Spring 5-2022

Other Transaction Authorities: Evaluating Innovation Policy Impact of Alternative Contract Vehicles in the Department of Defense

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OTHER TRANSACTION AUTHORITIES:

EVALUATING INNOVATION POLICY IMPACT OF ALTERNATIVE CONTRACT VEHICLES IN THE DEPARTMENT OF DEFENSE

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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

PUBLIC ADMINISTRATION AND POLICY

OLD DOMINION UNIVERSITY
May 2022

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ABSTRACT

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Since 1958, government agencies have used Other Transactions (OT) to encourage innovation and the development of new technology. OTs' purpose is to help government agencies acquire leading-edge technology from private sector sources in a flexible, goal-oriented manner. This dissertation is a pilot study assessing whether innovation policies, specifically 10 USC 2371b (Pub. L. No. 114-92, 2015) that authorizes DoD prototype OTs, influence the Department of Defense (DoD) alternative contracting activities to promote the development of innovative technologies and products. Using existing literature and interrupted time series analysis, this dissertation examines publicly available contract data to answer the following research question: how can innovation policy outcomes, in the form of other transaction authorities, influence alternative contracting activities to promote the development of innovative technologies and products? Based on the results and the three hypotheses examined, there is support for the research question because the analysis of the award data of OTs showed a statistically significant increase in the number of DoD Prototype awards from 2008-2020. Findings from this study will contribute to the current literature and encourage research from more diverse fields to promote policy innovation and provide policymakers a method of assessing innovation policies using quantitative methods.

This dissertation is dedicated to my husband,
Clinton J. Stavrou, who believed in me from the beginning
and motivated me across the finish line,
even when my legs were too weak to stand.

ACKNOWLEDGMENTS

There are so many people that I want to acknowledge in supporting this research and the dissertations process. The first group of people that I would like to thank is my dissertation committee for reviewing my manuscript and helping me overcome all the challenges that came with this effort. I would also like to thank Dr. John C. Morris for believing in me when I first applied to the program and helping guide me through the academic field. Next, I would like to thank my professional network, specifically Benjamin D. McMartin, Esquire, who took me under his wing, made time to listen to my ideas, and guided me along the way. Additionally, I would like to thank the fantastic people that I met at the Public Administration Committee Annual Conference: Innovative and Enterprising Public Services in Newcastle, United Kingdom; Dr. John Diamond, Dr. Ian Elliot, Dr. Thomas Bryer, Dr. Mike Row, Dr. Kristy Docherty, and others that encouraged me to proceed with my research and have been an amazing support system along the way. I cannot forget to thank my excellent support system of friends, family, and colleagues that listened to my ideas, read my drafts, provided coffee and snacks, and have cheered me on every step of the way. Lastly, I want to thank all the people encouraging innovation and improving the acquisition process. May we continue to create change and push ourselves to crack the mold.

Thank you all!

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CHAPTER I

INTRODUCTION

In 1960, the United States (US) accounted for 69% of global Research & Development (R&D), with US defense-related R&D alone accounting for more than one-third of global R&D (Schwartz & Peters, 2019). During this time, the US federal government funded approximately twice as much R&D as the private sector. According to Moshe Schwartz and Heidi M. Peters, "… from 1960 to 2016, the US share of global R&D fell to 28%, and the US federal government's share of total US R&D fell from 65% to 24%, while business's share more than doubled from 33% to 67%" (Schwartz & Peters, 2019, p. 11).

These declining trends raise concerns because historically, the US government has driven innovation by investing in emerging, and sometimes risky, developing technologies. The ramifications and success of many of these government investments are hard to overstate. As highlighted by Mazzucato (2015), government investments "have proved transformative, creating entirely new markets and sectors, including the Internet, nanotechnology, biotechnology, and clean energy" (Mazzucato, 2015, p. 4). These declining trends are causing US policymakers to become increasingly concerned about the relationship between innovation and government investment.

Lawmakers are also concerned about the relationship between innovation and government investment, due to how critical nature of technological innovation from an economic and national security perspective. A more competitive country in international markets may increase technological innovation demand to ensure security for the nation (Taylor, 2016). This is because competitive countries use competition among private sector organizations to their advantage to fund new entrants and leverage their innovative solutions to current advancements,

such as cybersecurity. Leveraging new entrants to the Department of Defense (DoD) marketplace is a challenge for the DoD because of the numerous entry barriers created by the Federal Acquisition Regulation (FAR) and Federal statutes.

Recognizing these trends, Congress established a new type of agreement for the DoD called Other Transaction (OT) agreements. OTs are excluded from most federal procurement laws and regulations. These exemptions decrease the barriers of entry and exclude clauses that are problematic such as clauses related to intellectual property rights. Additionally, OTs have flexibility resembling private sector (business-to-business) contracts, which are constructed to meet the needs of the parties and the project. Lastly, OTs can provide the DoD significant benefits by attracting new companies -specifically nontraditional contractors -establishing a resource pool with other entities to facilitate the development of innovative technology products and having the DoD invest in the development of these innovative technology products.

Background of the Problem

R&D, defined by the Oxford dictionary, is work that is directed toward the innovation, introduction, and improvement of products and processes (see Table 15 for a list of definitions and acronyms). The declining trend in funding R&D is troubling because R&D efforts are proven to lead to innovations like the internet and cell phones (Link, 2006). In addition to R&D, the terms *innovation* and *technology* must also be defined for the purposes of this dissertation. Innovation is a new method, idea, or product; in other words, innovation can be either a product or a process (Borrás & Edquist, 2013). Technology is the application of new knowledge and innovation from research and development efforts. The link between the three terms is vital because *R&D* leads to *innovation* and *technological change* (Link, 2006; Vonortas, Rouge, &

Aridi, 2014). The necessity to manage innovation and technological change has thus become an essential consideration for policymakers.

Innovation policy is a relatively new term when discussing the policy-making agenda (Edler & Fagerberg, 2017). The term innovation policy has historically gone under many different labels; "such as industrial policy, science policy, research policy, or technology policy" (Edler & Fagerberg, 2017, p. 5). For purposes of this dissertation, innovation policy is any policy that promotes innovation. This definition includes policies that directly support innovation using funding mechanisms such as grants, contracts, or indirect support such as incentive tax programs for the private sector matching the private firm's expenditure with public funding (Vonortas et al., 2014). Understanding innovation policy has become increasingly important. For example, "from the 1970s onward, Douglas North, Robert Thomas, Nathan Rosenberg, and other economic historians argued that innovation was aided by specific government institutions and policies" (Taylor, 2016, p. 307). The decrease in federal funding for R&D can be an indicator of the actions of public agencies. These combined actions of public agencies, whether direct or indirect, are innovation policy because they affect innovation in one way or another (Borrás & Edquist, 2013). Understanding the impact of innovation policy is crucial to help stimulate policies that address societal challenges such as cybersecurity, climate change, unemployment, and inequality.

The government can directly support innovation through robust innovation policies that leverage grants and contracts with agency-controlled funding (Vonortas et al., 2014). The federal government typically uses procurement contracts, which are contracts that are awarded according to the Federal Acquisition Regulation (FAR), to procure goods and services. However, innovation policy has also been known to promote alternative contracting vehicles similar to how

the National Aeronautics and Space Administration (NASA), the Defense Advanced Research Projects Agency (DARPA), and the DoD have done in the past (i.e., Space Race, internet, Global Positioning System (GPS), and Siri) (Mazzucato, 2015). A great example of using alternative contracting vehicles occurred when President Eisenhower signed the National Aeronautics and Space Act of 1958 (PL 85-568) Section 203 (b)(5), granting NASA the authority to "…enter into and perform such contracts, leases, cooperative agreements, or *other transactions* as may be necessary in the conduct of its work and on such terms as it may deem appropriate…" This provision provided NASA a flexible contract vehicle, known as other transactions, to procure innovative technology to combat the threat of the Soviet Union. This was the first mention of other transactions as an alternative contracting method for the federal government (Hanson, 2005; Lopes, 2018; Schwartz & Peters, 2018). Today OTs are used by twelve government agencies, including the DoD[1].

Significance of the Study

Since 1958, OTs have been used to encourage innovation and the development of new technology. The term OT refers to any kind of transaction other than a procurement contract, grant, or cooperative agreement (See 10 USC 2371). Although OTs are not a new concept, they are considered an alternative contracting vehicle for government agencies, such as the DoD. The implementation of these contracting vehicle policies has experienced a few changes over the years through the expansion of authority through the National Defense Authorization Acts (NDAA), a series of US federal laws specifying the annual business and expenditures of the

[1] See Appendix A for a Figure 6 titled Federal Other Transaction Authorities Per Agency.

DoD. Using a federal reporting system called Federal Procurement Data System – Next Generation (FPDS-NG), Congressional Research Services (CRS) found that, despite the small percentage of obligations to OTs ($2.1B), the use of OTs is increasing quickly and is expected to grow. The 2019 report found that from Fiscal Year (FY) 2013 to FY2017 (2012-2016), the number of new prototype OT agreements increased from twelve prototype agreements in 2012 to 94 prototype agreements in just four years (Schwartz & Peters, 2019, p. 11). One explanation for this increase, according to CRS discussions with the DoD Officials, is due to Congress expanding the statutory authority (p. 11).

The purpose of OTs is to help the government agencies acquire leading-edge technology from private sector sources using a flexible, goal-oriented manner to foster new relationships through public-private partnerships. The three main benefits of OTs to the private sector are the decreased cost and time of the acquisition process, an increase in negotiating power for intellectual property rights, and more cooperation between the public and private sector (Schwartz & Peters, 2018). This push for more cooperation between sectors and even between private sector firms positions the cooperative model (Bozeman, Crow, & Tucker, 1999) as a lens to examine innovation policies similar to those promoting alternative contracting methods.

In November of 1989, Congress enacted Section 251 of Public Law 101-189, codified in 10 USC 2371, giving DARPA authority to conduct research and technology developments using cooperative agreements and other transactions. Congress later expanded this authority to the entire DoD to provide the department with the necessary flexibility to incorporate commercial industry standards and best practices into its award vehicle. Before 2015, the two types of DoD OTs were science and technology (S&T) authority and prototype authority (Section 845 PL 103-

160). Today, there are three separate OT authorities which are used in different scenarios depending on the DoD's needs:

- 10 USC 2371 (Research OT) – used for basic, applied, and advanced research projects when procurement contract, grant, or cooperative agreement is not feasible or appropriate.
- 10 USC 2371b (Prototyping OT) – used for prototyping directly relevant to DoD mission requiring either one third (1/3) cost share or significant nontraditional defense contractor (NDC) participation, and
- 10 USC 2371b(f) (Production OT) – used for follow-on production contract or transactions authorized when: a) competitive procedures are used for the selection of parties for participation in the transaction; and b) the participants in the transaction successfully completed the prototype project provided by the transaction.

The passing of the most recent authority, 10 USC 2371b, is vital because prior to 2015, the DoD used Section 845 of Public Law 103-160, as amended, which authorized the use of OTs, under the authority of 10 U.S.C. 2371. This authority was used under certain circumstances for prototype projects directly relevant to weapons or weapon systems proposed to be acquired or developed by the DoD. After 2015, the Section 845 authority for prototype agreements was superseded by 10 USC 2373b.

The 2016 Annual Industrial Capabilities Report[2] stated that Congress believed OTs could support the DoD's efforts to access new contractors of technological innovation, specifically with Silicon Valley startup firms and small commercial firms. The government's utilization of innovative companies in these alternative contracting vehicles is also critical because the government can create markets and engage private organizations that do not typically do business with the government. Thus, resulting in innovative technologies and products that are public goods.

Purpose of the Study and Research Questions

This dissertation is a pilot study with a purpose to assess whether innovation policies, specifically 10 USC 2371b (Pub. L. No. 114-92, 2015), influence the DoD alternative contracting activities to promote the development of innovative technologies and products and fill the gap of academic and practitioner bodies of knowledge. Drawing from existing literature and using interrupted time series analysis to examine publicly available contract data in FPDS-NG, this pilot study will attempt to answer the following research question: how can innovation policy outcomes in the form of other transaction authorities influence alternative contracting activities to promote the development of innovative technologies and products?

Theoretical Framework

During the 2016 Annual Industrial Capabilities Report to Congress[3], the DoD acknowledged that it should take advantage of the private sector's rapid growth by leveraging

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[2] The 2016 Annual Industrial Capabilities report can be retrieved from https://www.businessdefense.gov/Portals/51/Documents/Resources/2016%20AIC%20RTC%2006-27-17%20-%20Public%20Release.pdf?ver=2017-06-30-144825-160

3 The 2016 Annual Industrial Capabilities report can be retrieved from https://www.businessdefense.gov/Portals/51/Documents/Resources/2016%20AIC%20RTC%2006-27-17%20-%20Public%20Release.pdf?ver=2017-06-30-144825-160

innovation created by "nontraditional defense contractors."[4] In a similar study, a Government Accountability Office (GAO) report GAO-17-644 in July 2017 used data collected from twelve innovative companies that do not engage in business with the DoD. This report identified six challenges that deter these companies from doing business with the agency. These challenges included: 1) complexity of the DoD's process, 2) unstable budget environment, 3) long contracting timelines, 4) intellectual property rights concerns, 5) government-specific contract terms and conditions, and 6) the inexperienced DoD contracting workforce. The DoD recommended promoting initiatives that make the acquisition process more accessible and flexible (Sullivan, 2017). Such initiatives included several innovation policies, such as the FY 2016 and 2017 NDAA provisions for the DoD, including the codification of the DoD's Other Transaction Authority (10 USC 2371b) for prototypes. This innovation policy authorized the DoD to award follow-on production contracts for successful prototypes without using competitive procedures.[5] It is important to note that although it is great to have all these initiatives and innovation policies to support a solution for the challenges listed above, the real problem becomes analyzing the outcomes of such initiatives to find if these policies are promoting innovative technologies and products.

Before analyzing the outcomes of innovation policies, it is vital first to understand the US government's level of involvement in promoting innovative technologies and products. Three policy paradigms can be used to examine the US's approaches to innovation policy: the market,

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4 The United States Code, 10 U.S. Code § 2302(9), defines nontraditional defense contractor as: an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by the Department of Defense for the procurement or transaction, any contract or subcontract for the Department of Defense that is subject to full coverage under the cost accounting standards (CAS) prescribed pursuant to section 1502 of title 41 and the regulations implementing such section.

2 See 10 USC 2371b(f)

mission, and cooperative models (Bozeman, Crow, & Tucker, 1999). Although these three models were developed for studying R&D policy, they are still applicable when discussing innovation policy due to the natural crossover (Borrás & Edquist, 2013; Edler & Fagerberg, 2017). The models depicted are based on the level of involvement the government should have in regulating and influencing private sector behavior (Bozeman et al., 1999). The role the government plays determines the model applicable to the specific paradigm. The market model applies market failure as the reason the government sponsors R&D efforts. The mission model assumes that the government should perform the innovative services of specific missions which cannot be efficiently served by the private sector (e.g., defense and national security-related innovation). Lastly, the cooperative model is a new model in which the government has a more active role in performing research and developing innovative technology and products for private-sector consumption or by merely being a funding vehicle for R&D efforts.

The challenges presented in GAO's report GAO-17-644 demonstrate the numerous problems the DoD has encountered, preventing the DoD from attracting innovative contractors to collaborate to develop new national defense technologies. Applying these three models can help understand the importance of the suggested initiatives in the GAO report and how innovation policies influence the DoD's contracting activities.

CHAPTER II

LITERATURE REVIEW AND CONCEPTUAL MODEL

Innovation Policy and Public and Private Roles

Governments, donors, and other practitioners in the development community are keen to determine program effectiveness with broad goals such as increasing innovative technologies and products in the US. Innovation policy is a relatively new term when discussing the policy-making agenda (Edler & Fagerberg, 2017). Innovation policy has numerous definitions because "much of what is called innovation policy today may previously have gone under labels such as industrial policy, science policy, research policy, or technology policy (Edler & Fagerberg, 2017, p. 5). For example, Edler and Fagerberg (2017) note that to determine the origins of the terms, one must decide if the phrase uses the qualifier "innovation," or the impact of the policy is innovation (Edler & Fagerberg, 2017). For this study, innovation policy is described as any policy that promotes innovation. This definition includes policies that directly support innovation using funding mechanisms such as grants and contracts or indirect support such as incentive tax programs for the private sector matching the private firm's expenditure with public funding (Vonortas et al., 2014). This distinction is necessary because it highlights the need to assess how an intervention affects outcomes.

Another important connection is how innovation policy is implemented, specifically with the influence of public versus private sector. The challenges presented in GAO's report GAO-17-644 demonstrate the problems the DoD has encountered, preventing it from attracting innovative contractors to collaborate in the development of technologies for national defense. The challenges highlighted above, and the need for public and private sectors to work together, demonstrate how neither the market model nor mission model is efficient in promoting

innovation. Rather, these illustrate the assumptions of the cooperative model. The government can have an active part in developing innovative technologies and products.

An interest in policy and innovation led to inquiries into studies examining the relationship between policy and innovation. “From the 1970s onward, Douglas North, Robert Thomas, Nathan Rosenberg, and other economic historians argued that innovation was aided by specific government institutions and policies” (Taylor, 2016, p. 307). Policy implementation is the process of carrying out a government decision (Berman, 1978) by transforming a policy idea into an action intended to alleviate a social problem (Lester & Goggin, 1998). These actions may result in programs, procedures, or regulations (DeGroff & Cargo, 2009). One way policymakers can use policy to promote innovation is by using public procurement to stimulate innovative activity, especially among small businesses (Vonortas et al., 2014, p. 16). Examining the outcomes of OTs can provide insight into how policy can promote the development of innovative technologies and products.

The connection between innovation and public-private partnerships is inherent (Roumboutsos & Saussier, 2014) because the relationship calls for the two sectors to “jointly develop products and services and share risks, costs and resources which are connected with these products” (van Ham and Koppenjan, 2002, p. 598). As a result, positive outcomes and some type of efficiency gains through the private sector’s involvement in providing goods and services should occur. Roumboutsos & Saussier (2014) pointed out that public-private partnerships allow for sharing resources, knowledge, and risks to support innovation in ways traditional contracting activities cannot (Roumboutsos & Saussier, 2014). Scholars have echoed the importance of the alignment of goals and values in public-private partnerships to help ensure

that the public goals are met using this type of arrangement (Clark, Heilman, & Johnson, 1997; Kettl, 1993; Lombard & Morris, 2012; Savas & Savas, 2000).

OTs provide an alternative contracting method that promotes more shared interest between the public and private sectors through the innovation policies enacted by Congress. For example, Congressional actions that expanded definitions of nontraditional defense contractors, to include small business and expanding the scope of prototype projects (Pub. L. No. 113- 291, 2014), influence how the DoD implements these policies through alternate contracting activities (i.e., OTs). To understand why OTs are the alternative, one must first be familiar with the procurement contract.

The Procurement Contract Approach

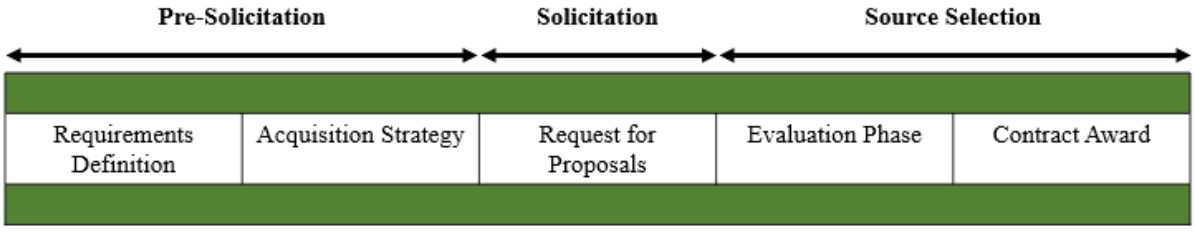
The procurement contract is a top-down regulated approach to procure goods and services from the private sector. These regulations are adopted by any agency that desires to do business with the private sector. As mentioned previously, OTs are not subject to the same regulations and rely heavily on the contracting officers' discretion to enforce and shape the policy governing these types of transactions. The procurement contract method of the acquisition process, Figure 1, begins with the DoD determining a need. Per the Federal Acquisition Regulations (FAR) Part 7, before the DoD acquires a product or service, it must conduct market research to determine which solution is most suitable to meet the specific need. Next, the DoD contracting officer will use the FAR and Federal Acquisition Regulation Supplement (DFARS) to procure the product or service based on the type of product they seek to obtain. For example, "DoD may use commercial item acquisition procedures under FAR Part 12 to procure commercially available products and negotiated contract procedures under FAR Part 15 for military-unique products" (Sullivan, 2017, p.4). These sections of the FAR provide a process,

guidelines, and applicable exceptions for contracting officers to follow in their decision-making process.

As identified in GAO-17-644, the current acquisition process is lengthy and complicated, resulting in a barrier for private sector companies to do business with the public sector. To put this into perspective, "in January 2017, the Army Contracting Command established standard contracting timelines that ranged from 55 days (about two months) for contracts valued less than $25,000 to 700 days (about 24 months) for contracts valued over $1 billion" (Sullivan, 2017, p. 13). As a comparison, data collected by the U.S. Air Force show that in the fiscal year 2016, it took an average of nearly 13 months from the time a request for proposal was issued until an award decision was made for 52 sole-source contracts valued between $50 million and $500 million" (Sullivan, 2017, pp. 13-14). For companies seeking a vehicle to complete R&D and prototyping efforts, this length of time can be a significant constraint.

Figure 1

Procurement Contract Method of the Acquisition Process



Note. This procurement contract method in the acquisition process can be broken into a three-phase approach: pre-solicitation, solicitation, and source selection phase.

The contract terms and conditions can also be a significant deterrent. Per the FAR, DFARS, and the DoD policies, the standard terms and conditions for DoD contracts are unique to the government. An example of this is a requirement in FAR Part 30 for companies to establish a government-unique cost accounting system when awarded cost-type contracts. The cost accounting system allows companies to disclose their costs in a specific manner to ensure consistency and accountability. An example provided in GAO-17-644, one company stated it took them "at least 15-18 months and cost millions to establish a government-unique cost accounting system" (Sullivan, 2017, p. 17). Government officials must track requirements from both a compliance and a liability standpoint. Combined, this results in an increased cost for the private sector and deters businesses from working with the government.

One of the critiques of the top-down model is that it is weak when there is "no dominant policy, but rather a multitude of governmental directives and actors, none of the preeminent" (Sabatier, 1983, p.30). The necessary discretion needed to utilize OTs make them an attractive alternate contracting method for the DoD amongst the challenges facing innovation policy.

Other Transaction (OT) Approach

The 2016 Annual Industrial Capabilities Report to Congress stated that Congress believed OTs are attractive for companies that do not generally engage in contracting with the government due to entry barriers and the "one size fits all" regulations governing defense procurements. The 2016 report also stated that OTs could support the DoD's efforts to attract new technological innovation offerings, specifically from Silicon Valley startup firms and small commercial firms.

Procurement contracts must follow the appropriate federal procurement laws and regulations. Conversely, OTs are legally binding contracts exempt from federal procurement

laws and regulations (e.g., Competition in Contracting Act and Federal Acquisition Regulations (FAR)). Most Federal Government acquisition statutes and regulations are not applicable to the OT authority, permitting more flexibility and freedom to contracting officials. For example, the private sector companies are not subject to follow the Government accounting rules (also known as Cost and Accounting Standards (CAS) as prescribed by FAR part 30). In other words, the contract resembles a private sector (B2B) contract as the terms and conditions are negotiable. The *DoD Other Transaction Guide for Prototype Projects* (2018) states, "this acquisition authority, when used appropriately, is a vital tool that will help the Department to lower barriers to attract nontraditional defense contractors and increase access to commercial solutions for defense requirements" (p. i).

OTs intend to provide benefits to the DoD such as attracting nontraditional contractors (as defined by 48 CFR § 212.001), establish a network for resources to develop and/or obtain innovative technologies, and provide an instrument for the DoD to influence technology and innovation as it did in the past. There are three types of OTs: Research, Prototype, and Production. Table 1 provides a comparison of the three. The different types of OTs specific to the DoD are in two sections of the law: 10 USC 2371 and 10 USC 2371b. The authority in 10 USC 2371 grants DoD the authority to use other transactions to conduct basic, applied, and advanced research projects. DoD regulations do not treat these projects as contracts, instead, the DoD treats these projects as financial assistance instruments. 10 USC 2371b permits the use of other transactions to conduct prototype projects and follow-on production (see Table 1). The two right columns are highlighted because they are the focus of this study - examining how innovation policy outcomes influence alternative contracting activities to promote the development of innovative technologies and products.

Table 1

Research, Prototype, and Production OT Comparison Chart

	Research OT	**Prototype OT**	**Production OT**
Regulation	10 U.S.C. 2371	10 U.S.C. 2371b (Previously in Section 845 P.L. 103-160)	10 U.S.C. 2371b(f)
Purpose	Conduct research	Develop prototypes	Follow-on production of a successful prototype project
Applicability	Basic, applied, and advanced research.	Prototype projects that are directly relevant to enhancing mission effectiveness of military personnel, simplicity platform, systems, components, or material to be acquired by DoD, and/or respective improvements	Follow-on contract after a successful prototype OT.
Restrictions	No duplication of research of the maximum extent practicable. A standard contract, grant, cooperative agreement not appropriate.	One of the following must apply: All participants are small or nontraditional business; **or** All significant participants must be small or nontraditional; **or** At least 1/3 of the total cost of the prototype project is provided by a nongovernment participant; **or** The senior procurement acquisition official provides a written explanation of exception and justification of OT award.	Can be conducted only if: The underlying prototype OT was competitively awarded; **and** The prototype project was successfully completed
Cost Sharing	50/50 cost share	Cost-share conditionally required.	NA
Competition Requirement	Competition to the maximum extent practicable.	Competition to the maximum extent practicable.	Not required if competitive procedures were used in the Prototype OT.

OTs as a Cooperative Model

Before analyzing the outcomes of innovation policies, it is vital first to understand the US government's level of involvement in promoting innovative technologies and products. Three policy paradigms can be used to examine the US's approaches to innovation policy: the market, mission, and cooperative models. A summary of three models associated with each paradigm is shown below in Table 2 developed for examining R&D policy (Bozeman et al., 1999). Although these three models were developed for studying R&D policy, they are still applicable when discussing innovation policy because innovation policy includes R&D policy (Borrás & Edquist, 2013; Edler & Fagerberg, 2017).

These three models are based on the level of involvement the government should have in regulating and influencing private sector behavior (Bozeman et al., 1999). The role the government plays determines the model applicable to the specific paradigm. The market model applies market failure as the reason the government sponsors R&D efforts. The mission model assumes that the government should perform the innovative services of specific missions which cannot be efficiently served by the private sector (e.g., defense and national security-related innovation). Lastly, the cooperative model is a new model in which the government has a more active role in performing research and developing innovative technology and products for private-sector consumption or by merely being a funding vehicle for R&D efforts.

Table 2

Three Competing Innovation Policy Models

	Market Model	**Mission Model**	**Cooperative Model**
Core Assumptions	1. Markets are most efficient allocator of information and technology. 2. Government role limited to market failures such as extensive externalities; high transaction costs; and information distortions. Small, mission domain, chiefly in defense. 3. Innovation flows from and to private sector, minimal government role.	1. The government role should be closely tied to authorized programmatic missions of agencies. 2. Government R&D is limited to missions of agencies, but not confined to defense. 3. Government should not compete with private sector in innovation and technology. But a government role in connection with traditional activities of line agencies.	1. Markets not always the most efficient route to innovation and economic growth. 2. Global economy requires more centralized planning and broader support for civilian technology development. 4. 3. Government can play a role in developing technology, especially pre-competitive technology, for use in the private sector.
Peak Influence	Highly influential during all periods	1945-1965; 1992- present.	1992-1994
Policy Examples	De-regulation; contraction of government role; R&D tax credits; capital gains tax roll back. Little or no need for federal laboratories except in defense support.	Creation of energy policy R&D, agricultural labs, and other such broad mission frameworks.	Expansion of federal laboratory roles in technology transfer and cooperative research; manufacturing extension policies.
Theoretical Roots	Neo-classical economics.	Traditional liberal governance with broad definition of government role.	Industrial policy theory.

During the 1980s, the US experienced economic uncertainty, and scholars began to re-examine the private sector's role in innovation. The market failure paradigm began to lose its luster, and scholars needed a new way of assessing innovation policy. The challenger to the market failure paradigm was the cooperative model, which emphasized cooperation among sectors (Bozeman et al., 1999). This is important to note in the innovation policy timeline as the DoD assessed its challenges in the development of innovative technologies and products. As aforementioned, Congress enacted Section 251 of Public Law 101-189, codified in 10 USC 2371 in 1989, which provided DARPA the authority to conduct research and technology developments using cooperative agreements and other transactions. At the time, this authority as only granted for a two-year pilot program. In 1991, the National Defense Authorization Act of FY1992 extended 10 USC 2371 authority to other DoD agencies and made it permanent. This was the first major expansion of authority for OTs because it enabled other departments in the DoD to use OTs for their efforts.

The DoD's procurement contract method of promoting innovation is an excellent example of the market failure model and the mission model. The market failure paradigm has been the dominant model for innovation policy by assuming that if there is a need for innovation, then the private sector will "sense the need and respond in an economically efficient manner" (Bozeman et al., 1999, p. 6). Thus, for any non-mission specific contracts, the DoD applies the market failure paradigm. The mission model becomes applicable for contracts that are mission-specific contracts (e.g., weapons systems). The mission paradigm assumes that the agency mission should derive innovation policy resulting in innovative products. These two models apply to the procurement contract method because they are not significantly different and are the most used innovation policy models.

The procurement contract method is a top-down regulated approach to procure goods and services from the private sector. A procurement contract is a contract awarded according to the Federal Acquisition Regulation (FAR). Regulations governing the procurement contract method (i.e., the FAR, Cost Accounting Standards (CAS), and the Bayh-Dole Act) are adopted by any government agency that desires to do business with the private sector. This procurement contract approach should be familiar to scholars accustomed to the Mazmanian and Sabatier paradigm of the "single-authority top-down" methodology (Hjern & Hull, 1982). In this approach, "implementation is the carrying out of a basic policy decision, usually made in a statute" (Mazmanian & Sabatier, 1981, p. 540). Government support is proposed once a market failure is identified (Mazzucato, 2015). Later this government support is evaluated as an investment, and value is assessed using cost/benefit analysis. The six challenges identified in GAO-17-644 apply to the procurement contract method, another example of the top-down model.

As the cooperative model's popularity grew, the innovative policy promoting OTs as an alternative contract method evolved. Two years later, the National Defense Authorization Act of FY1994 (PL 103-160) expanded the OT authority for DARPA to include prototype projects related to weapons or weapons systems procured or developed for a DoD agency. This was significant because the extension of authority allowed OTs as a procurement method rather than a stimulant for research efforts. This legislation is the second major expansion of authority for OTs because it changed how the DoD was using OTs. Three years later, the National Defense Authorization Act of FY1997 (PL 104-201) extended Section 845 prototype authority to the remainder of DoD.

Over the next two decades, the authority of OTs was both expanded and restrained by enacting additional clarifications and reporting requirements for transparency and accountability

of DoD agencies. These reporting requirements included annual reports that would include a description of the transaction, the reason for not using a contract or grant to support the research, the amount of the payment, and other requirements.

The next major expansion of authority for OTs occurred nearly 20 years after the first major event, the National Defense Authorization Act of FY1994 (PL 103-160). In 2014, Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for FY2015 (PL 113-291) expanded OT authority to include prototypes "directly related to enhancing the mission effectiveness of military personnel and supporting platforms, systems, components, or materials proposed to be acquired or developed by the Depart of Defense, or improvements of platforms, systems, components, or materials in use by the Armed Forces." Before this, OTs could only be used for weapons and weapons systems.

In 2015, the National Defense Authorization Act of FY2016 (PL 114-92) codified prototype OTs in 10 USC 2371b thereby rescinding the authority under Section 845, redefines and codifies nontraditional defense contractors in 10 USC 2302(9), and expands follow-on production (10 USC 2371b(f). This legislation is the fourth major expansion of authority and is the focus of this study on how this innovation policy has promoted the development of innovative technologies and products. To highlight the importance of this study, it is important to review key previous research efforts over the last few decades, which is discussed in the following section.

The amount of the investment depends on available funding, and with the trends of the last several decades, the decline in funding for innovation has caused great concern. This is where the mission model and market model are challenged. Available financing combined with the DoD's problem of not attracting innovative firms, can create a call for action. These

challenges and the need for public and private sectors to work together illustrate the cooperative model's assumptions that the market is not always the most efficient way of promoting innovation.

For this reason, the cooperative model has gained interest, especially in the application in the commercialization of technology (Bozeman et al., 1999) and when addressing intellectual property and the government becoming a partner in developing the technology. These are not new topics and are found in numerous federal reports such as the reports mentioned above, the 2019 CRS report (R45521), and the 2017 GAO report (Sullivan, 2017).

Scholars such as Hjern and Hull (1982) that support the bottom-up approach to policy argue that examining only the perspective of "central" decision-makers neglects other actors that play roles in policy implementation (Sabatier, 1986). In a similar manner, one of the top-down model's critiques is that the model is weak when there is "no dominant policy, but rather a multitude of governmental directives and actors, none of the preeminent" (Sabatier, 1986, p. 30).

OTs provide a bottom-up emphasis, giving significant decision-making power to public administrators. These public administrators have considerable influence in shaping and enacting policy on the ground, especially when it lacks clear direction on its implementation (Hill, 2003). However, difficulties may occur in implementing policy in cases where "implementing agents know multiple ways to implement a policy and must choose among them" (Hill, 2003, p. 5). One significant reason is that OTs are not subject to the same rules and rely heavily on the contracting professionals' discretion to enforce and shape the policy governing these types of transactions. The authority provided by 10 USC 2371b gives contracting professionals decision-making power versus the regulation-driven procurement contract method.

OTs' appeal is that they are not procurement contracts and are an alternative contracting method consistently highlighted to help alleviate these types of concerns. Additionally, OTs are designed to promote shared interests between the public and private sectors through Congress's several innovation policies. For example, Congressional actions that expanded definitions of nontraditional defense contractors to include small businesses and increasing the scope of prototype projects (Pub. L. No. 113- 291, 2014) influence how the DoD implements these policies. Additionally, these policies impact alternate contracting methods (i.e., OTs) to promote innovative technologies and products. This study will look specifically at the policy passed in 2015 in which Congress made OT authority permanent by codifying the law at 10 USC 2371b (Pub. L. No. 114-92, 2015). By using the cooperative model as a lens to examine how innovation policies such as 10 USC 2371b influence DoD alternate contracting activities, this study will also explore how this policy can promote innovative technologies and products using interrupted time series analysis.

Previous Research on OT Authority Policy

As mentioned by 2019 CRS Report R45521, limited attention has been paid to researching the use of OTs and their effectiveness. Although, relevant research has been prevalent for nearly 30 years, the findings have not been easily accessible to practitioners and academics, and most of the research is prior to the enactment of the 10 USC 2371b in 2015. This is significant because, as previously mentioned, 10 USC 2371b rescinded the authority under Sec 845 meaning that any studies that examined prototype authority under Section 845 have minimal applicability to the impact of the current prototype authority under 10 USC 2371b. However, themes from previous studies can be used to examine the current innovation policy.

One way to illustrate this is by focusing the review on published literature by doing a search using online queries in Old Dominion University's Library Database. This review used keywords such as "other transaction authority" and "Department of Defense" with the criteria that the articles were also from peer reviewed journals. The query yielded twenty-six articles from various sources. In addition to finding these articles, a search using similar keywords was performed to include some practitioner research.

Most of the published OT literature reviewed was either practitioner-oriented (Bloch & McEwen, 2001; Dix, Lavallee, & Welch, 2003; Dunn, 2017; Kuyath, 1995; Vadiee & Garland, 2018), theory based (Schooner, 2002), or metrics based (Fike, 2009). The literature in peer reviewed journals was focused on barriers for DoD's ability to keep pace with security needs in the current environment (Bell, 2014; Bonvillian & Van Atta, 2011; Michèle & Robert, 2016; Nunez, 2017; Peter, 2013; Steinberg, 2020; Steipp & Bezos, 2013), and the legal and administrative systems that govern OTs (Gunasekara, 2010; Nathaniel, 2019; Nikole, 2019; Selinger, 2020; Victoria Dalcourt, 2019). Although these research subjects are important when discussing OTs, none of the OT literature reviewed attempts to systematically identify and discuss the impact of innovation policy on the DoD's use of OTs.

Steven Schooner published his contract law desiderata in which he argues that three main policy goals of the United States procurement system are transparency, procurement integrity, and competition (Schooner, 2002). Schooner notes that it is important to acknowledge the role of risk avoidance. Avoiding undue risk is a responsibility of the governing body. However, too much focus on risk avoidance can stifle creativity and innovation. These observations about the culture of the DoD and its focus on avoiding undue risk provides some historical context of OTs as a potential solution to address certain institutional problems.

Several articles focused on the pros and cons of OTs (Bloch & McEwen, 2001; Dunn, 2017; Kuyath, 1995). Richard Kuyath (1995) is the earliest article developing a way to understand the pros and cons of OTs using data from program officials (Kuyath, 1995). David Bloch and James McEwen (2002) identified that OTs were created for three specific goals: enhancing military technological superiority, streamlining the procurement process, and integrating civilian and military technology industries (Bloch & McEwen, 2001). In his discussion in addressing the criticism of OTs, Richard Dunn (2009) provides case studies to help promote and encourage the DoD's use of OTs (Dunn, 2017). Gregory Fike (2009) research attempted to find a reliable quantitative metric to assess DoD's OT effectiveness. He suggested several metrics to evaluate the success of an OT such as cost saving, time saved in negotiations, the procurement timeline, and participation of nontraditional contractors (Fike, 2009). This article was one of the few articles that attempted to provide actual metrics using a quantitative approach to measure the effectiveness of OTs.

Articles in the last three years (2017-2020) have been focused on the barriers for DoD's ability to keep pace with security needs in the current environment (Nunez, 2017; Steinberg, 2020). Krista Nunez highlights the DoDs use of OTs to protect, defend, and even prevent cyber threats (Nunez, 2017). Douglas Steinberg (2020) provided more of a historical review of the need for the DoD to lower the barriers of entry to help accelerate the speed of innovation (Steinberg, 2020). Both authors echo the need to leverage tools that provide more flexibility when contracting for innovative technologies and products to be more effective in protecting the nation's security.

To illustrate the attention of similar academic studies such as dissertations and thesis a search for similar studies in the form of thesis and/or dissertations. During a search for similar

studies performed specifically as a thesis or dissertation, the results based on online queries in Google search engines and Old Dominion University's Research Database query yielded seven theses and one dissertation with similar research purposes. Seven of those studies originated from the Naval Post Graduate School prior to the enactment of 10 USC 2371b, a graduate university specifically for DoD professionals. In 2018, the eighth study was published from the Virginia Polytechnic Institute and State University (Virginia Tech). This dissertation was also unique because it was a study published in the field of Public Administration/Public Affairs. All studies examined if the OT authority policy was meeting its objective in attracting nontraditional business to do business with DoD. This dissertation is different as it looks at the direct outcome as it relates to innovation policy versus examining OTs and reviewing the data using quantitative methods versus qualitative methods.

The first thesis focused on OT authority policy was published in 1997 by a student at the Naval Postgraduate School in California. Howell (1997) focused on awards made by DARPA due to their experience and longevity in using this type of contract vehicle. The researcher examined these OTs to discuss the objectives that resulted in an OT. The methodology used for this study included a review of law journals, periodicals, publications, the US Code, and webpage literature. Additionally, the researcher performed interviews with DARPA's General Counsel, Contracting Officers, and Heads of Technical Offices. The study concluded that if the use of OTs increased, it will be able to facilitate technological innovation. The recommendation included allowing major systems commands to establish procedures and guidance, to collect feedback and lessons learned at a central location to support a unified direction, and to establish educational resources for acquisition personnel to help prepare the future acquisition professionals.

In his 1998 theses, Slade focused on the contractor's perceptions of benefits and limitations of Section 845 Agreements (Slade, 1998). During this timeframe, OTs for prototypes were also known as Section 845 Agreements. Like the present version of 10 USC 2371b these agreements attract nontraditional Government contractors and accelerate the development of prototypes. Also, Slade categorized the participating businesses as traditional and nontraditional, identified the perceived benefits of OT for attracting companies to participate in the 1997 Commercial Operation and Support Savings Initiative (COSSI 97) program, and determined if the businesses would participate in another Section 845 agreement. The study was limited to the thirty companies that participated in COSSI 97. The methodology used in the study involved a literature review of DoD publications, academic research, and internet websites. After completing the list of the thirty (30) COSSI agreements and respective contracts, Slade conducted phone interviews with professionals and representatives knowledgeable about the COSSI and performed follow-ups as necessary through email. The study concluded that although the participants found the agreements to be a useful tool to foster better relations with the government, the government's inexperience with the agreement was a significant limitation. Additionally, the study concluded that only six of the thirty (20%) of the participants in COSSI 97 were nontraditional contractors. Slade (1998) emphasized that these six contractors would not have done business with the government if the program used a different contract vehicle.

During the same year, Hayes (1998) conducted a study for his thesis to develop a decision model of DoD buying commands regarding their use of OTs (Hayes, 1998). The decision model criteria were developed using literature and interview data from buying authorities in the DoD, DARPA, the National Imagery and Mapping Agency (NIMA), and the Office of the Secretary of Defense (OSD) personnel. The study concluded that the business

decision was the central factor when deciding to use OTs for a specific procurement/acquisition. The other criteria included the type of product, nontraditional defense contractors, dual-use technology, cost-share arrangement, and risk analysis. The study concluded with recommendations to develop quantitative and qualitative performance measures to help identify if objectives are being met, along with an increase in research of OTs to determine if early involvement of the Defense Contract Management Agency (DCMC) would provide an added benefit and identify the common heuristic and associated biases used in the OT process.

In 1999, the objective of Stamatopoulos' thesis research was to identify and develop appraisal metrics to measure the value of Section 845 agreements and how they are used (Stamatopoulos, 1999). The methodology used in the study involved a literature review of academic research and internet websites. Stamatopoulos collected agencies and contact information of Program Managers and Acquisition Professionals engaged in Section 845 agreements. Next, the researcher used surveys and phone interviews from the selected government agencies.

Stamatopoulos found thirteen standard contract metrics appropriate to Section 845 agreements. Out of those thirteen, he identified four to serve as the core set of parameters. These four metrics include "attracting nontraditional defense firms, prototype acquisition cycle time, customer satisfaction and timeliness" (Stamatopoulos, 1999, p. 132). The researcher identified attracting nontraditional defense firms to be a core OT metric. "Eighty-eight percent of respondents' felt the measure was meaningful and indicated it related to their organization's goals, 80 percent claimed the metric data was measurable and 67 percent felt it was economical to collect" (Stamatopoulos, 1999, p. 134). He also stated that although it was a successful measure, the term "nontraditional" business needed to be better defined to be a valid and reliable

metric. Stamatopoulos (1999) recommended a future study to conduct a comparative analysis of other organizations contract metrics, a future quantitative study examining OTs ability to attract nontraditional contractors (prime and subcontractors), and a future study of how OT data can be precise, valid, and not a burden to collect.

Gilliand's (2001) study examined the effectiveness of Section 845 by soliciting nontraditional companies that participate in OT procurements from 1994 through 2000 (Gilliland, 2001). Effectiveness was analyzed by the number of nontraditional businesses doing business with the government per Title 10 USC 2371 authority. The study's methodology reviewed references and publications at the Naval Postgraduate School, published academic books and articles, and internet websites. The study found significant gaps in the definition of "nontraditional" businesses and that the DoD did not track the amount of technology resulting from OTs' use. Recommendations included performing a similar study with experience companies in industries that the DoD does not do business, performing quantitative analysis to measure OTs' effectiveness in attractive, nontraditional OTs, and additional education for contracting officers that execute OTs.

Tucker (2002) focused on Technology Investment agreements (TIAs) to determine the effectiveness of this contract vehicle to attract private firms to do business with the DoD (Tucker, 2002). A TIA is a contract instrument used to promote private sector involvement in pursuing technologies for defense research. TIAs are appropriate when research objectives are unlikely to be achieved using other types of contract instruments. TIAs may be executed as a cooperative agreement or a type of assistance transaction other than a grant or cooperative agreement, such as a Research OT (see 10 USC 2371). The study's methodology reviewed references and publications at the Naval Postgraduate School, published academic books and

articles, and internet websites. DoD Inspector General audits and Dual Use Science and Technology (DU S&T) Projects that were reviewed ranged from 1997 through 2001. The study found that TIAs were attracting commercial firms; however, it was not at the degree the government claimed. Tucker (2002) recommended examining the private sector's opinion of TIAs, a comparison of successful and unsuccessful TIAs, an analysis of TIA costs, and a review of why TIA usage has decreased.

Hanson's (2005) quantitative research thesis examined DoD reports to determine the extent to which the OT authority objectives were achieved (Hanson, 2005). The study's methodology reviewed references and publications at the Naval Postgraduate School, published academic books and articles, and internet websites. The analysis examined data from FY1997 – FY2003 (1996-2002) from the DoD Annual Report to Congress on the Cooperative Agreements, and OTs found on the Office of the Secretary of Defense, Defense Procurement and Acquisition Policy (OSD DPAP) website. Results of the analysis showed that only 11% of all awarded OTs went to nontraditional contractors and only "one-tenth of one percent of all DoD 'Research, Development, Test & Evaluation' funding in those fiscal years" (Hanson, 2005, p. v) reached those same nontraditional contractors. Thus, Hanson concluded that OTs were ineffective at attracting nontraditional contractors. The study recommends that the DoD "OT Guide" is revised to identify the funding allocated to nontraditional businesses to allow policymakers and DoD to track the RDT&E budget. The second recommendation was to encourage DoD and Congress to "evaluate and quantify the benefits of" (Hanson, 2005, p. 54) OTs.

In 2018, Lopes completed his dissertation using qualitative methods using historical institutionalism literature to explain why the DoD has not widely used OTs (Lopes, 2018). By using interviews with DoD employees and contractors, and OT case studies, Lopes offered six

policy recommendations to promote more extensive use of OTs by the DoD. These six policy recommendations include establishing a knowledge management resource website, providing resources such as templates to employees, updating respective policies, mandating FPDS-NG as a mandatory requirement for unclassified OTs, increasing educational needs for contract and program professionals, and establish an interagency OT group. Lopes (2018) also notated the seventh recommendation for academics to conduct additional research "using CPT and the potential causal mechanisms" (Lopes, 2018, p. 647) from his study.

Common themes are identified while examining these studies. The first is the lack of quantitative analysis to support the recommendation for "quantifiable" measures (Gilliland, 2001; Hanson, 2005; Hayes, 1998; Stamatopoulos, 1999; Tucker, 2002). Out of the eight studies, only one was a quantitative study that reviewed annual report data related to DoD OTs (Hanson, 2005). Hanson's data focused on the OT policy's ability to attract nontraditional contractors.

The gap for additional quantitative studies to measure how OTs are used was identified in the 2019 Congressional Report titled, Department of Defense Use of Other Transaction Authority: Background, Analysis, and Issues for Congress (CRS R45521 Version 4). As mentioned previously, the 2019 Congressional Report addressed a concern that there was no method to analyze the effectiveness of innovation policy efficacy on the way DoD OTs are used. This pilot study provides a method to look at the implementation of the policy, examines the policy with the most recent changes, examines how these policy changes affect the award rate of DoD OTs and understands its effect on alternate contracting methods.

The second theme of these studies is whether the OTs are meeting their objective in attracting nontraditional businesses. These studies have found that OTs are not meeting the objective or that the agency has failed to notice how successful the OTs have been at attracting

nontraditional businesses (Gilliland, 2001; Hanson, 2005; Lopes, 2018; Slade, 1998; Stamatopoulos, 1999). The attraction of nontraditional business is still a relevant topic and a growing concern based on the government's interest as referenced in government reports such as GAO-16-209, GAO-17-644, and CRS R45521 Version 4.

The third theme describes that although all eight of the studies evaluate the legislative history of OTs, none of them measure or discuss the impacts of the policy on the usage of OTs. As Hanson (2005) points out, previous researchers looked at various aspects of OTs, but most used qualitative methods to review the data (Hanson, 2005). In summary, the OT literature currently available has an apparent gap of literature using a quantitative research design and methods to examine and discuss the impact of policy on OT use in DoD. This gap for additional quantitative studies to measure how OTs are used was identified in the 2019 Congressional Report titled, Department of Defense Use of Other Transaction Authority: Background, Analysis, and Issues for Congress (CRS R45521 Version 4). As mentioned previously, the 2019 Congressional Report addressed a concern that there was no method to analyze the effectiveness of innovation policy efficacy on the way DoD OTs are used. The previous research projects on OTs included herein are primarily qualitative research designs asserting that OTs eliminate barriers preventing DoD from tapping into private sector R&D. Thus, gaining access to industry leaders who traditionally did not do business with the Department of Defense.

This dissertation seeks to fill this gap by providing a documented methodology to identify and discuss whether innovation policies, such as 10 USC 2371b (Pub. L. No. 114-92, 2015), influence the DoD alternative contracting activities to promote the development of innovative technologies and products. By examining the innovation policies influence on alternative contracting activities, this research will also attempt to provide a new perspective

through the lens of public administration and policy to encourage more research from diverse fields to promote policy innovation. This pilot study provides a method to look at the implementation of the policy, examines the policy with the most recent changes, examines how these policy changes affect the award rate of DoD OTs and understands its effect on alternate contracting methods.

CHAPTER III

DATA AND METHODOLOGY

Impact evaluation can assess the outcomes of alternative contract vehicles, such as OTs, resulting from innovation policy and evaluate valid and reliable data using quantitative approaches such as ex-post and ex-ante analysis. An ex-ante impact evaluation attempts to measure future programs and policies' intended impacts, given a targeted area's current situation, and involves simulations based on assumptions about how the economy works. Ex-post assessment defines policy monitoring and evaluation and assesses the process after the policy's adoption. This dissertation will be using an ex-post analysis for assessing the impact of DoD OT authority10 USC 2371b (Pub. L. No. 114-92, 2015).

Research Design

This dissertation's research design is quantitative to answer the research question: how can innovation policy outcomes in the form of other transaction authorities influence alternative contracting activities to promote the development of innovative technologies and products? Campbell initially proposed the time-series quasi-experiment to examine the impact of an intervention (McDowall, McCleary, Meidinger, & Hay Jr, 1980). Using the conventional Campbell-Stanley notation, the time series quasi-experiment is diagramed as:

… O O O O O X O O O O …

In this diagram, the O signifies an observation of a time series, while the X signifies a distinct intervention. The time-series quasi-experimental design examines OTs' utilization by the DoD based on contract award information. In its application, the O denotes the observations of all other innovation policies codified, and the X indicates the DoD OT authority 10 USC 2371b (Pub. L. No. 114-92, 2015). A quantitative approach can estimate relationships among a set of

constructs (Creswell, 2009). In other words, quantitative research uses statistical analysis to test hypotheses experimentally (Creswell, 2009; Remler, 2011; Singleton & Straits, 1993). By empirically examining the innovation policy outcomes, this pilot study will investigate how innovation policy outcomes influence alternative contracting activities to promote the development of innovative technologies and products.

The following are three sets of hypotheses relevant for answering this dissertation's research question. The cooperative model depicted Chapter II (see Table 2) will be used as a lens for this study. The following three hypotheses are in support of the research question for this dissertation

H1: Following the policy implementation in 2015, there was an increase in the number of awards and total dollars obligated of DoD prototype OT agreements.

H1A: Following the policy implementation in 2015, there was an increase in the number of awards of DoD prototype OT agreements.

H1B: Following the policy implementation in 2015, there was an increase in the total dollars obligated of DoD prototype OT agreements.

This hypothesis examines the policy's overall effect on DoD OT agreements, precisely the number of prototype agreements. A delineation between these two types of OT agreements matters because there are difference policies that govern R&D and prototype agreements. Specifically, R&D agreements are defined in 10 USC 2371and prototype agreements are defined in 10 USC 2371b. This hypothesis ties to the research question because the prototype OTs are an outcome of the 2015 policy. This hypothesis also links to the Cooperative Model because, in the

OT process, the government plays a role in collaboratively developing technology for commercialization through contract DoD awards to the private sector organization.

H2: Following the policy implementation in 2015, there was an increase in the number of new companies and total dollars obligated to new companies getting awarded DoD prototype OT agreements.

H2A: Following the policy implementation in 2015, there was an increase in the new companies awarded DoD prototype OT agreements.

H2B: Following the policy implementation in 2015, there was an increase in the new companies receiving total dollars obligated of DoD prototype OT agreements.

The second hypothesis examines the DoD's concern with attracting more nontraditional defense contractors wanting to do business with the DoD. This hypothesis ties to the policy's purpose and outcome, specifically in attracting nontraditional defense contractors as defined by 10 USC 2302(9). Like hypothesis 1, this hypothesis will examine companies awarded prototype agreements. This hypothesis also ties to the Cooperative Model because some companies do not have the resources to create innovative technologies.

H3: Following the policy implementation in 2015, there was an increase in the diversity of product and service categories awarded DoD prototype OT Agreements.

The third hypothesis examines the products and service codes awarded and subsequent changes based on the 2015 policy. An assessment of the diversity of products that are considered innovative will be examined. This hypothesis ties to the research question because innovative technologies and products should be an outcome of the 2015 policy. This hypothesis also

connects to the Cooperative Model because, in the OT process, the government plays a role in collaboratively developing technology and innovative products for commercialization.

Data Collection Methods

FPDS-NG is the source for the data because FPDS-NG reports contracts whose estimated value is $10,000 or more, including every modification to the respective contract, regardless of dollar value. It was used as a source outside of a common data collection source, because FPDS-NG provides procurement data to USASpending.gov, resulting in updated raw data on contract awards without including any grant or loan information that would be covered with USASpending.gov.

The data used for analysis is publicly available, meaning it is data generated for purposes other than this research (Singleton, 1993). The dataset was downloaded on 24 April 2021, from an online query form (FPDS-NG) website using three search criteria: 1) keyword "other transaction agreement, 2) defining the "Award Type" field as "other transaction agreement, and 3) defining "Department Full Name" field as "Dept of Defense". Using these keywords, the query resulted in 8,769 records from 2008 – 2020. The dataset included both types of DoD OTs and reported contract information such as:

1. Contract action information (e.g., contract number, contract modification number, the type of contract, and dollars obligated under the contract actions),
2. Procuring agency information (e.g., contracting agency unique identification number and the contracting agency name),
3. The purchased product or service information (e.g., the product or services code (PSC) type, the PSC, and the PSC description), and

4. The contractor's information (e.g., vendor name, vendor North American Industry Classification System (NAICS) code, Universal Numbering System (DUNS) number, and vendor address).

Operationalization of Variables

The raw data used from FPDS-NG captures details about OTs and provides a longitudinal data set that can capture how the enactment of specific innovation policy can result in outcomes such as an increase in OT agreements, an increase in new companies doing business with the government, and an increase in innovative (technology-based) products. To operationalize the data into variables, the following Table 3 provides the variable name and description related to each respective hypothesis in support of the research question.

Table 3

Operational Table of Variables by Hypothesis

Hypothesis 1: Following the policy implementation in 2015, there was an increase in the number of awards and total dollars obligated of DoD prototype OT agreements.	
Variable	**Definition & Source**
OT Agreements – Total (Monthly)	Total number of DoD OT contract awards and contract modifications annually (2008 –2020) Source: FPDS-NG
Prototype OT Agreements – Total (Monthly)	Total number of DoD prototype OT contract awards and contract modifications monthly (2008 – FY2020) Source: FPDS-NG
$ obligated OT Agreements – Total (Monthly)	The total amount of dollars obligated for DoD OT contract awards and contract modifications monthly (2008 –2020) Source: FPDS-NG
Hypothesis 2: Following the policy implementation in 2015, there was an increase in the number of new companies and total dollars obligated to new companies getting awarded DoD prototype OT agreements.	
Variable	**Definition & Source**
New Companies – Total (Monthly)	The number of new companies, including nontraditional defense contractors as defined by 10 USC 2302(9) awarded DoD OT contract awards monthly (2008-2020). Source: FPDS -NG
$ obligated OT Agreements – Total (Monthly)	The total amount of dollars obligated for DoD OT contract awards and contract modifications annually to new companies monthly (2008 –2020) Source: FPDS-NG
Prototype OT Agreements to new companies – Total (Monthly)	Total number of DoD prototype OT contract awards and contract modifications to new companies including nontraditional defense contractors as defined by 10 USC 2302(9) awarded DoD OT contract awards and companies already doing business with the government dollars obligated monthly (2008 –2020) Source: FPDS-NG
Hypothesis 3: Following the policy implementation in 2015, there was an increase in the diversity of product and service categories awarded DoD prototype OT Agreements.	
Variable	**Definition & Source**
Products/Services – Total (Monthly)	Number of product/service categories awarded on DoD OT contract awards monthly (2008 –2020) Source: FPDS-NG
DoD prototype OT Products/Services – Categorical (Monthly)	Types of DoD prototype OT product/service categories awarded on DoD OT contract awards monthly (2008 –2020) Source: FPDS-NG

Description of the Sample

The sample of data used was raw data downloaded from FPDS-NG on 24 April 2021.The FPDS-NG data reported by the DoD and is publicly available. The convenience of the data is a major advantage, and it helps mitigate risk associated with data collection and documentation. To process the data appropriately and to ensure that the method of analysis was applicable, the data was summarized using the Pivot Table feature in Microsoft Excel to run simple queries.

The first query examined the number of Contracting Agency's and their contract data. The downloaded data set included 8,587 records of total contract actions (i.e., contract awards and contract modification) totaling nearly $39 billion obligated nominal dollars. Table 4 below provides a breakdown of these numbers by contracting agency as well as the sum of obligated dollars for each agency.

Out of the 8,587 records, only 1,852 were unique values identifying a DoD OT contract award. In other words, from May 2008 – December 31, 2020, DoD awarded 1,852 other transaction agreements and the remaining 6,735 were the respective modifications to those awarded OTs. This information was identified by applying the "Remove Duplicates" feature in Microsoft Excel within the Contract ID column. Using the same feature, information regarding the awarded vendors was captured. Over the 13-year period, the 1,852 unique contracts have been awarded to 1,013 unique vendors[6]. This information was verified by running various pivot table queries using Microsoft Excel.

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6 One vendor Advanced Technology International had one Vendor DUNS and two Global DUNS. For purposes of this study, the Vendor DUNS was used as the identifier for the awarded vendors.

Table 4

Contracting Agency Contracted Summary

Contracting Agency	Total # of OT Contract Actions	Total Dollars Obligated
Dept of the Army	4,409	$30,195,196,488.14
Defense Advanced Research Projects Agency (DARPA)	1,546	$2,160,016,064.11
Dept of the Air Force	1,008	$4,348,989,521.24
Dept of the Navy	807	$956,647,076.03
Washington Headquarters Services (WHS)	268	$604,004,943.80
U.S. Special Operations Command (USSOCOM)	147	$77,607,065.12
Defense Contract Management Agency (DCMA)	146	-$61,536.52
Immediate Office of the Secretary of Defense	67	$76,362,833.79
Defense Information Systems Agency (DISA)	57	$71,474,930.20
Defense Threat Reduction Agency (DTRA)	45	$165,546,961.09
Missile Defense Agency (MDA)	32	$129,948,980.00
Defense Counterintelligence and Security Agency	21	$74,477,660.36
USTRANSCOM	14	$86,550,915.38
Defense Logistics Agency	13	$1,696,960.00
U.S. Cyber Command	7	$3,605,364.65
Grand Total	**8,587**	**$38,952,064,227.39**

Note. This table summarizes the DoD agencies that have used the OT authority from 2008 – 2020. The Department of the Army is the leading DoD agency to use OT with a total number of awarded contracts and modification of 4,409 totaling over $30B in obligated dollars.

Establishing the basis of analysis for the agencies is important to understand which agency within the DoD is most likely to use OT as a form of contracting. However, it does not provide data to tie back to the public law used to direct the decision making and purpose of OTs. To gain an understanding of this, it is important to run queries regarding the data focusing on the vendors that are being awarded. As mentioned previously, 10 USC 2371b states that the DoD must ensure that prototype OTs meet at least one of the criteria; the significant contributing parties are either nontraditional defense contractor or small business. At least one third of the total cost of the prototype projects is to be paid out of funds provided by parties to the transaction other than the Federal Government, or the senior procurement executive for the agency determines in writing that exceptional circumstances justify the use of an OT.

Examining this information is important and performing a simple pivot table analysis can provide interesting insights. Table 5 shows the top ten awarded vendors based on Contract ID count includes ten companies with at least 50 contract actions (this includes original award and modifications).

Last, an analysis of the items procured was completed by reviewing the PSCs. Table 6 shows that the top ten awarded PSCs based on contract actions (this includes original award and modifications).

Table 5

Top 10 Awarded Vendors Based on Total Contract Actions

Vendor DUNS	Vendor Name	Total # of OT Contract Actions	Total Dollars Obligated
025172953	Advanced Technology International	1097	$19,815,056,065.44
827760138	SOSSEC, Inc.	758	$902,376,274.73
079799555	Consortium Management Group, Inc.	482	$1,747,809,840.61
180035768	National Center for Manufacturing Sciences, Inc.	320	$864,797,067.05
079639398	Defense Energy Center of Excellence	225	$380,159,662.87
079981146	Medical Technology Enterprise Consortium	200	$342,969,834.76
080331419	Defense Automotive Technologies Consortium	107	$266,733,884.17
794598573	Raytheon Company	82	$254,737,663.80
078824783	Pivotal Software, Inc.	81	$218,058,411.25
963411066	Consortium For Energy, Environment and Demilitarization	80	$215,067,959.07

Note. This table shows that the top ten awarded vendors based on Contract ID count with at least 50 Contract ID counts (including contract awards and contract modifications). The vendor with the most awarded contract actions is Advanced Technology International with over 1,000 awarded contract actions from 2008 – 2020.

Table 6

Top 10 Awarded PSCs Based on Total Contract Actions

PSC	PSC Description	Total # of OT Contract Actions	Total Dollars Obligated
AD92	Other Defense (Applied/Exploratory)/ R&D- Defense Other: Other (Applied Research/Exploratory Development)	1460	$1,400,334,710.20
AC54	Weapons (Engineering)/ R&D- Defense System: Weapons (Engineering Development)	1027	$10,730,577,143.83
AD94	Other Defense (Engineering)/ R&D- Defense Other: Other (Engineering Development)	720	$3,192,877,867.58
AD91	R&D- Defense Other: Other (Basic Research)	625	$586,674,308.73
AD93	Other Defense (Advanced)/ R&D- Defense Other: Other (Advanced Development)	360	$1,308,369,574.35
AZ14	R&D- Other Research and Development (Engineering Development)	289	$414,448,298.25
AZ11	R&D- Other Research and Development (Basic Research)	273	$211,734,373.69
AZ12	R&D- Other Research and Development (Applied Research/Exploratory Development)	217	$980,857,526.63
AZ13	R&D- Other Research and Development (Advanced Development)	209	$364,119,993.98
6910	Training Aids	200	$303,407,768.50

Note. This table shows that the top ten awarded PSCs based on Contract ID count (including contract awards and contract modifications). The PSC with the most awarded contract actions is AD92 - Other Defense (Applied/Exploratory)/R&D-Defense Other: Other (Applied Research/Exploratory Development) with over 1,400 awarded contract actions from 2008 – 2020.

The benefit of this data is that it provides several years of longitudinal data from 2008 – 2020. It is important to note that in 2020 the government updated the PSC Manuals and retired hundreds of PSCs many of which were used during 2008 – 2020.

This overview information describes the overall of the data and highlights interesting data points to assess whether innovation policies, specifically 10 USC 2371b (Pub. L. No. 114-92, 2015), influenced the DOD alternative contracting activities to promote the development of innovative technologies and products and fill the gap of academic and practitioner bodies of knowledge. To examine if time series analysis is appropriate it is important to understand how many contract actions (contract award and modifications) have occurred over the time span. To assess the time in a time-series manner, another query was run using the Pivot Table feature in Microsoft Excel to examine if there was any type of linear trend among all the DoD OT contract awards over the course of twelve years. As a characteristic of time series data, the data must be in a sequence taken over equally spaced time. Table 7 provides a review of how the DoD awarded OT contract actions. Based on a visual review of the data, there is variation among the years. In 2017 one can see that there is a significant spike in the number of contract actions compared to the previous years. Comparing the number of contract actions totaling 366 in 2016 to 597 in 2017 resulting in a 63% increase in DoD OT contract actions.

Table 7

DoD OT Contract Actions by Year

Year	Award	Mod	Grand Total
2008	2	1	**3**
2009	5	26	**31**
2010	17	58	**75**
2011	17	155	**172**
2012	23	127	**150**
2013	12	161	**173**
2014	16	213	**229**
2015	21	266	**287**
2016	35	331	**366**
2017	101	496	**597**
2018	265	732	**997**
2019	551	1,462	**2,013**
2020	787	2,707	**3,494**
Grand Total	**1,852**	**6,735**	**8,587**

Data Cleaning Procedures

Once the data was downloaded, it went through a systematic data cleaning and interpretation techniques required before running the analysis. Data cleaning is essential to identify any missing data or errors within the data set (Singleton, 1993). To begin the data cleaning process, all blank columns were removed. Prior to deletion, all blank columns were verified using filtering techniques in Microsoft Excel and grouping mechanisms to ensure all columns were truly blank. The data cleaning procedure and steps were recorded in a protocol document to ensure the results could be replicated and can be found in Appendix 4.

Data Analysis Procedures

A time-series analysis uses historical data over time (Remler, 2011), making time series analysis different from cross-sectional studies. The overarching objective of time series analysis is to determine an appropriate model to describe a data pattern (Adhikari & Agrawal, 2013; Ramseyer, Kupper, Caspar, Znoj, & Tschacher, 2014). The model chosen in this study describes essential features of the time series pattern, explain how the past actions affect future actions, forecast values, or identify a control standard for quality.

Using interrupted time-series research can provide insight to monitor policy outcome by examining the effects of innovation policy enactment on prototype agreements. Using this quasi-experimental method, interrupted time-series analysis offers a practical way of evaluating the impact of already-implemented policies on outcomes. It is beneficial when a specific intervention has occurred at a particular time. The researcher's role is to assess whether the interruption had an impact on specific outcomes. Interrupted time-series designs resemble one-group pretest-posttest design, except multiple observations before and after (Singleton & Straits, 1993, pp. 251-252). It is crucial to have the treatment applied systematically by using a naturally

occurring intervention such as policy changes or other social changes. For example, “if a law had an impact, one would expect an ‘interruption’ or discontinuity in the time series…at the point where the law was introduced” (Singleton & Straits, 1993, p. 250). This study will use the 2015 enactment of 10 USC 2371b as the interruption. Information regarding the impacts of changes in policies is essential to both policymakers, industry, and practitioners.

Limitations

A limitation of this study is internal validity because more than one event could produce the disruption. This dataset is an official record, and it is crucial to verify that the record-keeping procedures or any reporting requirements have not changed. The primary benefit of this method is that it is useful for controlling problems of invalidity. As examined with the sources used for this study, DoD has exceptions to reporting and guidance on tracking the information. The regular updates to defined terms, PSC categorization, and reporting guidance can prove difficult for practitioners, policy makers, and academics to build a model using historical data.

CHAPTER IV

DATA ANALYSIS AND RESULTS

The purpose of this dissertation is to assess whether innovation policies, specifically 10 USC 2371b (Pub. L. No. 114-92, 2015), influence the DoD alternative contracting activities to promote the development of innovative technologies and products and fill the gap of academic and practitioner bodies of knowledge. This dissertation is based on publicly available data obtained through an online query from the Federal Procurement Data System– Next Generation (FPDS) -NG) website. Drawing from existing literature and using time series analysis, it is hypothesized that there is a difference in OT awards over the years due to the change in policy.

Results Analysis

After the cleaning the data and removing the cooperative agreements and contract modifications, Table 8 depicts the number of DoD prototype OT Awards from 2008 – 2020 to answer the research question and respective hypotheses. The data analysis and results described below relies on the 1,852 records, as displayed in Table 8.

Based on the information captured in table above, no R&D OT awards were awarded based on FPDS-NG database. This table also depicts the total dollars obligated of Prototype OT Awards from 2008 – 2020. It is important to note that the data in Table 8 represents prototype OT awards from the old authority, Section 845 of the FY1994 NDAA, and the authority being examined in this study, 10 U.S.C 2371b of the FY2016 NDAA. The rows in blue signify the contract activity related to 10 U.S.C 2371b of the FY2016 NDAA.

Table 8

DoD OT Prototype Agreement Awards

Year	Prototype OT Awards	Prototype OT Total Dollars Obligated*
2008	2	$54,400,492.00
2009	5	$10,159,563.74
2010	17	$60,273,400.17
2011	17	$26,085,023.10
2012	23	$28,901,836.72
2013	12	$7,171,153.35
2014	16	$9,824,842.50
2015	21	$49,852,914.10
2016	35	$377,649,495.72
2017	101	$142,242,205.83
2018	265	$1,161,481,671.51
2019	551	$1,289,722,477.14
2020	787	$3,771,908,520.51
Grand Total	**1,852**	**$6,989,673,596.75**

The dollars obligated in Table 8 were adjusted to the equivalent value in 2008 using the Implicit Price Deflators for Gross Domestic Product (indicated by the asterisk in the table column). Using the GDP deflator, the dollar amounts were deflated using the following equation using the GDP deflator provided in Table 20:

$$[\text{Dollar amount}]\text{in \$Year} \times \frac{\text{GDP in \$2008}}{\text{GDP in \$Year}} = [\text{Dollar amount}]\text{in \$2008}$$

An example of the calculation is provided below:

$$375\text{K in \$2010} \times \frac{94.801\text{ in \$2008}}{96.128\text{ in \$2010}} = 370\text{K in \$2008}$$

For more information on data cleaning processes, please see Appendix 4.

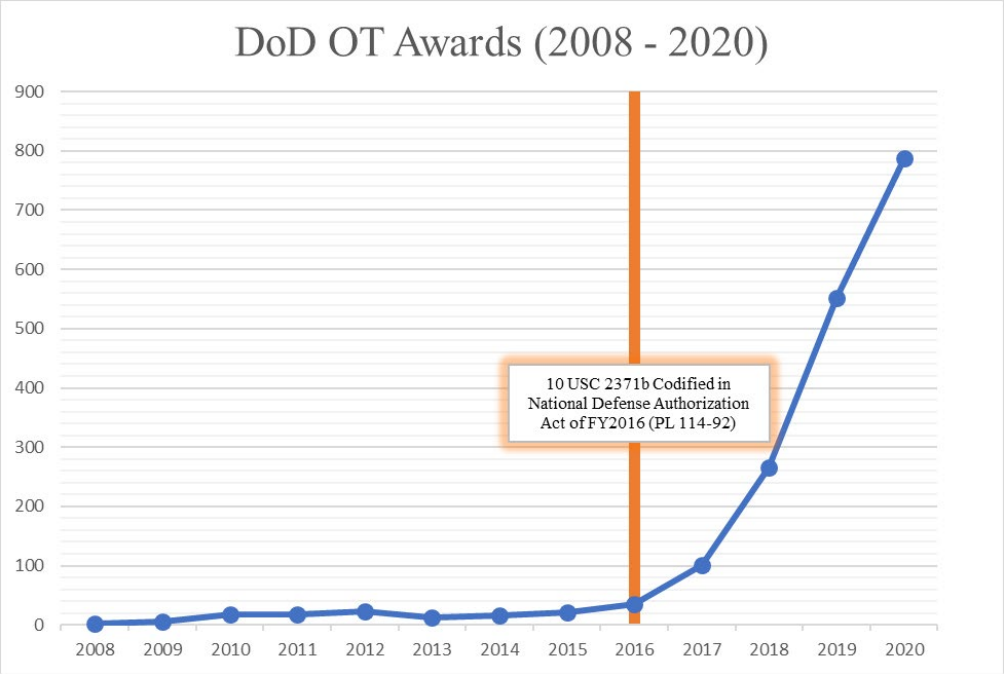
H1: Following the policy implementation in 2015, there was an increase in the number of awards and total dollars obligated of DoD prototype OT agreements.

The National Defense Authorization Act for Fiscal Year 2016 was passed on November 25, 2015, nearly two months into the government fiscal year. Since the passing of the FY2016 NDAA, which codified 10 U.S.C 2371b, the number of prototype awards has increased each year. In 2017, the number of awards increased threefold totaling 101 awards compared to only 35 awards in 2016. In the following years, the number of awards doubled annually as illustrated in Figure 2. The average annual growth rate (AAGR)[7] from 2008 to 2015 is 63% compared to 114% for 2016 -2020.

[7] Average annual growth rate (AAGR) is the average annualized return of an investment, portfolio, asset, or cash flow over time. AAGR is calculated by taking the simple arithmetic mean of a series of returns.

Figure 2

DoD Prototype OT Awards (2008–2020)



Note. The graph illustrates the DoD Prototype OT award information with the orange line depicting the year in which 10 USC 2371b was codified.

The Department of the Army had the most contract awards totaling 743 new OT prototype awards from 2008–2020. However, since 2015 the Department of the Army increased the number of awards from 17 to 253 from 2016–2020, respectfully. DARPA was second with 372 awards from 2008–2020, increasing their awards from 13 to 136 from 2016–2020, respectfully. It is important to note that several new agencies started awarding prototype OT agreements after 2015, including OUSDA, DISA, DLA, MDA, USCYCOMM, USTRANSCOM, Defense Counterintelligence and Security Agency, and DTRA. These agencies are considered

new since before 2015, these nine agencies had not previously awarded DoD prototype OT agreements, as shown in Table 9.

Table 9

DoD Prototype Awards by Agency (2008–2020)

Contracting Agency	**'08 - '15**	**'16**	**'17**	**'18**	**'19**	**'20**
Dept Of the Army	50	17	73	145	205	253
Defense Advanced Research Projects Agency (DARPA)	55	13	21	70	77	136
Dept Of the Navy	2	0	0	20	112	156
Dept Of the Air Force	2	5	6	19	69	140
Washington Headquarters Services (WHS)	0	0	0	9	47	40
U.S. Special Operations Command (USSOCOM)	4	0	1	1	21	29
Immediate Office of The Secretary of Defense	0	0	0	0	5	17
Defense Information Systems Agency (DISA)	0	0	0	0	4	8
Defense Logistics Agency (DLA)	0	0	0	0	2	5
Missile Defense Agency (MDA)	0	0	0	0	4	0
U.S. Cyber Command	0	0	0	0	2	1
USTRANSCOM	0	0	0	1	1	1
Defense Counterintelligence and Security Agency	0	0	0	0	2	0
Defense Threat Reduction Agency (DTRA)	0	0	0	0	0	1
Grand Total (Annual)	**113**	**35**	**101**	**265**	**551**	**787**

H1A: Following the policy implementation in 2015, there was an increase in the number of awards of DoD prototype OT agreements.

Hypothesis H1A focuses on the total number of the awards from 2008 through 2020. OT awards changed dramatically in December of 2015 when 10 U.S.C 2371b was passed and the months following this policy change. In the 95 months prior to the full implementation, only 110 OTs were award. Most months saw no awards (38%) or a single award (32%). A few months saw two (17%) or even three (11%) but only three months saw four or more awards (range 4-9). In contrast, in the 61 months that followed there were 1741 OT awards made and rarely (<10%) were there no awards or only one award distributed (n=4 and 1, respectively). In fact, following the intervention a majority (60%) of months saw 10 or more awards and about 30% of months saw 30 or more OT awards. The average number of OT awards prior to the implementation was 1.2 (s.d.=1.4) and rose to 28.5 (s.d. = 34.1) following the passing of 10 U.S.C 2371b.

As mentioned previously, interrupted time series analysis was used to test each of the hypotheses in this study. Given that the number of awards is highly skewed and that there is heterogeneity in the variance over time two ARIMA models were used, the first in its original metric and the second using the natural log of number of awards (see Table 10). Each model includes a constant, a linear trend (month), a dichotomous variable indicating pre (coded 0) and post (coded 1) and a linear component that begins with the change in policy—this is the critical variable in the model. Both models were used for all the hypothesis tested below. The effect of the policy change is not just statistically significant but has a robust effect increasing the explained variance by 44% in the first and by 16% in the second logged model.

Table 10

Pre-Post Time Series ARIMA Model DoD Prototype OT Awards

	Original Metric			Natural Log of Total Award		
	Estimate	**SE**		**Estimate**	**SE**	
Constant	0.491	3.178		0.298	0.128	*
Linear Trend	0.014	0.057		0.006	0.002	**
Pre-Post	-14.937	5.065	**	-0.14	0.203	
Linear Post	1.33	0.126	***	0.055	0.005	***
R-Square	0.801			0.802		
Change the linear post	0.438			0.155		
Ljung-Box Q	111.61 w 18 d.f. p<.001			36.85 w 18 d.f. <.01		

In reviewing these finding, there is strong evidence to support Hypothesis H1A. In ARIMA models presented in Table 10, the findings show statistical significance increase in the linear posttest, suggesting that that the passing of the policy in 2015, did increase the number of DoD prototype OT agreements.

H1B: Following the policy implementation in 2015, there was an increase in the total dollars obligated of DoD prototype OT agreements.

Hypothesis H1B focuses on the total dollars obligated for DoD prototype OT awards from 2008 through 2020. OT awards changed drastically in December of 2015 when 10 U.S.C 2371b as passed which, it when the intervention began. In the 95 months prior to the full implementation, only 110 OTs were award with a total of $182.7 million dollars obligated. Most months saw no awards (38%) or a single award (32%). A few months saw two (17%) or even three awards (11%) but only three months saw four or more awards (range 4-9). In contrast, in the 61 months that followed there were 1,741 OT with a total of $6.6 billion dollars obligated. Looking further into the data, the average value of an award prior to the interruption was $1.6 million of obligated funds. and after the interruption it increased to $56.6 million obligated funds, a 3,157% increase. The linear post-test (see Table 11) is statistically significant increasing the number of awards by just over $5.7 million each month, on average. The effect of the policy change is not just statistically significant but has a substantial effect increasing the explained variance by 11% in the first and a small effect by in the second logged model 0.5%.

Table 11

Pre-Post Time Series ARIMA Model DoD Prototype OT Awards ($)

	Original Metric			Natural Log of Total Award		
	Estimate	**SE**		**Estimate**	**SE**	
Constant	2,976,987	31,561,134		4.797	1.232	***
Linear Trend	(21,954)	570,920		0.066	0.022	**
Pre-Post	(70,985,783)	50,298,931	**	1.568	1.964	*
Linear Post	5,755,221	1,247,905	***	0.053	0.049	
R-Square	0.227			0.369		
Change the linear post	0.109			0.005		
Ljung-Box Q	5.716 w 18 d.f. p 0.997			16.697 w 18 d.f. p 0.544		

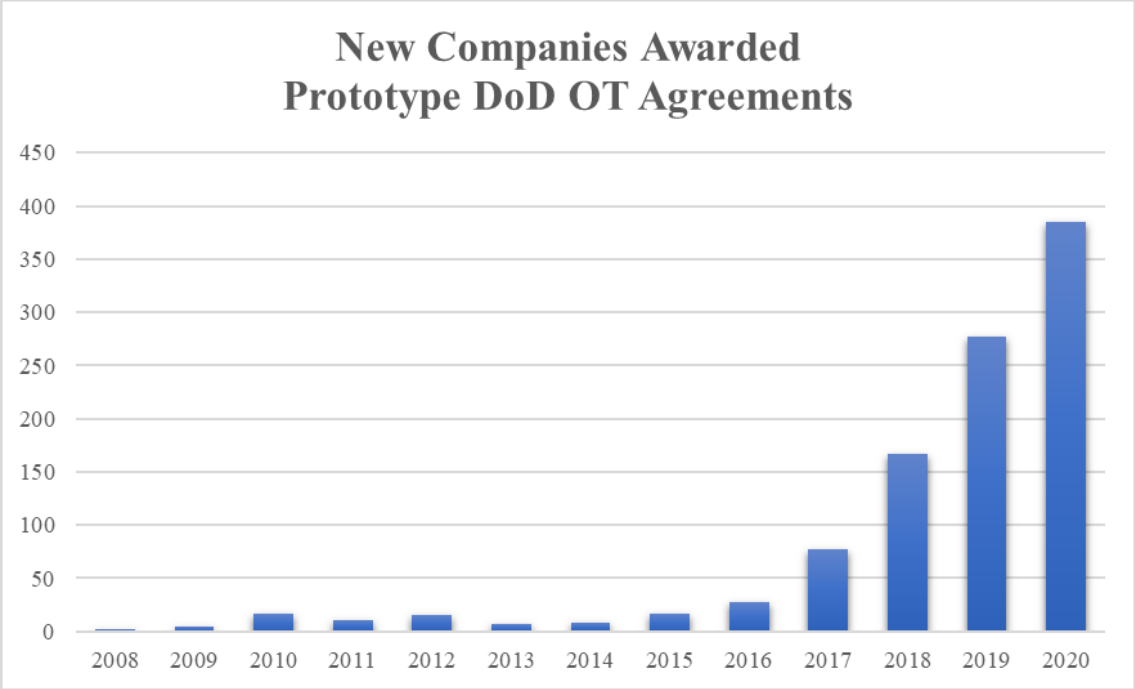
Similar to the previous hypothesis, there is strong evidence to support Hypothesis H1B. In the first ARIMA model presented in Table 11, the findings show a statistical significance increase however, after the log transformation of the data there was support for this hypothesis suggesting that after the passing of policy in 2015, there was an increase in the total dollars obligated of DoD prototype OT agreements.

H2: Following the policy implementation in 2015, there was an increase in the number of new companies and total dollars obligated to new companies getting awarded DoD prototype OT agreements.

The purpose of this hypothesis is to test the companies awarded DoD OT agreements and the diversity of the organizations awarded those agreements. Using the DUNS unique identifier for each company, the data coded all first time OT agreement awards as '1' and removed all duplicate records to capture only the first awards for each company. By coding the data this way, the analysis included only the number of new entrants from 2008 – 2020. New companies are defined as organizations that are recent entrants to DoD OT agreements. These companies include nontraditional defense contractors as defined in 10 USC 2302(9), and traditional defense contractors. Examining new companies awarded DoD OT agreements applies to innovation policy because it can provide insight to the diversity of organizations winning awards like DoD OTs and more. Using a similar method of analysis, the dollars obligated were examined for the first instance of obligation and removed from all duplicate records to capture only the total value of the first year the company won a contract.

Figure 3

Number of New Companies Awarded DoD prototype OT Agreements



H2A: Following the policy implementation in 2015, there was an increase in the new companies awarded DoD prototype OT agreements.

Hypothesis H2A specifically looks at new companies awarded prototype OT agreements. Examining FPDS-NG data, Figure 3 illustrates that the total number of new companies awarded DoD prototype OTs increased significantly, from 28 to 385 throughout 2016 - 2020. Based on the data illustrated in Figure 3, hypothesis H2A is supported because the graph shows an increase in new companies awarded DoD prototype OT agreements. The AAGR from 2008 to 2015 is 63% compared to 94% for 2016 -2020.

Hypothesis H2A focuses on the total number of the awards from 2008 through 2020 given to new companies that have not been previously awarded these contracts. The diversity of companies changed drastically in December of 2015 when 10 U.S.C 2371b passed which, is when the intervention began. In the 95 months prior to the full implementation, only 78 new companies were awarded DoD prototype OTs. Most months saw no new companies (53%) or only one new company was a awarded a DoD prototype OT award (49%). In contrast, in the 61 months that followed there were 935 new companies were awarded DoD prototype OTs and rarely was there a month that had no new company awards (<1%). Furthermore, following the intervention a majority (51%) of months saw 10 or more awards to new companies and about 30% of month saw 20 or more OT awards. The linear post-test (see Table 12) displays a statistically significant increase in the number of new companies being awarded DoD Prototype OT awards each month. The effect of the policy change is not just statistically significant but has a strong effect increasing the explained variance by 23% in the first and by 15% in the second logged model.

Table 12

Pre-Post Time Series ARIMA Model DoD Prototype OT—New Companies

	Original Metric			Natural Log of Total Award		
	Estimate	**SE**		**Estimate**	**SE**	
Constant	0.464	1.66		0.276	0.122	**
Linear Trend	0.007	0.03		0.004	0.002	*
Pre-Post	-5.308	2.646	*	0.001	0.194	
Linear Post	0.62	0.066	***	0.046	0.005	***
R-Square	0.609			0.757		
Change the linear post	0.229			0.145		
Ljung-Box Q	100.923 w 18 d.f. p 0. <0.001			53.129 w 18 d.f. p <0.001		

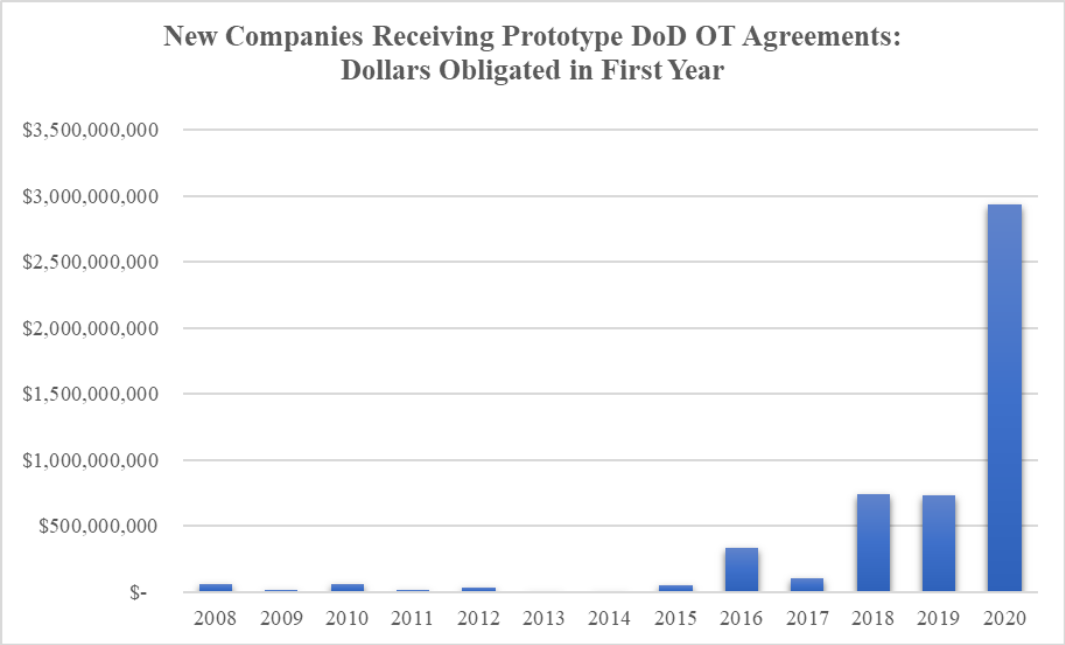
Examining the results presented in Table 12, there is support of Hypothesis H2A. In both ARIMA model, the findings show a statistical significance increase. This hypothesis is intended to further dive into the results from Hypothesis 1 and to review the impact of the policy on new companies receiving DoD OT awards. Based on the results presented above, there is support that following the codification of 10 U.S.C 2371b there was an increase in the new companies receiving DoD prototype OT agreements.

H2B: Following the policy implementation in 2015, there was an increase in the new companies receiving total dollars obligated of DoD prototype OT agreements.

Hypothesis H2B looks at new companies awarded prototype OT agreements. Examining FPDS-NG data, Figure 4 shows that DOD obligated a total of $5.54 billion in prototype OT awards to new companies from fiscal years 2016 through 2020. Based on the data illustrated in Figure 4, hypothesis H2B is supported because the graph shows an increase in new companies awarded DoD prototype OT agreements. The AAGR from 2008 to 2015 is 140% compared to 296% for 2016 -2020.

Figure 4

Dollars Obligated to New Companies Receiving DoD prototype OT Agreements



Hypothesis H2B focuses on the total dollars obligated to new companies awarded DoD prototype OT awards from 2008 through 2020. The diversity of companies changed drastically in December of 2015 when 10 U.S.C 2371b as passed which, rather when the intervention began. In the 95 months prior to the full implementation, only 78 new companies were awarded DoD prototype OTs with a total of $153 million dollars obligated. Most months saw no new companies (53%) or only one new company was a awarded a DoD prototype OT award (49%). In contrast, in the 61 months that followed there were 935 new companies were awarded DoD prototype OTs with a total of $3.2 billion dollars obligated and rarely was there a month that had no new company awards (<1%). In fact, following the intervention a majority (51%) of months saw 20 or more awards and about 30% of month saw 20 or more OT awards. After running the interrupted time series analysis to test the hypothesis, the effect of the policy change is

statistically significant but does not have a substantial effect increasing the explained variance by 10% in the first and a small effect by in the second logged model 1%.

Examining the results presented in Table 13, there is evidence to support Hypothesis H2B. In the first ARIMA model, the findings show a statistical significance increase post the interruption however, after the model was logging the second model did not provide support that was statistically significant. This hypothesis is intended to further dive into the results from Hypothesis 1 and to review the impact of the policy on new companies receiving DoD OT awards. Based on the results presented below, there is support that following the codification of 10 U.S.C 2371b there was an increase in the new companies receiving total dollars obligated of DoD prototype OT agreements.

Table 13

Pre-Post Time Series ARIMA Model DoD Prototype OT—New Companies ($)

	Original Metric			Natural Log of Total Award		
	Estimate	**SE**		**Estimate**	**SE**	
Constant	2,636,410	13,994,136		4.437	1.271	***
Linear Trend	(21,308)	253,145		0.053	0.023	**
Pre-Post	(24,867,922)	22,302,890		1.767	2.026	
Linear Post	2,499,073	553,328	***	0.077	0.05	
R-Square	0.234			0.348		
Change the linear post	0.103			0.01		
Ljung-Box Q	10.162 w 18 d.f. p 0.926			15.060 w 18 d.f. p 0.658		

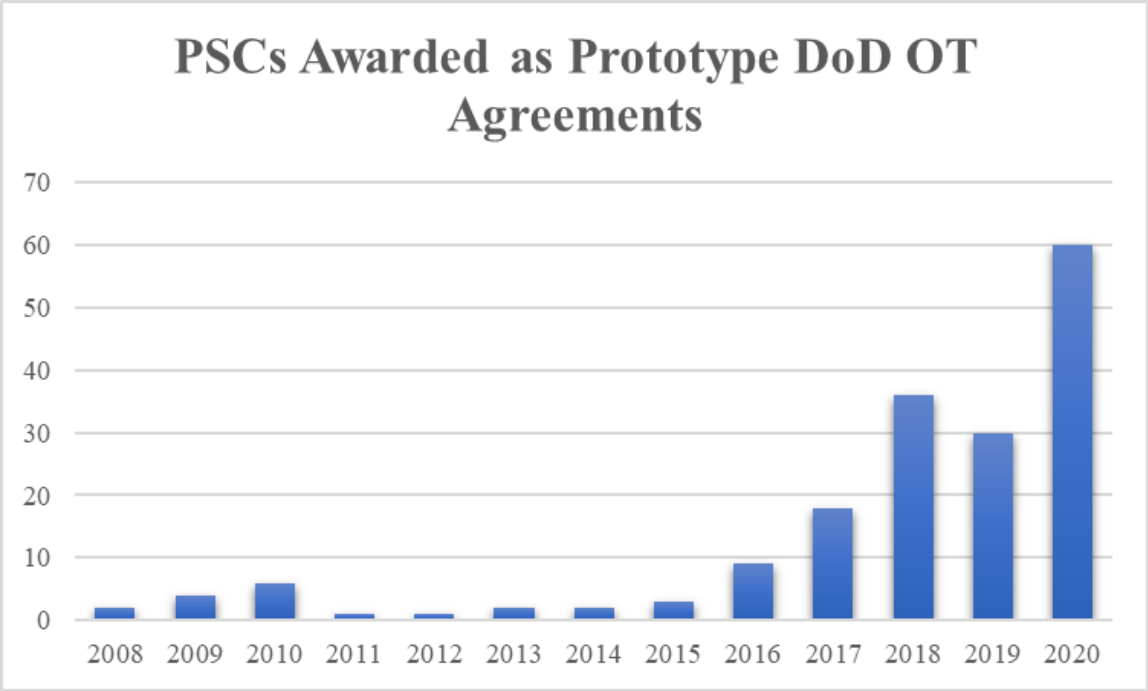
H3: Following the policy implementation in 2015, there was an increase in the diversity of product and service categories awarded DoD prototype OT Agreements.

The purpose of this hypothesis is to examine the PSCs associated with DoD prototype OT agreements and the diversity of the product and service categories awarded by those agreements. PSCs are a measure of diversity, and the impact of innovation policy, because the government categorizes all the products and services purchased by these codes. Using the PSC unique identifier for each contract, the data coded all first time a PSC with a "1" and duplicate records were removed to capture only the first awards for each PSC. By coding the data this way, only the number of newly introduced PSCs were analyzed from 2008 – 2020. A similar methodology was used in which dollars obligated were analyzed for the first instance they were mentioned and removed all duplicate records to capture only the total value of the first year the company won a contract.

Hypothesis H3 examines new product service categories (PSCs) awarded in prototype OT agreements. Examining FPDS-NG data, Figure 5 illustrates the total number of new PSCs awarded DoD prototype OTs increased significantly from 9 to 60 from 2016 - 2020. Based on the data illustrated in Figure 5, hypothesis H3B is accepted because the graph shows an increase in new PSCs awarded DoD prototype OT agreements. The AAGR from 2008 to 2015 is 31% compared to 97% for 2016 -2020.

Figure 5

PSCs Awarded as DoD prototype OT Agreements



An analysis of the PSCs from 2008 – 2020 provides a review of types of products and service categories procured with DoD Prototype OT agreements. As DoD includes more PSCs, there is a clear growth in company diversity with the unique offerings coming into the agency. This is important to recognize for the encouragement of competition and overall improvement of product offerings in the marketplace. The top category based on the data is PSC AD92 - Other Defense (Applied/Exploratory)/R&D- Defense Other: Other (Applied Research/Exploratory Development). The activity for this PSC highly increased from 9 to 205 total awards from 2016 – 2020. The second most awarded PSC is AD91 - R&D- Defense Other: Other (Basic Research) with 1 – 49 awards from 2017 – 2020.

Hypothesis H3 focuses on the diversity of products purchased by the government using PSC associated with DoD prototype OT awards from 2008 through 2020. OT awards changed dramatically in December of 2015 when 10 U.S.C 2371b as passed which, it when the intervention began. In the 95 months prior to the full implementation, only 21 new PSCs were award with a total of $59 million dollars obligated. In contrast, in the 61 months that followed there were 152 new PSCs were awarded with a total of $510 million dollars obligated. Looking further into the data, the average value of an award prior to the interruption was $624 thousand of obligated funds. and after the interruption it increased to $8.3 million obligated funds, a 1,230% increase. The effect of the policy change is statistically significant and has a substantial effect increasing the explained variance by 18% in the first and by 13% in the second logged model.

In reviewing these findings, there is strong evidence to support Hypothesis H3. In the ARIMA models presented in Table 14, the findings show statistical significance increase in the diversity of product and service categories awarded DoD prototype OT Agreements after the intervention in the linear posttest.

Table 14

Pre-Post Time Series ARIMA Model DoD Prototype OT—New PSC

	Original Metric			Natural Log of Total Award		
	Estimate	**SE**		**Estimate**	**SE**	
Constant	0.272	0.264		0.173	0.085	*
Linear Trend	-0.001	0.005		-0.001	0.002	
Pre-Post	-0.168	0.421		0.181	0.135	
Linear Post	0.081	0.01	***	0.024	0.003	***
R-Square	0.559			0.608		
Change the linear post	0.177			0.133		
Ljung-Box Q	24.338 w 18 d.f. p 0.144			17.216 w 18 d.f. p 0.508		

Discussion of the Results

This dissertation seeks to empirically examine **how innovation policies influence alternative contracting activities to promote the development of innovative technologies and products**. Due to the need of product diversity and challenges facing contracting efficiency, it is important to understand if the OT system is proving to be positive following the recent policy changes. To investigate this exact issue, the hypotheses' examined the amount of dollars obligated, awards given, and diversity of products and services following the 2015 policy implementation. Based on the results and the three hypotheses examined, there is support for the research question because the statistical analysis of the award data of OTs showed an increase in the number of DoD prototype OT awards, new companies getting DoD prototype OT awards, and diversity of products awarded from 2016-2020 compared to 2008-2015.

For this study, innovation policy is described as *any* policy that promotes innovation. This definition includes policies that directly support innovation using funding mechanisms such as grants, contracts, or indirect support such as incentive tax (Vonortas et al., 2014). Three policy paradigms can be used to examine the US's approaches to innovation policy: the market, mission, and cooperative models (Bozeman, Crow, & Tucker, 1999). For purposes of this dissertation, the cooperative model is a model in which the government has a more active role in performing research and developing innovative technology and products for private-sector consumption or by merely being a funding vehicle for R&D efforts.

Unlike the procurement contract which is aligned with the mission model (Bozeman, Crow, & Tucker, 1999), OTs intend to provide benefits to the DoD such as attracting new companies, establish a network for resources to develop and/or obtain innovative technologies, and provide an instrument for the DoD to influence technology and innovation. This is at the

core of the cooperative model which has been growing in popularity almost in parallel with DoD's effort to promote innovation through the expansion of OT authority (See Table 16 for detailed legislative history).

The need to measure impact of OT authority on public procurement has not only been the focus of academic and practitioner literature, but it was also highlighted by Congress as a recommendation in the 2019 CRS Report R45521. Several government reports have tried to examine the use of DoD OT agreements and their usage. Each of these reports looking at certain years using data from publicly available sources like this study, specifically FPDS-NG. Award data for DoD R&D in FPDS-NG was consistent throughout the years because FPDS-NG does not include DoD R&D data. After discussions with experts and a review of DoD public documents, the DoD implemented a deviation to the rule through C-Note: 20-03 which states all Research OTs, including modifications, are to be reported in Financial Assistance Award Data Collection System ("FAADC"), effective July 2019. Prior to that, the DoD recorded R&D OTs in the Defense Assistance Awards Data System (DAADS). Having various deviations and process adjustments throughout the years has an impact on the completeness of data available to the public and can create a validity issue if the Administrative Agreements Officer is not reporting accurately. It will be interesting to see if reporting requirements for R&D and Prototype OT agreements will be adjusted again.

An important observation of the data is the fluctuation in the number of DoD prototype OT awards and the associated dollars obligated annually. The fluctuations may be a result of authority expansion since National Defense Authorization Act of FY2016 (PL 114-92) which permanently codifies OTs in 10 USC 2371b, thereby rescinding the authority under Sec 845, redefines and codifies nontraditional defense contractors in 10 USC 2302(9), and expands

follow-on production. Two years later, National Defense Authorization Act of FY2018 (PL 115-91) added education and training requirements, increased approval thresholds, included language to clarify the approval levels applicable to OTs, and included express authority to allow for the award of Prototype OTs in the SBIR program and non-profit research institutions. Additionally, the FY2018 NDAA broadened the follow-on production language to include individual sub-awards under an OT consortium. Lastly, the John S. McCain National Defense Authorization Act for FY2019 (PL 15-232) removed USD (AT&L) as the highest-level approver and replaced it with USD (A&S) or USD (R&E) and clarified the application of follow-on production authority for projects carried out through CMFs. It is difficult to capture changes based on these policies, because it is not possible to differentiate prototype and production DoD OTs like you can between R&D and prototype OTs. Based on conversations with experts the government does not have intentions to update the PIID nomenclature at this moment.

Another big focus of practitioner and academic literature is the government being able to attract new companies and nontraditional defense contractors to do business with the DoD. Per 10 U.S.C. 2302(9)) nontraditional defense contractors are defined as an entity that has not worked or is not currently working with the government. This definition was updated the same year 10 U.S.C. 2371b was codified to provide more clarification regarding the definition of nontraditional defense contractors. One may defer that only small businesses would qualify under this definition, but in fact many large businesses also qualify. In fact, as provided in Chapter III, the top contractors receiving OT prototype awards are consistent with the Top 100 Federal Contracts as reported by FPDS-NG. This guidance changed the definition creating a hardship for contracting officers attempting to further define if the awarded company qualifies under the definition, especially with the addition of the language “and the regulations

implementing such section, for at least the 1-year period preceding the solicitation of sources by DoD for the procurement" 10 U.S.C. 2302(9)). Now, contracting officers must contend with both large and small businesses, leading to more competition and time in the contracting process and again making it difficult to differentiate the status of the contractor winning DoD OT agreements.

Another interesting observation is the number of Consortium Management Firms (CMFs) being awarded OT agreements. A CMF is defined as "an association of two or more individuals, companies, or organizations participating in a common action or pooling resources to achieve a common goal and can range from a handful to as many as 1,000 members. A consortium does not have to be a legal entity but must be legally bound through some form of teaming agreement or Articles of Collaboration" (Department of Defense Inspector General, 2021, p. 3). The privity of contract is with the prime entity doing business with the government; thus, reporting may not identify the performing party, only the managing party in the agreement. In other words, in a traditional principal-agent framework the agent would typically perform the work under the contract arrangement. In a consortium, the agent is the contracting party, but they have an agreement in which a third party is performing the work. This raised concerns in a recent U.S. Department of Defense Inspector General's report titled Audit of Other Transactions awarded through Consortiums (Date April 21, 2021) Report No. DODIG-2021-077 and the results of this study showed that the top three awarded companies include consortia such as Advanced Technology International, SOSSEC, Inc, and Medical Technology Enterprise Consortium.

The 2021 DoD IG report used a sample of thirteen base OT awards valued at $24.6 billion from 2017 – 2018 and found that these awards were not properly tracked, were not awarded in accordance with applicable laws and regulation and were not consistent in

negotiations of fees (Department of Defense Inspector General, 2021). The recommendations of the report provided that the DoD needs to develop policies for awarding and tracking OTs that are awarded to CMFs. These policies were intended to reinforce guidance, provide best practices, clarify current policies, establish controls for proper vetting, and develop procedures to review solicitations provided to CMF members. As stated previously, Office of the Under Secretary of Defense for Acquisition and Sustainment is expected to release an updated OT guide for DoD in 2022 and it is suspected guidance will be provided in the updated manual.

Lastly, the purpose of OTs is to bring innovative products and technology to the government for their use and commercialization. Like the concerns of regular policy changes and requirement updates through internal agency documentation, PSCs may be the most reliable measure across agencies on the product and service categorization. The most awarded PSCs have been retired as of 10/29/2020. Since 2015, over 839 PSCs have been retired, and 815 of those codes were retired on October 29, 2020, comprised of, 741 R&D PSCs, 27 IT PSCs, and the 17 remaining PSCs included maintenance, quality control, inspection, and leasing of equipment. In accordance with the Federal Procurement Data System Product and Service Codes (PSC) Manual dated October 2020, the 741 R&D PSCs that start with the letter “A” are being replaced by 155 new R&D PSCs that start with “A”. Additional updates were made activating 23 new IT service PSCs and 17 new IT product PSCs. It is important to note that, these PSC categories are used across all Federal Departments, not just the DoD.

CHAPTER V

CONCLUSION AND DISCUSSION

The purpose of this pilot study was to assess whether innovation policies, specifically 10 USC 2371b (Pub. L. No. 114-92, 2015), influence the DoD alternative contracting activities to promote the development of innovative technologies and products and fill the gap of academic and practitioner bodies of knowledge. Drawing from existing literature and using interrupted time series analysis to examine publicly available contract data in FPDS-NG, this pilot study sought to answer the following research question: how can innovation policy outcomes in the form of other transaction authorities influence alternative contracting activities to promote the development of innovative technologies and products? This pilot study concludes with the Collaborative Model application for DoD prototype OT agreement to promote innovation using alternative contracting methods.

Innovation policy is a term that encompasses any policy that promotes innovation, which can include funding mechanisms such as grants, contracts, or indirect support such as incentive tax programs for the private sector matching the private firm's expenditure with public funding (Vonortas et al., 2014). The government can directly support innovation through robust innovation policies that leverage grants and contracts who has controlled agency (Vonortas et al., 2014). The federal government generally uses procurement contracts, which are contracts that are awarded according to the Federal Acquisition Regulation (FAR), to procure goods and services. However, innovation policy has also been known to promote alternative contracting vehicles such at Other Transaction Authorities.

The motivation behind OTs is to help the public authority organizations get driving edge innovation from private sector sources utilizing an adaptable, objective arranged way to cultivate

new partnerships through open private associations. The three principal advantages of OTs to the private sector are, a decreased cost and time of the acquisition process, an increase in negotiating power for intellectual property rights, and more cooperation between the public and private sector (Schwartz & Peters, 2018). This push for more cooperation between sectors, and even between private sector firms, positions the cooperative model (Bozeman, Crow, & Tucker, 1999) as a lens in which we can examine innovation policies similar to those promoting alternative contracting methods such as OTs. Twelve agencies currently have the authority to issue OTs.

For this dissertation, the focus was the DoD because R&D and defense acquisition has assumed a significant part in propelling a wide assortment of innovations including, among others, PCs and related semiconductor advancements, correspondence, media transmission, aviation, and photonics. Additionally, the DoD has increased their annual budget significantly over the last decade and is the largest defense budget in the world. For context, from 2008 – 2020, the DoD awarded 1,852 Prototype OT awards totaling $7B obligated funds (deflated using the Implicit Price Deflator for Gross Domestic Products).

The attractiveness of OTs is that they are an alternative contracting method to traditional procurement contract. OTs promote shared interests between the public and private sectors through Congress's innovation policies. For example, Congressional actions that expanded definitions of nontraditional defense contractors to include small businesses and increasing the scope of prototype projects (Pub. L. No. 113- 291, 2014) influence how DoD implements these policies. Additionally, these policies influence alternate contracting methods (i.e., OTs) to promote innovative technologies and products. This study examines the policy passed in 2015 in which Congress made OT authority permanent by codifying the law at 10 USC 2371b (Pub. L. No. 114-92, 2015). By using the cooperative model as a lens to examine how innovation policies

such as 10 USC 2371b influence DoD alternate contracting activities, this dissertation allows researchers to explore how innovation policy promote innovative technologies and products.

The published OT literature reviewed was either practitioner-oriented (Bloch & McEwen, 2001; Dix, Lavallee, & Welch, 2003; Dunn, 2017; Kuyath, 1995; Vadiee & Garland, 2018), theory based (Schooner, 2002), or metrics based (Fike, 2009). The literature in peer reviewed journals was focused on barriers for DoD's ability to keep pace with security needs in the current environment (Bell, 2014; Bonvillian & Van Atta, 2011; Michèle & Robert, 2016; Nunez, 2017; Peter, 2013; Steinberg, 2020; Steipp & Bezos, 2013), and the legal and administrative systems that govern OTs (Gunasekara, 2010; Nathaniel, 2019; Nikole, 2019; Selinger, 2020; Victoria Dalcourt, 2019). Although these research subjects are important when discussing OTs, none of the OT literature reviewed attempts to systematically identify and discuss the impact of innovation policy on the DoD's use of OTs.

Summary of Results

The results of this study show that **innovation policy outcomes influence alternative contracting activities to promote the development of innovative technologies and products**. The ARIMA models examined the role of the 2015 policy, 10 U.S.C 2371b, on DoD prototype OT awards, new companies receiving those awards, and the diversity of products and services associated with those agreements. All the hypotheses were supported: H1, H1A, H1B H2, H2A, H2B and H3. There was strong evidence that after the passing of the policy in 2015, the number of DoD prototype OT agreements and the diversity of product and service categories awarded increased. Two of the hypotheses H1B and H2B resulted in a substantial increase after the policy passing in original metric model, but not in the logged model. This may be indicative of the dollar values being a deeper dive of the DoD prototype OT data supporting the results of the

hypotheses examining the number of awards. In other words, this is a secondary analysis diving into the additional data associated with OT awards and could have potential autocorrelation. Something future research should take into consideration when applying interrupted time series analysis.

Through the lens of the cooperative model, this policy has able to have an impact in both influencing the use of alternative contracting methods and the development of innovative technologies and products. The policies themselves have room to grow through the early success of initial attempts. As some were proven more applicable than others, studies like these are necessary to enhance our knowledge base while encouraging change for more innovation. While continued research would allow for clearer results, the forward momentum and clear growth should not be ignored.

From 2015 – 2020, the DoD significantly increased its use of prototype OTs in terms of number of DoD prototype OT awards and the amount of funds obligated for DoD prototype OTs. Nearly seventy percent of the dollars' obligated were awarded to two traditional defense contractors and to three consortiums. The driving force for these changes is from the FY 2016 NDAA provision which expanded OT authority (10 U.S.C 2371b) to include follow-on production. Prior to 2015, DoD OT authority only covered R&D OT agreements and all prototype authority was granted through Section 845 agreements. This meant that once a capability was developed that could move to full production, the government would have to use a traditional FAR-based contract. As a result of Congress codifying 10 U.S.C. 2371b in FY 2016 NDAA, follow-on production effort could be awarded without having to issue a traditional FAR based contract. under

Additional policy changes also affected the use of OTs in DoD. In the 2016 NDAA, Congress authorized the Small Business Innovation Research program (SBIR) to award prototype OTs, provided clarification for OT approval levels within DoD and increased approval thresholds, and mandated additional training requirements. Following these changes many DoD agencies such as the Army Contracting Command saw an increase in cross-service use of OT capabilities however, there was no impact on overall OT adoption. Congress addresses this challenge in 2017, by including in the NDAA a mandate to increase the collection, storage, and reporting of OT usage data.

Other major contributing factors that may have impact on OT utilization are initiatives related to the Unites States near peer adversaries such as China and Russia. The DoD has been focused on addressing these threats specifically targeting acquisition speed and intellectual property (IP) considerations. According to one study, the threat of China's massive IP purchases is costing the Unites States nearly $600 billion a year (Huang & Smith, 2019). OTs provide a mechanism for companies doing business with the government to have negotiation power when it comes to IP. By promoting a more cooperative relationship between government and industry, the concerns related to IP can be reduced if proper legal language is used and both parties have mutual agreement on licensing rights. Additionally, since the COVID-19 pandemic government agencies have been able to see the benefit of research initiated using OTs through the rapid development of the COVID-19 vaccine which was a result of an OT (Soloway, Knudson, and Wroble, 2020). These environmental changes and policy changes external to the US example demonstrate the importance of government involvement in supporting innovative research and development of technology hence while supporting the cooperative model of interpretation.

Implications for Researchers and Practitioners

This dissertation provides a framework of thought for academic researchers and practitioners to examine innovation policy but will need additional qualitative data to expand on the findings herein. Due to regular policy updates, deviations, authority expansion and limitation it can be difficult to measure the effectiveness of a policy if policy makers do not look at data prior to revising current policy and/or introducing new policy. Significant steps are necessary to ensure that OT authorities achieve their purpose and impact is measured in accordance with the policy objectives.

The authority provided by 10 USC 2371b gives the contracting officers' decision-making power outside of the procurement contract method, allowing more flexibility in their decision making. This flexibility is highly dependent on the contracting officer. As pointed out by Montagnes and Wolton (2017), "… a principal can choose a rule-based regulatory framework. However, unlike discretion, rules do not adapt to circumstances and are thus inefficient." (Montagnes & Wolton, 2017, p. 457). However, the argument in favor of the procurement contract method is that it provides a detailed process to ensure accountability and transparency. Policymakers require valid and relevant data to support their decision making, a gap highlighted throughout 2019 CRS Report R45521.

The implications of this study show how important it is to have a centralized system and procedures for reporting contract data and being ensuring that the same type of data is being tracked. For example, having R&D and prototype OT agreements reported in different systems can make it challenging for agencies assess the impact of a contracting method and track the product development through the product development lifecycle. The second implication of this study is related to the regular changing guidance, regulation, and definitions associated with

DoD OT agreements. These regular updates make it hard to have a consistent classification system for reporting and differentiate between prototype and production DoD OT agreement as well as traditional versus nontraditional defense contractors. Lastly, the issue of transparency of the performing entity on a contract is echoed in the 2019 CRS Report R45521 and the 2021 DODIG-2021-077 reports. Although this is not a novel issue in public procurement, it is heightened with OTs because there is so much scrutiny when it comes to CMFs.

Interrupted time series analysis can examine the impact of a policy change after implementation, identify the changes the policy initiated, and illustrate any changes in the outcome over time. Providing information about the impact of policy can be essential in policy development. This includes bringing in data that is housed in other DoD databases such as DAADs and now FAADC. Additionally, mapping the PSCs to their appropriate categories and possibly providing clarification or simplification to how products and services are categorized is a necessary effort.

In Public Administration, the changes resulting from innovation policy increase supplier diversity, thus supporting a continuous government acquisition goal to avoid company monopolization. In the procurement space, more dollars obligated, and efficient processes lead to sustained improvements, more outcomes, and technological advancements that can be built upon. The development of innovative technologies has a cyclical tie to our innovation policy, with one affecting the other, to promote new and positive outcomes within the procurement space. This implies moving towards efficient procurement timelines and defense technologies based on continuously updating innovation policies.

Limitations and Delimitations

A potential limitation of this study is internal validity because more than one event could produce a disruption of the current results. This dataset is an official record, and it is crucial to verify that the record-keeping procedures or any reporting requirements have not changed. While a certain level of error is expected, a thorough cleaning process is necessary to combat potential invalid information for the clarity of the study. The primary benefit of this method is that it is useful for controlling problems of invalidity. As examined with the sources used for this study, DoD has exceptions to reporting and guidance on tracking the information. The regular updates to defined terms, PSC categorization, and reporting guidance it can be difficult for practitioners, policy makers, and academics to build a model using historical data.

The three ways of mitigating threats to internal validity include special design features, examining additional data, and using theory to identify if a particular risk is not an alternative explanation (Singleton & Straits, 1993). In other words, in quasi-experimental designs, it is vital to identify potential issues and consider how to rule out their threat by using a systematic approach. For example, one method that can be applied is the use of a pretest. The pretest benefit is that it provides an initial examination of the data to observe if there are any evident differences (Singleton & Straits, 1993). Also, it gives a first look at the data being used to examine if there are any problems the research design and methodology approach could experience. Identifying these issues early in the process enables a better analysis of the data and could save time for the researcher. This dissertation used a pre-test as a tool to mitigate threats of internal validity by testing the data to observe any differences.

Another limitation to consider is the time variable for pre-policy and post-policy analysis because the time span is not equal. The pre-policy timeframe is from 2008 – 2015, a total of

eight years. However, the post-policy time frame is from 2016 – 2020, which is only a five-year time span. To further evaluate the policy impact of 10 USC 2371b, this analysis should be replicated the next five years or within the next ten years to have an equal number of years after the interruption for a better pre-and post-analysis.

A major delimitation is biasing from both the originators of the data for government reporting and the interpretation of the data. Additionally, the R&D environment and DoD demands have changed with the political climate and the tenuous situations in Congress. Another delimitation of this data is the exclusion criteria of the observed OTs. The data set selected does not include OTs awarded by NASA, Department of Energy (DOE), Department of Health and Human Services (HHS), Department of Homeland Security (DHS), and Department of Transportation (DOT) because this study focuses on DoD policies and data. Another delimitation of the study is that the scope will be bound to only the new OTs award and not contract modifications. The data set provides information on the dollars obligated; however, it does not provide the government's actual amount of those obligated dollars for each individual OT agreement. The lack of information related to the government's actual funds is a delimitation because one cannot measure the actual dollars spent during the performance of the OT agreement. Another delimitation of the study is the method of analysis because an interrupted time series does not explain why a policy has or has not affected outcomes in an intended manner. However, the interrupted time series does provide empirical evidence of the relationship between policies and changes in outcomes.

Recommendations for Future Research

This study scratched the surface of available points of interest. Delving deeper into the effects of policy changes on current contracting methods has the potential to expand our

capabilities, technologies, and efficiency. As a recommendation, future studies are necessary to assess how much cooperation occurs between government and the private sector. Although, the DoD has the authority the use of OTs is not consistent across all agencies. In fact, the two agencies (Army and DARPA) dominate the number of awards from 2008 - 2020. Further review may indicate policy adoption readiness by agency and organizational inconsistencies. This is important because although the DoD OT authority has increased scrutiny, it has not been viably compared to other authorities to measure its effectiveness. Thus, additional research may show other gaps or successes in the policy that may indicate where the policy could be improved.

Academic research in areas of public administration, business administration, economics, law, and other sciences can support such research by focusing on the importance of the topic. Many academic institutions do not include a focus on acquisitions and many public administration journals do not highlight acquisition, public procurement, or innovation policy topics like their counterparts in economics and law. Using academia to further assess policy and contribute to the policy writing and measuring policy effectiveness may improve adoption ratings among agencies and provide valuable metrics to promote more innovation policy.

A replication of this study in five to ten years will be essential to see if the trends in this study will be observed in the long term. Using time series analysis provides an ability to forecast. Therefore, researchers can use time series data in the past to predict future values of the dependent variables (Remler, 2011). If a proper time-series analysis is completed, being able to forecast OT award based on the data can be beneficial for policy makers. This allows policy makers to understand how changes to the policy can affect the decision making of contracting officers. It can also provide insight to the discretion used by contracting officers as more documentation is provided in clarifying the utilization and application of OTs. How can this be

applied? In November 2018, the Defense Undersecretary for Acquisition and Sustainment stated that the DoD plans to release another revision to the DoD Handbook on the use of OTs (Edwards, 2018). Depending on the impact of this revision, a model can forecast how this clarification will affect OT awards in the upcoming year(s). This is a way that decision makers can take a glance at the future. What is more innovative than being able to predict the future?

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APPENDIX A

FEDERAL OTHER TRANSACTION AUTHORITIES

Figure 6

Federal Other Transaction Authorities Per Agency

APPENDIX B

IMPORTANT TERMS, ACRONYMS, AND DEFINITIONS

Table 15

Important Terms, Acronyms, and Definitions

Key Term	Acronym	Definition
Transaction		The entire process of interactions related to, entering into an agreement, executing, and transitioning a prototype project.
Procurement Contract		A contract awarded according to the Federal Acquisition Regulation.
Prototype Project		The definition of a "prototype project" in the context of an OT is as follows: a prototype project addresses a proof of concept, model, reverse engineering to address obsolescence, pilot, novel application of commercial technologies for defense purposes, agile development activity, creation, design, development, demonstration of technical or operational utility, or combinations of the foregoing. A process, including a business process, may be the subject of a prototype project.
Prototype		DoD generally describes a prototype as a physical, virtual, or theoretical model used to evaluate the technical or manufacturing feasibility, or effectiveness, of what is intended to come later. It need not be a physical model; prototypes can involve designs, novel applications of commercial technologies, demonstrations of operational utility, and proofs of concept (source: Other Transactions Guide, p. 31).
Other Transaction Authority		Refers to the authority of the Department of Defense (DoD) to carry out a particular prototype, research, and production projects. OTAs were created to give DoD the flexibility necessary to adopt and incorporate business practices that reflect commercial industry standards and best practices into its award instruments (see 10 USC 2371b)
Other Transaction	OT	Refers to any kind of transaction other than a procurement contract, grant, or cooperative agreement (See 10 USC 2371).
Nontraditional Defense contractor	NDC	An entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by DoD for the procurement or transaction, any contract or subcontract for the DoD that is subject to full coverage under the cost accounting standards prescribed pursuant to section 1502 of title 41 and the regulations implementing such section (see 10 USC 2302(9)).

Table 15 Continued

Key Term	Acronym	Definition
Awardee		Any responsible entity that is a signatory to an OT agreement. A sub-awardee is any responsible entity performing effort under the OT agreement, other than the awardee.
Agreement		The mutually agreed terms and conditions of the parties to an OT. Absent exceptional circumstances, it will take the form of a legally binding written instrument.
Department of Defense	DoD	The United States Department of Defense is an executive branch department of the federal government charged with coordinating and supervising all agencies and functions of the government related to national security and the United States Armed Forces.
Federal Acquisition Regulations	FAR	The Federal Acquisition Regulations cover many of the contracts issued by the US Military and NASA. The largest single part of the FAR is Part 52, which contains standard solicitation provisions and contract clauses.
National Aeronautics and Space Administration	NASA	The National Aeronautics and Space Administration is an independent agency of the U.S. Federal Government responsible for the civilian space program, as well as aeronautics and space research. NASA was established in 1958, succeeding the National Advisory Committee for Aeronautics.
Defense Advanced Research Projects Agency	DARPA	The Defense Advanced Research Projects Agency is a research and development agency of the United States Department of Defense responsible for the development of emerging technologies for use by the military.
Federal Procurement Data System - Next Generation	FPDS-NG	The Federal Procurement Data System is a single source for US government-wide procurement data. The Federal Procurement Data Center, part of the U.S. General Services Administration, manages the Federal Procurement Data System, which is operated and maintained by IBM.
Government Accountability Office	GAO	The U.S. Government Accountability Office is a legislative branch government agency that provides auditing, evaluation, and investigative services for the United States Congress. It is the supreme audit institution of the federal government of the United States.
Cost Accounting Standards	CAS	Cost Accounting Standards are a set of 19 standards and rules promulgated by the United States Government for use in determining costs on negotiated procurements. CAS differs from the Federal Acquisition Regulation in that FAR applies to substantially all contractors, whereas CAS applies primarily to the larger ones.

Table 15 Continued

Key Term	Acronym	Definition
Bayh-Dole Act		The Bayh–Dole Act or Patent and Trademark Law Amendments Act is United States legislation dealing with inventions arising from federal government-funded research. Sponsored by two senators, Birch Bayh of Indiana and Bob Dole of Kansas, the Act was adopted in 1980, is codified at 94 Stat.
Department of Energy	DOE	The United States Department of Energy is a cabinet-level department of the United States Government concerned with the United States' policies regarding energy and safety in handling nuclear material.
Department of Health and Human Services	HHS	The United States Department of Health & Human Services, also known as the Health Department, is a cabinet-level executive branch department of the U.S. federal government with the goal of protecting the health of all Americans and providing essential human services.
Department of Homeland Security	DHS	The United States Department of Homeland Security is the U.S. federal executive department responsible for public security, roughly comparable to the interior or home ministries of other countries.
Department of Transportation	DOT	The United States Department of Transportation is a federal Cabinet department of the U.S. government concerned with transportation. It was established by an act of Congress on October 15, 1966 and began operation on April 1, 1967. It is governed by the United States Secretary of Transportation.
Public Private Partnerships	PPP	A public–private partnership is a cooperative arrangement between two or more public and private sectors, typically of a long-term nature. In other words, it involves government and business that work together to complete a project and/or to provide services to the population.
Defense Contract Audit Agency	DCAA	The Defense Contract Audit Agency is an agency of the United States Department of Defense under the direction of the Under Secretary of Defense. It was established in 1965 to perform all contract audits for the Department of Defense.
Defense Contract Management Agency	DCMA	The Defense Contract Management Agency is an agency of the United States federal government reporting to the Under Secretary of Defense for Acquisition and Sustainment. It is responsible for administering contracts for the Department of Defense and other authorized federal agencies.
Fiscal Year	FY	A fiscal year is used in government accounting, which varies between countries, and for budget purposes. It is also used for financial reporting by businesses and other organizations. The time spans from October 1st – September 30 of every year.

Table 15 Continued

Key Term	Acronym	Definition
National Defense Authorization Act	NDAA	The National Defense Authorization Act is the name for each of a series of United States federal laws specifying the annual budget and expenditures of the U.S. Department of Defense. The first NDAA was passed in 1961.
Science and Technology	S&T	Science and technology are an interdisciplinary topic encompassing science, technology, and their interactions: Science is a systematic enterprise that builds and organizes knowledge in the form of explanations and predictions about nature and the universe.
Defense Contract Management Agency	DCMC	The Defense Contract Management Agency is an agency of the United States federal government reporting to the Under Secretary of Defense for Acquisition and Sustainment. It is responsible for administering contracts for the Department of Defense and other authorized federal agencies.
National Imagery and Mapping Agency	NIMA	The National Geospatial-Intelligence Agency is a combat support agency under the United States Department of Defense and a member of the United States Intelligence Community, with the primary mission of collecting, analyzing, and distributing geospatial intelligence in support of national security.
Office of the Secretary of Defense	OSD	The Office of the Secretary of Defense is a headquarters-level staff of the United States Department of Defense.
Commercial Operation and Support Savings Initiative	COSSI 97	The goals of the Commercial Operational and Support Savings Initiative (COSSI) are to improve readiness and reduce operations and support (O&S) costs by. inserting existing commercial items or technology into military legacy systems.
Congressional Research Services	CRS	The Congressional Research Service, known as Congress's think tank, is a public policy research institute of the United States Congress.
National Defense Authorization Act	NDAA	The National Defense Authorization Act (NDAA) is the name for each of a series of United States federal laws specifying the annual budget and expenditures of the US Department of Defense. The first NDAA was passed in 1961.
North American Industry Classification System	NAICS	The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the US business economy.
Data Universal Numbering System	DUNS	The Data Universal Numbering System, abbreviated as DUNS or D-U-N-S, is a proprietary system developed and managed by Dun & Bradstreet that assigns a unique numeric identifier, referred to as a "DUNS number" to a single business entity.

Table 15 Continued

Key Term	Acronym	Definition
Product Service Codes	PSC	Also referred to as federal supply codes, product service codes are used by the United States government to describe the products, services, and research and development purchased by the government. Government procurement specialists and government contractors alike require a solid understanding of these codes to produce quality partnerships between buyers and suppliers.

APPENDIX C
LEGISLATIVE HISTORY

Table 16

Department of Defense OT Authority Legislative History

Year	Policy	Description
1989	National Defense Authorization Act for FY1990 & FY1991 (P.L. 101-189)	Section 251 of the FY90 NDAA codifies the OT authority for Defense Advanced Research Project Agency (DARPA) in 10 USC 2371 for "Advanced research projects" only.
1991	National Defense Authorization Act of FY1992 & FY1993 (PL 102-190)	Section 826 repealed the temporary restriction and made the authorities permanent. Section 821 authorized DoD to enter into cooperative and other transaction agreements to develop critical technologies.
1993	National Defense Authorization Act of FY1994 (PL 102-160)	Section 845 of the FY94 NDAA expands DARPA's authority to include prototype development related to weapons or weapons systems acquired by DoD. This authority was to terminate after three years.
1996	National Defense Authorization Act of FY1997 (PL 104-201)	Section 804 of the FY97 NDAA authorizes OTs for the military services and designated officials and extends the authority through 1999 (another three years).
2002	National Defense Authorization Act of FY2002 (PL 107-107)	Section 822 of FY2002 NDAA granted DoD the authority to award follow-on production contracts to prototype projects with the stipulation that at least one third of the total cost of the prototype project is paid by non-federal government sources.
2003	National Defense Authorization Act of FY2004 (PL 108-136)	Section 847 of the FY04 NDAA expands the definition of weapons system, authorizes pilot program for follow-on contracting to produce commercial items, and extends the authority through FY2017.
2008	National Defense Authorization Act of FY2008 (PL 110-181)	Section 824 of the FY08 NDAA expands the scope of the NDAA FY04 pilot program and extends the authority through FY2013.

Table 16 Continued

Year	Policy	Description
2009	National Defense Authorization Act of FY2009 (PL 110–417)	Section 822 required DoD to issue guidance on rights in technical data under non-FAR agreements, including OTs. Section 824 expanded the scope of the pilot program for transition to follow-on contracts for certain prototype projects to include research projects carried out under 10 USC 2371. Section 874 required OT data be included in the Federal Procurement Data System.
2011	National Defense Authorization Act for FY2011 (PL 111-383)	Section 866 changed the definition of nontraditional defense contractor, conforming the definition to that found in 10 USC 2302(9).
2012	National Defense Authorization Act of FY2013 (PL 112-239)	Section 863 of the FY13 NDAA extends the authority through FY2018.
2014	Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for FY2015 (PL 113-291)	Section 812 expanded OT authority to include prototypes "directly related to enhancing the mission effectiveness of military personnel and supporting platforms, systems, components, or materials proposed to be acquired or developed by the Depart of Defense, or improvements of platforms, systems, components, or materials in use by the Armed Forces."
2015	National Defense Authorization Act of FY2016 (PL 114-92)	Section 815 of the FY16 NDAA permanently codifies OTs in 10 USC 2371b, thereby rescinding the authority under Sec 845, redefines and codifies nontraditional defense contractors in 10 USC 2302(9), and expands follow-on production
2017	National Defense Authorization Act of FY2018 (PL 115-91)	Section 863-864 of the FY18 NDAA added education and training requirements, increased approval thresholds, includes language to clarify approval levels applied to OTs, includes express authority to allow for the award of Prototype OTs in the SBIR program and non-profit research institutions, and broadens the follow-on production language to include individual sub-awards under an OT consortium

Table 16 Continued

Year	Policy	Description
2018	John S. McCain National Defense Authorization Act for FY2019 (PL 15-232)	Section 211 of the FY19 NDAA removes USD (AT&L) as the highest-level approver and replaces it with USD (A&S) or USD (R&E) and clarifies the application of follow-on production authority for projects carried out through consortia; Section 873 provisioned for the collection, storage, use, and reporting of OT usage data; the Joint Explanatory Statement accompanying the Department of Defense Appropriations Act, 2019 (Public Law 115-245), pages 153-154, established additional reporting requirements
2019	Department of Defense Appropriations Act, 2019 (PL 115-245)	The enacted FY2019 defense appropriation bill did not include language addressing OTs. The report highlighted the concern for lack of transparency of OTs. Also, the report advised the GAO to review DoDs use of its use to determine any conflicts and compliance with current regulations.

APPENDIX D
DETAILED DATA CLEANING PROCEDURES

Once the data was downloaded from FPDS-NG, it was processed using data cleaning and interpretation techniques required. Data cleaning is essential to identify any missing data or errors within the data set (Singleton, 1993). To begin the data cleaning process, all blank columns were removed. Prior to deletion, all blank columns were verified using filtering techniques in Microsoft Excel and grouping mechanisms to ensure all columns were truly blank. In addition to the blank columns, the following Columns were deleted as they were not necessary for the analysis: Transaction Number, Solicitation Date, NAICS, NAICS Description, Additional Reporting Code, Additional Reporting Description, Global DUNS Number, and Global Vendor Name. Next, four observations were dropped that were before 10/14/2008 (10USC2371). The Contract IDs include contract awards DAAE300190008, HDTRA10790002, HDTRA1079000, and Task Order 129 (parent OT Contract ID DAAE300190008. An exception was made for one record prior to 10/14/2008 because it was the original award for a contract that was awarded by the US Army, Contract ID: W15QKN089000 which had 118 modifications from 2008 through 2020. Additionally, any OTs awarded in 2021 were removed because the time parameters of this study are May 2008 to December 31, 2020. As a result, 158 records were removed from the data set.

Next, three columns were created by the researcher to help answer the research question (see Table 17). These three columns include: Award or Mod, Adj Action Obligations ($) 2008, and R&D or Prototype. Columns that were not part of the original data set were color coded green in the column header and tracked in the Data Set Code Book within the Excel Workbook to keep track of researcher created columns for ease in replicating this study or reusing this data set for future research.

Table 17

Data Set Code Book

Field	Description	Source
Contract ID	The contract numbers.	FPDS
Reference IDV	A secondary ID for contracts. For this dataset, the parent contract to the Task Order is tracked here.	FPDS
Modification Number	A unique value of the modification to a contract. If this is the original award, then the number is '0'. (Ex. Mod 1 would be P0001 or 1)	FPDS
Award or Mod	Is this an Award ("Award") or Modification ("Mod")?	Author
R&D or Prototype	Using the contract award information, this column identifies the contract as an R&D agreement or as a Prototype Agreement	Author
Award IDV Type	Type of Agreement (Other Transaction Award, Other Transaction Agreement, Other Transaction Award Other Transaction Order)	FPDS
Action Obligation ($)	The net amount of funds (in dollars and cents) obligated or de-obligated by this contract.	FPDS
Adj Action Obligation ($) 2008	The adjusted net amount of funds (in dollars and cents) obligated or de-obligated by this contract using the 2008 Implicit Price Deflators for Gross Domestic Product.	Author
Date Signed	The date that the transaction was signed.	FPDS
Contracting Agency ID	This corresponds to the agency that awards the contract. This will be defaulted to the agency that the contracting officer belongs to.	FPDS
Contracting Agency	The appropriate four (4) digit agency or subagency identification code.	FPDS
Contracting Office Name	The contracting or funding office.	FPDS
PSC Type	Type of PSC, is it a Product (P) or Service (S)	FPDS
PSC	Product or Service Codes (PSC) represents major products or services offered by a business. The Classification PSC screen is used as a reference table for award documentation.	FPDS
PSC Description	Description of PSC	FPDS
Vendor DUNS	The Dun & Bradstreet D-U-N-S Number is a unique nine-digit identifier for businesses and is assigned once Dun & Bradstreet's patented identity resolution process.	FPDS
Vendor Name	Name of private company that was awarded the contract	FPDS
Vendor City	City of private company that was awarded the contract	FPDS
Vendor State	State of private company that was awarded the contract	FPDS
Vendor ZIP Code	Zip Code of private company that was awarded the contract	FPDS

Note. This table provides the names and description of each column in the data set after data cleaning. Columns that were from the original data set are marked by the source "FPDS." Any columns created by the researcher for purposes of this study are marked by the source "Author."

The first new column was titled "Award or Mod" which coded a new contract award as "award" and a modification to the award as "mod." This coding was made referencing the column titled "Modification Number" and coding all "0" as "award" and all others as "modifications" Upon verification of this coding, it was observed that several contracts were awarded with underlying Task Orders ("TO"). The FPDS-NG data set tracked the original contract award similarly to all other contracts, however, when a TO was awarded under each agreement, the Contract ID was recorded as the TO and the parent contract was recorded under the column Reference IDV. The following contracts were tracked in this manner.

- W15QKN1090006
- W81XWH1590001
- W15QKN189P001
- N666041890001
- N652361890001
- W900KK1890005
- N001641990001
- M678541899000
- W52P1J1995023
- FA86041994050
- W15QKN199P011
- W912HZ1990001
- W15QKN209P004
- W900KK2090002
- N004211990001
- W15QKN199P003
- W56HZV209D001
- W15QKN199P002
- N652362090004
- N652362090002
- W15QKN209P950
- N652362190001

- HQ0034209P001
- N613311990004
- W9132T209D001
- W52P1J2194100

For purposes of this research, the Task Orders were coded as all other OT awards for consistency in the data analysis.

The second column created by the researcher was titled "Completed the Adj Action Obligation ($) 2008" which adjusted all the dollars obligated in column "Action Obligation ($)" to the equivalent value in 2008 using the Implicit Price Deflators for Gross Domestic Product. Adjusting all dollar values upward into real 2021 dollars to account for inflation could bias the post-2015 years upward. Using a 2008 base and the GDP price deflator helps address this issue. Using the GDP deflator, the dollar amounts were deflated using the following equation:

$$[Dollar\ amount] in\ \$Year\ \times \frac{GDP\ in\ \$2008}{GDP\ in\ \$Year} = [Dollar\ amount]\ in\ \$2008$$

An example of the calculation is provided below:

$$375K\ in\ \$2010\ \times \frac{94.801\ in\ \$2008}{96.128\ in\ \$2010} = 370K\ in\ \$2008$$

The last column created by the researcher titled "R&D or Prototype" identified the contract award as either an R&D agreement or a Prototype Agreement based on the Federal Procurement Instrument Identifier ("PIID"). Each PIID (Solicitation or Award number) is comprised of thirteen alphanumeric characters. Characters 1 through 6 identify the department, agency, unit, or organization that has issued the solicitation. Effectively, these six digits are Activity Address Code (AAC) that is unique for every federal agency. Looking at these you know who the potential buyer of your services or goods is. Characters 7 through 8 are the last two digits of the fiscal year in which the solicitation is issued or awarded. The character at

position 9 is a capital letter or number that identifies the Instrument type (solicitation or award). These alphabetic codes are regulated under Federal Acquisition Regulation FAR Part 4.1603 which are defined as:

- **A** = Blanket Purchase Agreement
- **B** = Invitation for Bid
- **C** = Contracts (except Indefinite Delivery Contracts
- **D** = Indefinite Delivery Contracts
- **F** = Task Orders, Delivery Orders, or Calls under Indefinite Delivery Contracts, Blanket Purchase Agreements, or Basic Ordering Agreements
- **G** = Basic Ordering Agreements
- **H** = Basic Agreements and Loan Agreements
- **L** = Lease Agreements
- **P** = Purchase Orders
- **Q** = Request for Quotations
- **R** = Request for Proposals

As mentioned previously, OTs are not procurement agreements. The numeric codes that apply to OTs are regulated by the *DCMA Manual 2501-08: Grants, Cooperative Agreements, and Other Transactions*[8]. The following is the coding found in the DCMA Manual.

[8] DCMA Manual 2501-08: Grants, Cooperative Agreements, and Other Transactions; Dated March 14,2019, Section 5: Other Transactions (OT) pages 22-23. Retrieved from: https://www.dcma.mil/Portals/31/Documents/Policy/DCMA-MAN-2501-08.pdf

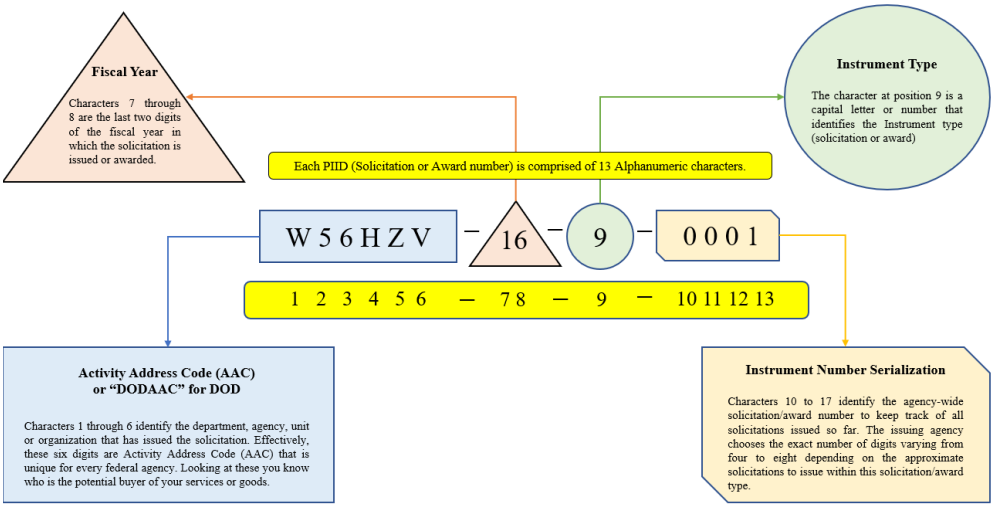
- 1 = Grant
- 2 = Cooperative Agreement
- 3 = R&D Other Transaction Agreement
- 9 = Prototype Other Transaction Agreement

Characters 10 to 17 identify the agency-wide solicitation/award number to keep track of all solicitations issued so far. The issuing agency chooses the exact number of digits varying from four to eight depending on the approximate solicitations to issue within this solicitation/award type. Figure 7 provides an illustration of the PIID formatting described above.

It is also important to note that there are two different types of a modification. The “P” identifies that this modification is issued by the procuring contracting office. The numeric values “00001” identify that this is the 1st modification. (Ex: P00001). The “A” identifies that the modification is issued by the administration contracting office. The numeric values “00001” identify that this is the first modification. (Ex: P00001). Figure 8 illustrates of the modification formatting.

Figure 7

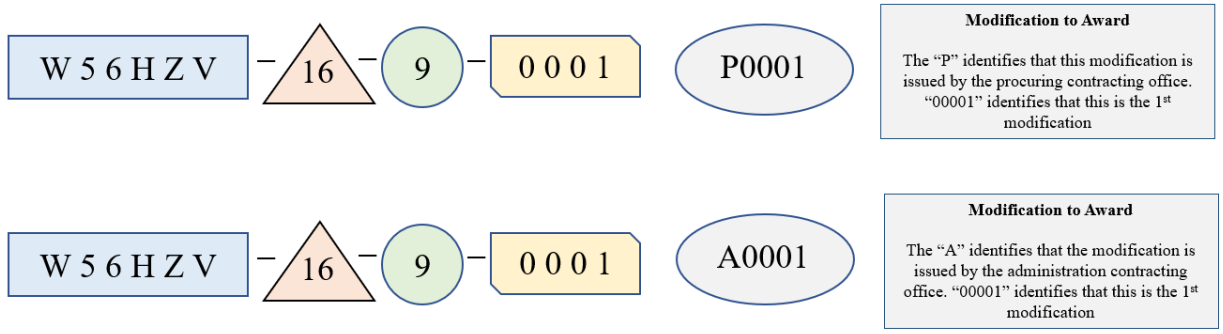
Federal "Procurement Instrument Identifier" or "PIID" Format



Note. This illustration provides a visual representation on how to read the Procurement Instrument Identifier (PIID). Adapted from McMartin, B. "How to Read a Federal Solicitation or Award Number called a PIID." June 2020, Slide 1.

Figure 8

Modification Format



Note. This illustration shows the differentiation of the type of contract modifications. Adapted from McMartin, B. "How to Read a Federal Solicitation or Award Number called a PIID." June 2020, Slide 3.

Using this numeric code, the character in the ninth position determines if the OT was an R&D Agreement or Prototype Agreement. A column titled R&D or Prototype was created to code the contract types, Table 18 shows the results after the coding. Using this table, three modifications to two contracts (W56HZV0720001 & W56HZV0420001) were removed from the OT dataset because their PIID identified them as Cooperative Agreements.

Table 18

DoD OT Agreement Awards and Modifications

Contract Type	08	09	10	11	12	13	14	15	16	17	18	19	20	Grand Total
2 - Cooperative Agreement	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
Award	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mod	0	0	0	1	1	1	0	0	0	0	0	0	0	3
3 - R&D OT Agreement	**0**	**0**	**1**	**2**	**0**	**2**	**0**	**0**	**0**	**1**	**3**	**4**	**3**	**16**
Award	0	0	0	1	0	1	0	0	0	1	0	0	0	3
Mod	0	0	1	1	0	1	0	0	0	0	3	4	3	13
9 - Prototype OT Agreement	**3**	**31**	**74**	**170**	**150**	**171**	**229**	**287**	**366**	**596**	**994**	**2,009**	**3,491**	**8,571**
Award	2	5	17	16	23	11	16	21	35	100	265	551	787	1,849
Mod	1	26	57	154	127	160	213	266	331	496	729	1,458	2,704	6,722
Grand Total	**3**	**31**	**75**	**173**	**151**	**174**	**229**	**287**	**366**	**597**	**997**	**2,013**	**3,494**	**8,590**

Next, it was observed that the R&D agreements coded in the table above were not actual R&D agreements. For example, Task Order 3 on Contract W15QKN1090006, Task Order 13 on Contract W15QKN1090006, and Task Order 3 on Contract W81XWH1590001. Both parent agreements were with the Department of the Army. Contract W15QKN1090006 was awarded to Insitech, Inc. (DUNS 158252143) and Contract W81XWH1590001 was awarded to Medical Technology Enterprise Consortium (DUNS 079981146). After the data cleaning, there were no R&D OT Agreements in the data set and all records were recorded appropriately. By running the PIID review of the parent agreements, it was evident that the data needed to be adjusted to reflect all contract numbers under Prototype OT Agreements as shown in Table 19.

This dissertation is examining only new contract awards; thus all 6,722 records were removed from the dataset for analysis. The data analysis and results are further described in Chapter IV, titled Data Analysis and Results.

Table 19

DoD Prototype OT Agreements After Data Clean

Contract Type	08	09	10	11	12	13	14	15	16	17	18	19	20	Grand Total
9 - Prototype OT Agreement	**3**	**31**	**74**	**170**	**150**	**171**	**229**	**287**	**366**	**596**	**994**	**2,009**	**3,491**	**8,571**
Award	2	5	17	16	23	11	16	21	35	100	265	551	787	1,849
Mod	1	26	57	154	127	160	213	266	331	496	729	1,458	2,704	6,722

APPENDIX E

IMPLICIT PRICE DEFLATORS FOR GROSS DOMESTIC PRODUCT (2008–2020)

Table 20

Implicit Price Deflators for Gross Domestic Product (2008–2020)

Line		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Line														
1	**Gross domestic product**	94.419	95.024	96.166	98.164	100	101.751	103.654	104.691	105.74	107.747	110.321	112.294	113.648
2	**Personal consumption expenditures**	94.325	94.062	95.747	98.17	100	101.354	102.887	103.116	104.148	106.051	108.318	109.922	111.225
3	Goods	96.122	93.812	95.183	98.773	100	99.407	98.92	95.896	94.332	94.615	95.281	94.832	94.16
4	Durable goods	106.012	104.02	102.107	101.28	100	97.968	95.429	93.358	91.141	89.05	87.544	86.488	85.784
5	Nondurable goods	91.904	89.467	92.182	97.652	100	100.082	100.599	97.092	95.876	97.451	99.343	99.249	98.602
6	Services	93.458	94.182	96.017	97.875	100	102.322	104.88	106.796	109.197	111.965	115.1	117.836	120.302
7	**Gross private domestic investment**	100.597	99.366	97.699	98.748	100	100.876	102.872	103.697	103.726	105.258	107.156	108.991	109.698
8	Fixed investment	100.296	99.076	97.568	98.641	100	101.091	103.172	104.075	104.202	105.928	107.925	109.684	111.052
9	Nonresidential	99.832	99.184	97.416	98.559	100	100.251	101.469	101.909	101.119	101.977	102.815	104.137	104.813
10	Structures	94.335	92.613	92.006	95.362	100	101.455	107.198	109.403	109.67	112.545	114.391	119.058	120.852
11	Equipment	102.542	103.168	99.471	99.447	100	99.787	99.169	98.671	97.593	97.543	97.683	97.816	97.388
12	Intellectual property products	99.834	98.589	98.306	99.517	100	100.081	100.791	101.374	100.302	101.125	102.266	103.172	104.574
13	Residential	102.249	98.671	98.317	99.049	100	105.054	111.118	114.114	118.127	123.454	130.417	134.145	138.541
14	Change in private inventories	---	---	---	---	---	---	---	---	---	---	---	---	---
15	**Net exports of goods and services**	---	---	---	---	---	---	---	---	---	---	---	---	---
16	Exports	95.493	89.803	93.35	99.237	100	100.148	100.216	95.373	93.458	95.897	99.135	98.66	96.188
17	Goods	95.67	88.908	92.952	99.793	100	99.32	98.312	91.323	87.772	90.058	93.274	91.792	88.162
18	Services	95.083	91.745	94.23	98.001	100	101.987	104.466	104.431	106.155	108.934	112.212	114.082	114.517
19	Imports	98.796	87.852	92.656	99.716	100	98.697	97.961	90.144	87.058	88.996	91.515	90.078	88.075
20	Goods	98.972	86.54	91.961	99.869	100	98.059	96.752	87.644	83.999	85.883	88.267	86.389	83.963
21	Services	97.963	93.763	95.891	98.987	100	101.841	104.018	102.981	102.856	105.069	108.3	109.262	109.82
22	**Government consumption expenditures and gross investment**	93.343	92.921	95.391	98.289	100	102.363	104.47	104.638	104.899	107.389	111.319	113.246	114.861
23	Federal	94.42	94.193	96.425	99.069	100	100.933	102.643	103.143	103.695	105.702	108.776	110.781	112.018
24	National defense	94.801	94.126	96.128	98.946	100	100.609	102.056	102.334	102.65	104.306	107.149	108.865	110.039
25	Nondefense	93.713	94.308	96.951	99.284	100	101.481	103.621	104.466	105.37	107.902	111.325	113.775	115.108
26	State and local	92.59	92.045	94.674	97.747	100	103.332	105.698	105.656	105.739	108.524	112.984	114.863	116.725
	Addendum:													
27	Gross national product	94.421	95.018	96.162	98.165	100	101.747	103.652	104.681	105.727	107.734	110.314	112.283	113.636

VITA

Dolores Kuchina-Musina is the Chief Disruptor at REXOTA Solutions, LLC, a consulting company in the DC-Metro area focusing on strategy, planning, pursuit, capture, management, and administration of Federal Contract/Agreement Awards. Dolores is also a Fellow at George Mason University's Center for Government Contracts conducting research, thought leadership, and outreach to support the Center's effort with the Department of Defense, other U.S. Government agencies, and companies across the government contracting community. Dolores has over 10 years' experience in federal, state, and international public procurement, specifically directing and managing strategic pursuits in collaboration with business development, proposal development, change management initiatives for Federal procurement acquisitions and served as a strategic partner in providing risk management support for Federal compliance contracts. Dolores was featured in The Business Magazine of Coastal Virginia in 2019 and named "Millennials on the Move" for her business community involvement and civic contributions. She was awarded the Jacques S. Gansler Fellowship - Professional Services Council Foundation in April 2020. Dolores holds a Master of Business Administration from Old Dominion University and a Bachelor of Science in Business Administration from Christopher Newport University. She has a graduate certificate in Public Procurement and Contract Management (PPCM), is a Certified Federal Contract Manager (CFCM), and has held numerous leadership positions in her local non-profit organizations. Her research interests include innovation policy, other transaction authorities, federal procurement reform, and decision-making models.