanders' decisions at all levels of war. However, bureaucracy hinders innovation and it can be reduced in force development and force integration through crowd sourcing requirements and crowd funding solutions. In this way, the cost to develop and maintain materiel will be reduced, and the U.S. Army can afford to continually adopt new technology to better prepare itself for future engagements.

Table of Contents

Introduction **1**

What is Innovation? 2

What Drives Army Innovation? 3

Army Force Management and Acquisitions Process **5**

Force Development Challenges 7

What Hinders Army Innovation? 8

What Helps Army Innovation? 12

What Drives Innovation within Industry? **14**

Driving Army Innovation through Industry **16**

Institutional Challenges 17

Managing RDT&E Costs Effectively 17

Decreasing Equipping and Training Time 19

Designing Simpler Systems 19

Putting it all Together: "The Competition" 20

Conclusion **21**

Endnotes **24**

Introduction

Innovation seems to be a new catch phrase within the United States Army. Army leaders continuously seek to make changes to their establishment in order to reduce costs and increase efficiencies and capabilities. The sudden increase in the usage of the word implies that the Army needs to innovate more. However, the reality is that the U.S. Army has never stopped innovating. The discrepancy between the perception and the reality of Army innovation implies that there is a flaw in the process that the Army uses.[1] This raises the question as to whether the model by which the U.S. Army develops itself to fight future wars needs to be changed. This paper will conduct an analysis of the Army's acquisition process and compare it with how industry develops new products in order to identify flaws in the former's model and then offer solutions to help reinvigorate Army innovations. The U.S. Army must change its force development and force integration practices in order to maintain its current advantage over its adversaries.

Changes in technology over the past 50 years have significantly impacted how organizations operate. Moore's Law, which assesses technology improvements over time, states that the numbers of transistors on a Central Processing Unit (CPU) will double every two years.[2] There are two other ways to look at this law. The first is that two years from now, machine sizes will be half of what they are today. The second is that machines will be twice as fast as they are today. Ultimately, this translates into smaller systems that are more capable and have higher operating capacities than those of today. Additionally, the costs for purchasing the systems of today will decline as new technologies continue to emerge. This means that the enemies of the United States could have similar capabilities in the not-too-distant future. In order to stay ahead of its adversaries, the U.S. Army must continually evolve.

However, due to the size and complexity of the Army and how it runs, change comes slowly and, often, the U.S. Army cannot keep pace with the factors influencing its need to adapt. Meanwhile, global industries continue to develop new technologies that change the way society operates. The disparity of the speed of innovation between the Army and the civilian sector continues to grow, and it is this imbalance that the Army needs to overcome.

What is Innovation?

This paper uses the Merriam-Webster definition of innovation: "a new idea, device, or method."[3] Within the Army, there are some who argue that invention, adaptation and innovation are mutually exclusive. However, the definition of innovation inherently encompasses both invention and adaptation. Therefore, inventions and adaptations are both different types of innovations, and this paper will use these three words interchangeably.

Private companies innovate when it leads to a net increase in monetary gains. Whether changes create revenue or reduce operating costs is irrelevant. The end state is all that matters. After all, businesses that do not make profits ultimately fail. While the U.S. Army operates like a large corporation, there is one key difference: it is not in the business of making money. Instead, its business objectives are derived from key documents such as the National Military Strategy (NMS) and the Quadrennial Defense Review (QDR). The most recent QDR, written in 2014, uses pillars to define the United States' military mission: defend the homeland, build security globally, project power, and win decisively.[4] To accomplish its roles in these missions, the U.S. Army must have superior capabilities than its enemies.

Army capabilities are broken down into seven Warfighting Functions (WfF): Fires, Intelligence, Mission Command, Movement and Maneuver, Protection, Sustainment, and

Engagement. The U.S. Army combines elements from each WfF in order to accomplish its missions. Additionally, each WfF consists of eight domains that allows them to perform their individual roles. These are: doctrine, a guide to how the Army fights; organization, what the force structure looks like; training, how the Army trains its individuals and units; materiel, equipment needed by the force in order to complete its mission; leadership and education, how the Army trains its leadership to lead the fight; personnel, the numbers of people the Army needs to complete its mission; facilities, the numbers and types of bases the Army needs for its mission; policy, guidance, procedures and standards for how the force operates (DOTMLPF-P).[5] These domains allow Army leaders to systematically identify areas of improvement in order to drive innovation. To remain superior to its enemies, the U.S. Army innovates across its WfFs and their subsequent domains. Therefore, Army innovation is any DOTMLPF-P change to one or more WfF. However, because materiel is the most resource intensive domain to develop against, this paper will solely focus on that singular domain. Any improvement that can be identified and applied within this domain will be applicable to the other seven in a similar manner.

What Drives Army Innovation?

Innovation for the sake of innovation does not work within industry or the military. Change must leave an organization better off than where it originally started. As was stated above, private industry's mission is to make money. Because of this, how they measure successful innovation is relatively easy. Do the gains obtained from innovation yield a larger net worth than if the idea, method or device was never implemented in the first place? Successful military innovation is not as easy to measure because mission accomplishment is not always

quantitative in nature. To illustrate this, the U.S. Army's missions of homeland defense, global security, power projection, and winning decisively must be looked at individually.

Homeland defense is a broad mission set that allows the U.S. Army flexibility in how it achieves success. However, if the United States is never attacked, can one definitively state that the reason is because the Army was successful in establishing and maintaining defenses, or can it be that no other country wants to attack the United States right now? Similarly, how does one define success as it pertains to global security and power projection? A lack of hostilities does not always translate into success. Lastly, the U.S. Army cannot win a war if there are no wars to be won. This translates into a peacetime belief that if the U.S. Army creates a preponderance of capabilities compared to its adversaries across each WfF and their subsequent domains, it will achieve success on the battlefield when that time finally arrives. Therefore, according to *How the Army Runs*, "success in force management is measured on the battlefield in overmatching our adversaries."[6]

Before looking at case studies that support this claim, there are four key components that every Army innovation must have in order to be successful. The first of these is a reasonable cost. This is due to the Army having a budget that Congress must approve. Research, development, test and evaluation (RDT&E) accounts for 5.4% of the Army's 2016 proposed budget.[7] Any one innovation must be balanced against the others due to limited resources. The second component to successful innovation is development and implementation time. If an idea takes too long to manifest into a capability and then deploy to the force, it may not be an advantageous capability by the time it reaches the consumer. The third component to successful innovation is leadership support for the change. Not only do senior leaders control their organization's budgets, but they also have to accept risk, in many forms, for any changes they

make. This will become more apparent in the next section. Lastly, simplicity to implement change is a determining factor for successful change. A change that requires year's worth of training may not be one worth undertaking in the first place. Does the U.S. Army currently use these four components when developing its force?

Army Force Management and Acquisitions Process

The United States Army has a responsibility to organize, train and equip a force capable of implementing its part of the national military strategy.[8] In order to accomplish these three tasks, the U.S. Army has developed numerous models. The Army Force Management Model (AFMM) is one of those and it is a system-of-systems approach to creating trained and ready units for employment.[9] The AFMM consists of seven steps: determine strategic and operational requirements; develop required capabilities; design organizations; acquire materiel solutions; determine authorizations; acquire, train, and distribute personnel; acquire and distribute equipment. It is important to note that these steps do not have to happen sequentially. The end state of the AFMM is a force that is trained and equipped to complete its assigned missions. The Army uses other models that compartmentalize the seven steps of the AFMM in order to answer: what is the mission, what is needed to accomplish the mission, and what resources are available; essentially ends, ways, and means.[10] Additionally, there are two sub-processes of force management that directly affect innovation efforts: force development and force integration.

The first phase in force development begins with developing capabilities based on requirements derived from the National Security Strategy, National Military Strategy, QDR, National Defense Strategy, Defense Planning Guidance, Guidance for Development of the Force, Global Force Management Implementation Guidance, and guidance from Army senior leadership.[11] The second phase is "design organizations" and it focuses on building

organizations to fulfill requirements. This deals with designing functional units that are equipped with personnel and materiel necessary to fulfill capability gaps identified in the first phase. The third phase of force development is "develop organizational models" and it establishes the table of equipment (TOE): the document that architecturally depicts a fully mission-capable unit.[12] Phase four, "determine organizational authorizations," is where new units are resourced after Headquarters, Department of the Army (HQDA), approves the TOE. Since funding and total force strength are established by Congress, any newly established unit's requirements must be taken away from existing units' resources. "Document organizational authorizations" is the fifth and final phase of force development. This grants units authorization to place functional demands on Army systems.[13]

Force integration, the second sub-process of force development has three main components. The first is to place new or changed doctrine, organizations and equipment into the Army.[14] The second component is to develop strategies to integrate units and command structures across the Army. This occurs when modular units are placed under the command of a higher-headquarters while deployed to a theater of operations. Lastly, force integration assesses the impact of any changes that the process led to along the way. Despite these two systems being intricate and all-encompassing, there are components therein that help innovation, and there are components that hinder it. The following three sections will analyze force development and force integration by using the metrics of cost, time, leadership support, and simplicity.

Force Development Challenges

Change within the Army happens at the speed of bureaucracy. This is not a new concept, but one that has been a part of the Army since its inception. Article I, Section 8, Clause 12 of the Constitution of the United States says that congress shall, "raise and support Armies, but no appropriation of money to that use shall be for a longer term than two years."[15] Money, whether to pay a soldier's salary, purchase new equipment, or maintain vital equipment and facilities, has always been a restraint on the size and type of operations the Army can conduct. However, it is not just finances that slow innovation within the U.S. Army. Bureaucracy, mass equipping, and training have hindered innovation as well.

Bureaucracy is an essential part of the United States' government. Part of the reason for this is that it ensures that change occurs slowly and deliberately. It is what creates stability to an ever-changing world. Similarly, bureaucracy is a large part of the U.S. Army. By moving slowly and deliberately, senior Army leaders are able to gather facts, make assumptions, and understand risks that relate to every Army command within their purview. It also helps them to prioritize which missions they must accomplish and those which they can afford to place on hold. The outcome of their decisions drives the requirements for what equipment their organizations must have in order to succeed in their assigned missions. Bureaucracy is essential for senior Army leaders to make well-informed and timely decisions that ultimately affect the security of the nation.

Because the bureaucratic process is so complex, leaders often simplify other areas within their command. An example of this is how the U.S. Army structures its forces. Prior to 2002, the Army fought as divisions, and each one was structurally similar. After 2002,

the Army switched to a modular fighting force known as a brigade combat team (BCT). These units are similar in nature and are able to perform similar roles. The concept for having similar force structures across the entire Army is to reduce the learning curve when a soldier changes from one unit to the next. For this reason, both the structure and the types of equipment they require are almost identical. To simplify the process of equipping such similar units, leaders adopted the standard practice of mass equipping their entire force.

Mass equipping, the act of providing equipment to large portions of the Army at once, has always been a problem for the U.S. Army. A prime example of this occurred in 1956, when General Maxwell D. Taylor tried to reorganize his forces into Pentomic divisions.[16] Due to resource constraints, General Taylor's forces did not receive the equipment they needed in order to accomplish their assigned missions. To overcome this hurdle during Operation Iraqi Freedom the Army adopted the practice of leaving equipment from a departing unit to the unit that was replacing them. Leave behind equipment (LBE) was an attempt at modularly equipping the force without having to equip the Army as a whole. This worked well for an Army that was only fighting in one part of the world and where LBE was readily available to the region.

What Hinders Army Innovation?

Money, time, leadership support, and simplicity help to promote innovation within an organization. This section uses these four metrics to identify what is currently hindering Army innovation.

The entire force development process is both comprehensive and complex. A common theme within force development and force integration is the balancing of resources. The Army's budget is approved annually by congress and it is broken down into a budget that accounts for personnel, operation and maintenance (O&M), procurement, RDT&E, construction, family housing, and revolving and management funds.[17] This balancing of money is one of the reasons innovation is hindered within the U.S. Army .

Most materiel innovations end up costing money rather than saving money from existing funds. In 1990, the U.S. Army instituted a program, the Army Ideas for Excellence Program, through which the Army attempted to leverage the ideas of its workforce to increase efficiencies in an effort to reduce operating costs.[18] With the drawdown of forces occurring in 2016 like it did in the 1990s, it is imperative that the U.S. Army becomes more efficient across all of its domains. However, without a better way to manage funding for new initiatives within the Army, leaders are faced with two choices: allocate funds for future requirements while sacrificing current needs, or sacrifice future needs to fulfill current requirements. This does not bode well for innovations that take years to develop.

Time is always against the military. According to *Army Doctrine Publication 3-0*, to seize the initiative is to set and dictate the terms of action.[19] However, when bureaucratic processes, such as acquisitions, get in the way of implementing change, one can lose the initiative quickly. This is the case with force development and force integration. Before a service can begin acquiring materiel in order to fulfill a requirement, it must first have the money to do so. The system by which the Department of Defense (DOD) allocates resources is called Planning, Programming, Budgeting and Execution (PPBE).[20] During the programming phase, the program objective memorandum (POM), the document that

depicts a service's needs for the current year plus five years in advance, is produced.[21]

Since some key technology essentially doubles every two years, it is almost impossible to know what capabilities one will need four to five years in the future. Therefore, the acquisitions process, by attempting to predict and allocate resources and conduct RDT&E for future requirements against unknown future adversarial capabilities, is an inefficient use of time. Further, forecasting adds overhead to what Army senior leaders need to focus their planning efforts on which could adversely affect their desire to innovate in the first place.

Army innovation is designed to provide the force with the necessary means to accomplish its assigned missions. Since senior leaders identify capability gaps that result in materiel requirements, their support for innovation is crucial.[22] However, strategic requirements do not always align with the tactical requirements of the soldier on the battlefield. A prime example of this was the information network that units in Iraq required during Operation Iraqi Freedom and Operation New Dawn.

From the height of the Iraqi war to December of 2011, the number of Army bases declined from 500 to 5.[23] During this transition, the size of an area of responsibility for a given BCT increased as the number of units decreased. This led to a command and control issue as battalions and their subsequent companies were spread further apart. In 2010, the Army only provided satellite data communications down to battalion-sized elements. However, companies, managing Forward Operating Bases (FOBs) by themselves, then had a requirement for satellite communications as well. The strategic requirements did not align with the tactical requirements generated by the companies and

the Army had to rapidly innovate to fill this gap.

Finally, for any innovation to be useful, its implementation must be simple. Complex ideas, gadgets, and methods that are too difficult to use could end up decreasing efficiencies. There are two ways in which Army innovation is hindered by complexity: equipping and training.

As with the General Taylor example mentioned above, attempting to equip the Army as a whole is complex. The Army Force Generation (ARFORGEN) cycle is a method by which the Army prioritizes which units get manned, trained, and equipped for upcoming missions.[24] Historically, units across the Army all end up with similar capabilities based on new equipment as they each progress through the ARFORGEN cycle. Units scheduled to deploy are typically resourced first while those who just returned from deployment are the last to receive new equipment. The process is complex and there may be alternative solutions the Army can use to equip its force in a less cumbersome manner.

Just as equipping the Army is complex, so too is training the force. Every soldier in the Army goes through basic combat training and advanced individual training in order to learn basic combat and military occupational specialty (MOS) skills. After new equipment is released to the force for a particular WfF, soldiers with an MOS affected by the change require additional training. The new training is typically conducted at the various Centers of Excellence (COE) for each WfF and requires that soldiers travel to their respective schoolhouses to receive the new training. This costs money and takes a significant amount of time to send every soldier with a particular MOS through training.

Overall, the complexity of training hinders rapid innovation due to an outdated training model.

What Helps Army Innovation?

Despite the previous section detailing what hinders innovation, the Army as a whole has attempted to implement solutions that address those shortcomings. Again, this paper will use the metrics of cost, time, leadership support, and simplicity to describe how the Army is helping to drive innovation.

Reducing operating costs is one way in which the Army can save money. However, it takes millions of dollars to conduct RDT&E on new pieces of equipment. Once new materiel is developed and fielded, it costs even more money to train soldiers and maintain the new devices. Since World War II, the Army has partnered with industry and universities in order to purchase or co-develop new technology.[25] Commercial off-the-shelf (COTS) systems have migrated into every WfF the Army has. While purchasing existing equipment is not innovative in and of itself, finding new ways to use everyday technology is.

If maintaining the initiative is a goal of every commander, then evolving with technology allows commanders to meet that ambition. COTS products allow for this to happen. There are a plethora of companies that hire former soldiers and implement their ideas only to sell those products back to the Army.[26] Because of this, the time to develop products is reduced, and, coupled with industry practices, the cost for development is decreased. The result is a product that the Army can implement at a fraction of the cost and much quicker than had the Army developed it from start to finish.

Another way in which the Army is helping innovation by reducing the time to implement new solutions stems from its use of Mobile Training Teams (MTTs). MTTs travel to installations and train soldiers on new equipment, leadership, and core tasks.[27] By doing this, the MTTs reduces the expenses that a unit would otherwise incur by sending their soldiers on temporary duty (TDY) to a different installation. Further, it increases the number of soldiers who can attend the training, and it ultimately reduces the amount of time it takes to train changes to a particular MOS. In addition to being time-effective, MTTs increase the simplicity of incorporating change within the Army.

Leadership support for innovation at the tactical level can be challenging due to monetary constraints. For this reason, organizations such as the Army's Rapid Equipping Force (REF) have established programs where soldiers can submit requirements or solutions that will garner attention outside of their command.[28] The end result is that the REF can equip smaller units who have an operational requirement for new materiel with COTS solutions.

Additionally, how the Army identifies new requirements helps drive innovation. The Army Capabilities Integration Center (ARCIC) has established Integrated Capabilities Development Teams (ICDTs) whose mission is to "prioritize, integrate, and synchronize all DOTMLPF-P requirements within their assigned portfolio."[29] The premise is to identify requirements across all WfFs and their subsequent domains and then create working groups with the other WfFs in order to develop solutions to requirements that benefit more than one WfF. By giving a voice to each member of the working group, the Army is inherently generating leadership support from each CoE.

What Drives Innovation within Industry?

As was previously mentioned, money is the driving force behind innovation within industry. While pride can be an additional motivator for why companies innovate, this paper will focus on money as the metric by which to measure innovation. If one considers the global market to be a battlefield, companies who earn the most money are the victors. Everyone else is constantly trying to find ways to beat those who are on top. Cost, time, leadership support, and simplicity are still valid lenses through which to view innovation enablers. Using these four metrics, this section will identify industry practices in the forms of financing, RDT&E, and the lifecycle management processes that constantly drive innovation.

The saying that it takes money to make money is slowly falling to the wayside. Whereas companies used to have to secure start-up loans or have private financing in order to start their businesses, crowd funding is now allowing companies to create products without acquiring initial capital through traditional methods. Instead, sites like Kickstarter.com allow individuals interested in a new product to purchase the item before it is even created.[30] When the company selling the to-be-developed products reach a certain monetary goal, they begin their own RDT&E process. The result is that people are able to take their innovative ideas directly to consumers without having a tangible product in hand. This translates into innovation being less hindered than it has ever been in the past.

Along these lines, crowd sourcing, "the application of Open Source principles to fields outside of software," ideas has increased over the past decade.[31] The ability to leverage the ideas, expertise, and equipment of many people physically dispersed from one another has increased innovation efforts of many companies. The whole premise behind the internet was to share information, and companies are leveraging this tool more now than they ever have before.[32]

Crowd sourcing ideas decreases the amount of time it takes for businesses to determine if their would-be products will be successful.

Leadership support in industry correlates directly with how much money the private sector spends in developing new technology. Companies that develop successful new products are likely to make more money which immediately garners support from their executives. Like crowd funding and crowd sourcing, the private sector's ability to innovate is ultimately driven by its RDT&E processes. In 2014, the top 10 companies who spent the largest amounts of money on innovation collectively invested $100.6 billion.[33] Compared with the Army's request for $6.6 billion in 2015, private industry is spending considerably more than the U.S. Army . Since money is the driving force behind innovation, companies that make existing products better, are able to produce old items more efficiently, or develop altogether new gadgets stand to increase their revenue stream. Research and development are what allow the private sector to obtain its desired end state: money.

Development, testing, and evaluation practices also help to drive innovation within industry. Whether a product is simple to make or simple to use, simplicity helps to advance technology. The advent of 3D printing allows for prototypes to be made simply and at relatively low costs. Additionally, small companies can outsource production to overcome the burden of having to own their own facilities. One of the greatest drivers of innovation, though, stems from the fact that companies can have their products sampled by small groups of their consumers during the developmental phase. Beta-testing, as this is called, allows consumers to test and evaluate original designs that allow for the companies to modify their widgets prior to mass-production. By combining their ideas with those of their consumers during these three phases,

companies essentially increase their design pool and end up with a product that will yield more money.

The last driver of innovation for industry is the lifecycle management process that industry can leverage. From inception to creation, the entire innovation undertaking has the potential to earn businesses money. After a company has identified a capability gap that they can fill, they begin the RDT&E process. Once that is complete, they have a product they can sell. Additionally, attached to the product can be training packages, insurance options, maintenance and support additions, and myriad other services that can bring additional revenue. The benefit that industry has is that companies can choose when to shelf old products and discontinue support options. Companies are not bound to support products for decades that would increase their operating costs and deter them from innovating. A prime example of this was when Microsoft ended support for their Windows XP operating system in 2014.[34] Having the ability to end support requirements allows companies to focus on the future while minimizing the costs associated with maintaining legacy systems.

Driving Army Innovation through Industry

Army materiel development and acquisitions are difficult processes that have had over 200 years to grow into their current forms. As the Army's mission begins to change from 15 years of war into a state of expeditionary readiness, how the organization operates may need to change as well. This section combines current and new ideas within the Army and the private sector in order to provide solutions that will help drive innovation by overcoming institutional challenges, reducing RDT&E costs, decreasing equipping and training time, and designing simpler systems to promote rapid change.

Institutional Challenges

The strategic, operational, and tactical levels of war continue to pose a challenge to Army innovation. The strategic level is concerned with applying national power, the operational level with planning and executing campaigns, and the tactical level with planning and executing battles.[35] This is important because commanders at each level have requirements they deem necessary in order to complete their respective objectives. However, the majority of funding for new requirements is held at the strategic and operational levels. This causes problems when tactical commanders try to acquire new materiel in order to accomplish their missions. The first change that the Army must make in order to increase its innovation is how it identifies and resources capability gaps at each level of war. To do this, commanders at all levels need to be able to identify current capability gaps and requirements.

Managing RDT&E Costs Effectively

If innovation costs too much, the Army will not implement it. RDT&E costs need to be kept to a minimum in order to allow for a larger number of materiel solutions to be developed. To do this, the Army needs to look at modularity, partial force equipping, and a new method for product development.

According to the *Army Acquisition Policy, AR 70-1*, the Army is supposed to build hardware and software systems that are modular.[36] This is designed to increase interoperability between systems. However, if the Army were to take this idea and combine it with crowd sourcing and crowd funding, it could leverage industry to develop items at a fraction of the cost it currently pays corporations to build entire systems. Further, by asking individual companies to create components of a system, it would mask the nature of

the materiel that the component would be a part of. Compartmentalization would allow for secure systems to be developed by industry while allowing the developers to sell the individual items to the public writ large. Additionally, since the private companies could crowd source and fund the projects, they could receive input from the public sector as to how to make the product better. In this way, RDT&E costs would be reduced while innovation increased.

To further increase the amount of RDT&E funding available for materiel, the Army would need to reallocate portions of its budget. The Army has an operation and maintenance (O&M) budget of $44.7 billion for fiscal year 2016.[37] Compared with the $6.9 billion for RDT&E, the O&M is just under 650% of the Army's RDT&E budget.

Instead of purchasing equipment and the associated maintenance, training, and field support, the Army could look at reducing the amount of operational equipment it keeps on hand. This would lead to a reduced O&M budget and would allow for an increase in RDT&E funds. To do this, the Army could adopt a plan where it only maintained a training fleet, operational fleet, and spares fleet for technology-driven equipment. Legacy equipment could be used during the ARFORGEN train-up to a Combat Training Center (CTC) rotation. At that point, the CTC deployment would incorporate training on the new equipment that the unit would see in theater. By only equipping a part of the force with the newest technology, the Army could reduce its O&M budget.

The counter-argument to this suggestion is that industry will not produce materiel if the costs to design and fabricate it outweigh the price the military pays for it. This solution only works if industry can create the systems cheaply enough to make it worthwhile.

Therefore, by leveraging crowd sourcing and crowd funding to build modular systems, the Army can reduce O&M costs in order to increase their RDT&E allowance.

Decreasing Equipping and Training Time

The aforementioned modular solution coupled with equipping only part of the force has non-monetary benefits as well. Leadership backing is key to implementing innovation, and decreasing the time it takes to both equip and train the operational force should garner their support. The previous section depicted how partial equipping can expedite the time it takes to equip a force. However, the interoperability of new systems with legacy systems is crucial if this methodology is to succeed.

Training time usually stems from new systems operating differently than legacy systems. Even if MTTs exist to train units on new materiel, they still demand weeks' worth of training time that commanders must allocate to the MTTs. The reason for long training times stems from a lack of standards by which developers create solutions for the Army. Despite AR 70-1 mandating that systems be interoperable, they often times are not.[38] To support innovation efforts, the Army must hold systems' developers accountable for both modularity and interoperability requirements. If the Army does this, they could adopt a partial equipping model that would allow for troops to only require rapid training both at their CTC's and their reception, staging, and onward integration (RSO&I) phase when they first enter a theater of combat.

Designing Simpler Systems

The last part to designing modular systems is in their simplicity. One area that the Army needs to improve in is how complex their systems have become. The current force

development model leads to two problems: the design of manuals and the time it takes to train soldiers on a new system.

The smart phone market has figured out how to create a simple-to-use device that is complex in how it works. If this methodology were applied to military systems, the amount of training that a soldier required would decrease. Additionally, many smart phone applications provide training to their users when the application is launched for the first time. This concept works extremely well and could be adopted by materiel developers. Part of what hinders innovation is development time which includes manuals creation, editing, and production. By implementing a smart phone-like implementation to instruction and usage, innovative solutions could be implemented quicker and for less money. Further, the time it would take to train soldiers on new equipment would decrease which would increase unit readiness.

Putting it all Together: "The Competition"

The Army Ideas for Excellence program was a good attempt at asking individual Army personnel for solutions to problems that an individual identified. However, if the Army leveraged the idea of crowd sourcing within its ranks to identify capability gaps, they could have total-force input across each level of war. In order to streamline the process, commanders at the strategic and operational levels of war can create competitions that identify their requirements. Elements at the tactical level of war would be the ones to develop solutions. In this way, the tactical units could incorporate their own requirements into the final solution, and the result would be a materiel answer that supports the strategic, operational, and tactical level requirements.

The competition would take place within BCTs of a given division. The winners at each division would be partnered with scientists and development teams from industry that could develop prototypes. Additionally, the non-military components could leverage consumer crowd sourcing and crowd funding to help increase the idea pool and reduce development costs. Due to security issues and modularity requirements, crowd sourcing would be limited to portions of the materiel vice the entire solution. This in turn would also reduce production costs for individual companies and end up driving innovation both within the Army and the private sector.

Finally, the implementation of the new solutions would take place at one or more of the CTCs. This would allow commanders at all levels to see how the solution works in conjunction with legacy systems on the battlefield. However, before this competition could work as intended, the Army would have to overcome institutional challenges, reduce RDT&E costs, decrease equipping and training time, and require developers to design simpler systems to promote rapid change.

Conclusion

Any organization that is as complex and vital to national security and operates for as long as the United States Army is bound to have areas in which it can improve. As technology rapidly evolved through much of the 20th century, the Army had to adapt in order to remain ahead of its enemies. Long range field artillery, the airplane, the atomic bomb, and modern computing led to institutional changes that were conceived and implemented in relatively short amounts of time. Alongside of the Army's evolution were

changes to government, the economy, and technology; each one directly impacting how the Army fought.

As the cost of today's technology decreases, the United State's adversaries have the ability to procure materiel that will provide them with capabilities rivaling that of the United States. For this reason, the U.S. Army must innovate in every way it can in order to maintain an advantage over its opponents. While the entire DOTMLPF-P domain encompasses how the Army can change, this paper focused on the most difficult portion: materiel. If the Army can change its acquisition process, then it stands to reason that it can change any of the other domains just as easily.

In order to change, the Army must overcome institutional hurdles that are currently hindering innovation. Likewise, the Army needs to leverage some of its current best practices and expand upon those capabilities. Since the processes for these programs are already in place, adapting them to apply to the Army writ large should be relatively easy.

Additionally, Industry has provided the world with some important lessons over the past decade with regard to crowd funding and crowd sourcing ideas. These provide a good framework for how the U.S. Army can develop new capabilities based on total Army input. Additionally, the end result would be a thoughtful approach at solving current mission requirements while enabling the Army to rapidly change in the future.

Cost, time, leadership support, and simplicity are the four factors that any organization must consider when attempting to make a change. The proposed changes to how the Army acquires materiel as outlined in this paper aim to reduce costs, reduce development and equipping time, garner leadership support and increase the simplicity of modern Army systems. Over the course of 240 years, the Army has never stopped

innovating. However, the speed at which technology increases demands that the Army adapts its current practices in order to stay ahead of its enemies. By implementing the changes proposed within this document, the Army will achieve its missions and win.

Endnotes

[1] Jon T. Hoffman and Center of Military History, eds., *A History of Innovation: U.S. Army Adaptation in War and Peace* (Washington, D.C: Center of Military History, United States Army: U.S. G.P.O, 2009).

[2] "What is Moore's Law?" Graham Templeton, *ExtremeTech*, last modified July 29, 2015, http://www.extremetech.com/extreme/210872-extremetech-explains-what-is-moores-law.

[3] "Innovation | Definition of Innovation by Merriam-Webster," accessed February 21, 2016, http://www.merriam-webster.com/dictionary/innovation.

[4] United States Army War College, *How the Army Runs* (Carlisle, PA: U.S. Army War College, August 28, 2015), 2-4.

[5] United States Army War College, *How the Army Runs*, 1-2.

[6] United States Army War College, *How the Army Runs*, 1-5.

[7] United States Department of Defense, *Fiscal Year 2016 Budget Request*, (Washington, D.C.: Office of the Under Secretary of Defense CFO, 2015), A-6.

[8] United States Army War College, *How the Army Runs*, 1-1.

[9] United States Army War College, *How the Army Runs, 3-1*.

[10] United States Army War College, *How the Army Runs, 3-9.*

[11] Headquarters Department of the Army, *Force Development and Documentation*, AR 71-32 (Washington, DC: United States Army, 1 July 2013), 18.

[12] United States Army, *Force Development and Documentation*, 19.

[13] United States Army, *Force Development and Documentation*, 19.

[14] United States Army War College, *How the Army Runs, 3-31*.

[15] "Article 1, Section 8," accessed February 29, 2016, http://www.shmoop.com/constitution/article-1-section-8.html.

[16] Donald A. Carter, The U.S. Army before Vietnam, 1953-1965 (Center of Military History, 2015), pg. 28.

[17] United States Department of Defense, *Fiscal Year 2016 Budget Request,* A-6.

[18] Headquarters Department of the Army, *Army Ideas for Excellence Program,* AR 5-17 (Washington, DC: United States Army, 19 October 1990).

[19] Headquarters Department of the Army, *Unified Land Operations*, ADP 3-0 (Washington, DC: United States Army, October 2011), 1.

[20] "Planning, Programming, Budgeting & Execution Process - Programming [DAP]," accessed March 6, 2016, https://dap.dau.mil/aphome/ppbe/Pages/Programming.aspx.

[21] "Program Objectives Memorandum (POM)-Defense Acquisition Glossary[DAP]," accessed March 6, 2016, https://dap.dau.mil/glossary/Pages/2490.aspx.

[22] Army Capabilities Integration Center, *Information Paper,* (Washington, DC: ARCIC, 14 May 2015), pg. 1.

[23] Dennis Steele, *The Sun Sets on Operation New Dawn, but the Shadows Remain, Army* 62, no. 1 (01, 2012): 52-55. http://search.proquest.com.lomc.idm.oclc.org/docview/914995009?accountid=14746.

[24] Headquarters Department of the Army, *Army Force Generation*, AR 525-29 (Washington, DC: United States Army, 14 March 2011), pg. 18.

[25] "ENIAC: The Army-Sponsored Revolution," accessed March 6, 2016, http://ftp.arl.Army.mil/~mike/comphist/96summary/. The first computer was developed by the Army in conjunction with the University of Pennsylvania in 1946.

[26] "25 of the Most Influential Companies for Veteran Hiring," accessed March 6, 2016, http://www.diversityjournal.com/15431-25-of-the-most-influential-companies-for-veteran-hiring-2015/. The companies listed on this site hire service men and women in order to apply their leadership and skillsets to their own companies.

[27] "2009 U.S. Army Posture Statement," accessed March 6, 2016, http://www.Army.mil/aps/09/information_papers/mobile_training_teams.html. MTTs reduce TDY time and money requirements for units to train their soldiers.

[28] "REF Rapid Equipping Force - United States Army," accessed March 6, 2016, http://www.ref.Army.mil/aboutus.html.

[29] United States Army War College, *How the Army Runs, 3-19.*

[30] "About — Kickstarter," accessed March 6, 2016, https://www.kickstarter.com/about?ref=nav.

[31] "Crowdsourcing Industry Trends: Unique Ways Companies Are Leveraging the Crowd - CrowdSource," accessed February 29, 2016, http://www.crowdsource.com/blog/2014/05/crowdsourcing-industry-trends-unique-ways-companies-leveraging-crowd-will-impact-future-job-markets/.

[32] "Total Number of Websites - Internet Live Stats," accessed February 24, 2016, http://www.internetlivestats.com/total-number-of-websites/. The internet has had as many as 1 billion websites at its peak. It is expected to go above that number in 2016.

[33] "The Top 10 Biggest R&D Spenders Worldwide - Fortune," accessed February 29, 2016, http://fortune.com/2014/11/17/top-10-research-development/.

[34] "Windows XP End of Support," accessed February 29, 2016, https://www.microsoft.com/en-us/WindowsForBusiness/end-of-xp-support.

[35] "An Article from The Clausewitz Homepage," accessed March 7, 2016, http://www.clausewitz.com/readings/Dunn.htm.

[36] Headquarters Department of the Army, *Army Acquisition Policy*, AR 70-1 (Washington, DC: United States Army, 22 July 2011), pg. 51.

[37] United States Department of Defense, *Fiscal Year 2016 Budget Request,* A-6.

[38] Headquarters Department of the Army, *Army Acquisition Policy*, pg. 35.

Bibliography

Army Capabilities Integration Center, *Information Paper.* Washington, DC: ARCIC, 14 May 2015.

Carter, Donald A. *The U.S. Army before Vietnam, 1953-1965*. Center of Military History, 2015.

Hoffman, Jon T., eds. *A History of Innovation: U.S. Army Adaptation in War and Peace*. Washington, D.C: Center of Military History, 2009.

Headquarters, Department of the Army, *Army Acquisition Policy, AR 70-1.* Washington, DC: United States Army, 22 July 2011.

Headquarters, Department of the Army, *Army Force Generation, AR 525-29*. Washington, DC: United States Army, 14 March 2011.

Headquarters, Department of the Army, *Army Ideas for Excellence Program, AR 5-17*. Washington, DC: United States Army, 19 October 1990.

Headquarters, Department of the Army, *Force Development and Documentation, AR 71-32*. Washington, DC: United States Army, 1 July 2013.

Headquarters, Department of the Army, *Unified Land Operations, ADP 3-0.* Washington, DC: United States Army, October 2011.

Steele, Dennis. *The Sun Sets on Operation New Dawn, but the Shadows Remain.* Washington, DC: Army. 2012.

United States Army War College, *How the Army Runs.* Carlisle, PA: U.S. Army War College, 2015.

United States Department of Defense, *Fiscal Year 2016 Budget Request.* Washington, D.C.: Office of the Under Secretary of Defense CFO, 2015.