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Number of Authorized Suppliers and Supplier Delivery Performance

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NUMBER OF AUTHORIZED SUPPLIERS AND SUPPLIER DELIVERY PERFORMANCE

THESIS

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Abstract

Every year, federal agencies spend over $500 billion to buy a wide variety of products and services, ranging from cutting-edge military aircraft to common office supplies. Supplier performance and sourcing strategies within the Air Force are distinctively complex due to the wide array of weapon systems and limited number of suppliers available within the marketplace. Academics and industry experts agree that the foundation for strong buyer-supplier relationships is a means to achieving superior performance. However, this dynamic can yield varying results when there are a limited number of suppliers available. One of the problems which emerges from the critical need of spare parts is that the delinquent rates increase as the number of approved suppliers increases. Conversely, although delinquent rates tend to be improved when there are two or less suppliers, the Air Force is highly susceptible to disruptions in the event of single sourcing failures. Therefore, the Air Force needs to optimize its supply base by considering supply risks within relevant laws and regulations.

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I. Introduction

Background

Every year, federal agencies spend over $500 billion to buy a wide variety of products and services, ranging from cutting-edge military aircraft to common office supplies (GAO, 2021). Effective and efficient supply chain and inventory management is critical for supporting the readiness and capabilities of the Armed Forces and for helping to ensure the Department of Defense (DoD) avoids spending resources on unneeded inventory, transportation, and the costs associated with delinquent purchases which could be better applied to other defense and national priorities.

The 2018 National Defense Strategy (NDS) is clear; we are emerging from a period of strategic atrophy, fully aware that our competitive military advantage has been eroding. Inter-state strategic competition, not terrorism, is now the primary concern in U.S. national security (NDS, 2018). Therefore, it's imperative that the Air Force leverages individuals' knowledge, expertise, and experiences from operations, exercises, and education to find innovative solutions for increasing efficiency and removing redundancies so that we are a more agile and lethal Air Force. The DoD has consistently experienced weaknesses in inventory management, particularly in the following areas (GAO, 2015).

1. Material distribution - challenges in delivering supplies and equipment, including not meeting delivery standards and timelines for cargo shipments.
2. Asset visibility - weaknesses in maintaining visibility of supplies.
3. Predictive forecasting - lacks the capability to predict maintenance and logistics requirements to enhance operational needs and optimize the procurement process.
4. Supply chain sustainment simulation tools - simulation tools are poorly equipped to integrate sustainment flow modeling at the strategic and operational levels.

Supplier performance and sourcing strategies within the Air Force are complex due to the wide array of weapon systems, complexity of the manufacturing process, and limited number of suppliers available within the marketplace. These challenges are further compounded by the strategic planning and budgeting method for the Flying Hour Program (FHP) which makes it difficult for procurement organizations to accurately forecast planned spares purchasing, which in turn can shorten the anticipated timeframe supplier(s) have to deliver the spare parts.

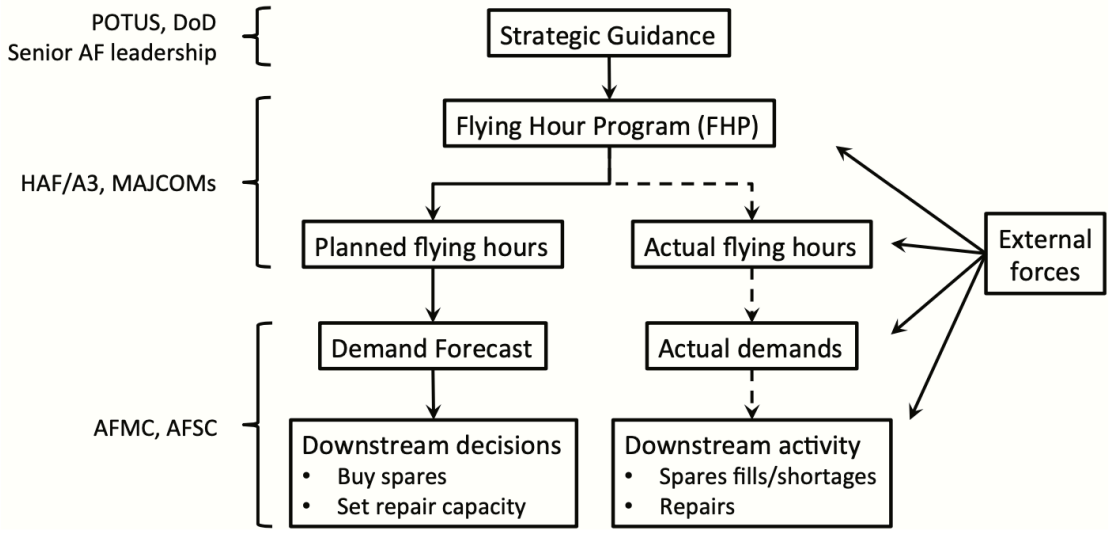

Figure 1. Air Force Flying Hour Program Development and Demand Forecasting

As depicted in Figure 1, under "strategic guidance" the President, Secretary of Defense (SecDef), and Senior Air Force leadership assess the anticipated requirements to support global and regional operations, training, equipment to support worldwide capabilities, and a realistic classification of objectives with decision points that include investments and/or divestments to achieve needed capabilities over the next 30 years (AFPD 90-11, 2015). The boxes on the left depict the decisions from senior leadership and the trailing decisions as they flow to procurement planning at the bottom. The planned FPH drives the demand forecast, which, subsequently, drives the decision to buy spare parts. Somewhere in this decision process, because of lead times and changing requirements, the purchasing decisions cannot be reversed without the additional investment of capital, contract renegotiation, time, or some combination thereof. The right side of Figure 1 represents the challenges of logisticians and financial managers within the procurement and contracting community trying to meet the actual demands and needs of the operational Air Force. The "external forces" box represents everything that can influence the predicted flying hours from the actual hours flown; these can be fiscal changes, humanitarian events, contingency operations, and safety issues. Procurement and contracting officials attempt to use this information to forecast predicted needs when negotiating contracts and setting delivery dates with this data. However, unanticipated changes in requirements can yield varying results when there are a limited number of suppliers available.

Problem Statement

The Air Force spends about $4 billion annually on aircraft spare parts (Mills et al., 2018). One of the problems which emerges from the critical need of spare parts is that the delinquent rates increase as the number of approved suppliers increases. Conversely, although delinquent rates tend to be improved when there are two or less suppliers, the Air Force is highly susceptible to disruptions in the event of single sourcing failures. To help mitigate some of the risks encountered by the DoD, the Office of Management and Budget (OMB) and the General Services Administration (GSA) established a government-wide benchmarking initiative intended to improve efficiency and operational quality across several mission support areas, including procurement (GAO, 2021). This initiative uses a common set of performance metrics to collect process-oriented information from federal agencies and are intended to provide agency procurement leaders with data to help improve procurement process within their respective agencies. Since then, the Air Force has developed performance metrics for procurement organizations which are aligned with the OMB and GSA initiatives (GAO, 2021)

1. Cost savings and avoidance;
2. Timeliness of deliveries;
3. Quality of deliverables;
4. End-user satisfaction.

Additionally, the Air Force is currently working on an outcome-oriented metric defined as Total Acquisition Lead Time (TALT), which is meant to track the identification of a requirement to the delivery of a capability. However, the Air Force does not currently

have the technical capability necessary to measure TALT, but there are ongoing efforts to develop this capability (GAO, 2021).

Purpose Statement

This intended purpose is to delve deeper into an operational Air Force organization with the purchasing data available for over two thousand contract purchases. The intent is to identify, related to government purchasing, the ideal number of suppliers and if delinquency rates are affected as the number of suppliers increase and, conversely, what impact this has on supplier performance.

Research Questions

In this study, data sets from the 448th Supply Chain Management Wing (SCMW), were used to investigate the number of authorized suppliers and supplier delivery performance between major weapon system suppliers and one of the organizational units responsible for procurement. This study focused on the following research questions.

RQ 1: Does a higher number of authorized suppliers promote competition and improve supplier delivery performance?

RQ 2: Does contract volume affect supplier delivery performance?

Research Focus

The focus of this research is to use a quantitative framework for examining supplier performance within the context of federal contracting and defense logistics. Supplier performance and sourcing strategies within the Air Force are distinctively

complex due to the wide array of weapon systems and limited number of suppliers available within the marketplace. Academics and industry experts agree that the foundation for strong buyer-supplier relationships is a means to achieving superior performance (Dyer and Singh, 1998). However, this dynamic can yield varying results based on the number of suppliers available.

Methodology

This study examines the relationship between the delivery delinquencies as the dependent variable and the number of suppliers and their contract volume as independent variables using a logistics regression model. The data is collected from the Contractor Performance Assessment Reporting System (CPARS), provided by the 448th SCMW.

Logistic regression predicts the probability of an outcome that can have one of two values. The prediction is based on the use of numerical predictors. In this case, linear regression is not appropriate for predicting the value of a binary variable for two reasons: first, it will predict values outside of the acceptable range, e.g., outside of the range 0 to 1, and the residuals will not be normally distributed along the predicted line. On the other hand, logistic regression produces a logistic curve, but the curve is constructed using the natural logarithm of the "odds" of the target variable, rather than the probability. Additionally, the predictors do not have to be normally distributed or have equal variance in each group.

Assumptions and Limitations

This study includes three variables: delivery delinquency for the binary dependent variable and the number of authorized suppliers and contract volume for independent variables. These variables do not consider the complexity of manufacturing spare parts, e.g., some parts may be relatively simple to make, while others may be complex or difficult to produce. Nevertheless, once a supplier has been contracted to manufacture an item, it is assumed that they are able to meet the contractual delivery schedule.

II. Literature Review

Chapter Overview

There are many studies on the relationship between the number of suppliers and their performance. The studies analyzed in this section focus on contemporary theories regarding supplier performance, supplier relationships, sourcing strategies, and strategic purchasing. Federal Acquisition Regulations are also briefly covered as they add another level of complexity to the federal agency's procurement processes, which operate much differently than non-governmental organizations.

Supplier Performance

The buying organization's primary goal in instituting supplier development activities is to improve the supplier's performance and capabilities to meet the organization's current and future needs (Prahinski and Benton, 2004). The relational view of the firm provides the theoretical foundation for the notion that strong buyer-supplier

relationships are preferred strategies to achieve superior performance (Dyer and Singh, 1998). They described how interfirm dynamics could be sources of mutual benefit and materialized only through a partnership of the parties involved by arguing that the shared profits in a supplier and buyer relationship could not be realized by either organization in isolation. The development and ongoing maintenance of cooperative and committed buyer and supplier relationships could be a source of competitive advantage. Commitment to these types of relationships was believed to result in higher performance on both sides of the transaction.

Supplier development programs (SDPs) are a method to monitor the performance of suppliers and improve these relationships via bilateral communication, incentive programs, and the exertion of competitive pressures by purchases when multiple suppliers exist. Benton et al. (2020) conducted the first large-scale empirical study to investigate the use of SDPs using structural equation modeling and primary data from 141 first tier North American automotive suppliers. Their results suggested that the SDPs directly affected the relationship between buying and selling organizations and were key drivers of supplier performance.

From an interfirm arrangement perspective, Madhok and Tallman (1998) hypothesized that greater appreciation of the relationship management process was needed to truly realize the potential value between two firms. This was further supported in supply chain literature, which postulated that empirical evidence existed which showed strong relationships, characterized by cooperation and commitment and lead to superior exchange performance (Prahinski and Benton, 2004; Shin et al., 2000).

Number of Suppliers

Having the right number of suppliers has been a major consideration of firms for a long time (Richardsson, 1993; Gadde and Hakansson, 1994). When organizations think about the correct number of suppliers, they're often thinking about reducing the overall number of suppliers. It has been argued that a smaller supply base has many advantages such as volume discounts, lower administration costs, improved quality, and coordination (Lemke et al., 2000). Choi and Krause (2006) argued that even though decreasing the number of suppliers might be beneficial in terms of transaction costs, it might or could result in lower supplier innovation. The underlying reason for this hypothesis was that suppliers were potentially able to identify innovative solutions by analyzing information, which might be available from other suppliers. Coincidentally, Koufteros and Marcoulides (2007) suggested that a smaller supply base enabled more collaborative relationships with suppliers and closer ties, which was ultimately able to reduce fears about opportunistic behavior, and the increased volumes for the remaining suppliers might increase their motivation to become more competitive within their respective marketplace.

An important strategic purchasing decision is the selection of an appropriate number of suppliers for each purchase category (Faes and Matthyssens, 2009; Svahn and Westerlund, 2009). Richardsson (1993) stated that there were several types of sourcing modes such as single, dual, and multiple sourcing. Single sourcing might create an environment in which it is easier to exchange ideas (Cousins et al., 2008). Additionally, it enables the buying firms to invest in a collaborative relationship with the supplier, which encourages more commitment and innovation from the supplier's side (Gadde and

Snehota, 2000). Faes and Matthyssens (2009) suggested that single sourcing was the best sourcing strategy when specialized items and expertise were required. On the other hand, this can also restrict the buyer's flexibility to acquire new technologies and innovations existing in the wider supply network (Cousins et al., 2008). Greater dependence of a buyer onto a single supplier ties up the buyer's resources (Walter et al., 2003) and diminishes its capabilities to develop, specify, and evaluate new technologies, a dynamic which may eventually deteriorate a buyer's innovativeness (Sako, 1994; Corsten and Felde, 2005; Nordin, 2008).

Two suppliers or dual sourcing can be used as an alternative to balance the counter-effects of both single and multiple sourcing. This is the preferred method for long contract durations and typically allows for information sharing by suppliers, except cost information (Choi et al., 2006; Faes et al., 2009; Melek et al., 2015). The primary focus includes long-term strategic issues, such as the development or sharing of technologies and, like single sourcing, it can lead to improved relationships with the suppliers.

There appears to be a consensus with multiple sourcing in that the primary focus is on costs and the objective is to create bargaining power in order to drive these costs down (Cousins et al., 2008). Multiple sourcing is also useful as a hedge against the risk of supply disruption (Homburg and Kuester, 2001). However, Newman (1989) warned that price was only one of the costs affected by competition, and that there could be additional indirect costs associated with multiple sourcing. An alternative to balance the counter-effects of both single and multiple sourcing would be using dual sourcing.

Strategic Purchasing Performance

In academia, the discussion of purchasing knowledge and integration has been an important topic regarding strategic roles and the performance of organizational purchasing. Time and again the primary goal has been to create a competitive advantage and receive the required items or services when required. Carter and Narasimhan (1996) empirically showed that, next to essential inputs such as competition level, pricing and positioning, or marketing, strategic purchasing accounted for 43 percent of the overall firm performance variance. They argued that the strategic decisions made by purchasing greatly influenced an organizations competitive advantage.

The first discussions on purchasing's strategic contribution started in the 1970s, of the function's administrative focus (Carter and Narasimhan, 1996). The first studies connected purchasing strategy to firm performance and discussed the shift of the function from tactical to strategic that evolved in the 1980s (Freeman and Cavinato, 1990; Pearson and Gritzmacher, 1990). Since then, strategic purchasing research has been broadened significantly, but it is predominantly conceptual or case based instead of empirically validated (Ellram and Carr, 1994). Carter and Narasimhan (1996) provided a clear and fact-based definition of strategic purchasing performance and showed that purchasing and its strategy had a direct impact on firm performance.

Expanding upon these studies, Chen et al. (2004) developed a conceptual model identifying strategic purchasing, management capabilities, customer responsiveness, and financial performance as depicted in Figure 2. The hypotheses of the model were from the perspective of the buyer and identified the links, which were able to be mutually beneficial when the buyer-supplier relationship was cultivated. They insisted that these

relationships were able to facilitate a viable competitive advantage by enabling organizations to

1. Foster close working relationships with a limited number of suppliers.
2. Promote open communication among supply-chain partners.
3. Develop long-term strategic relationship orientation to achieve mutual gains.

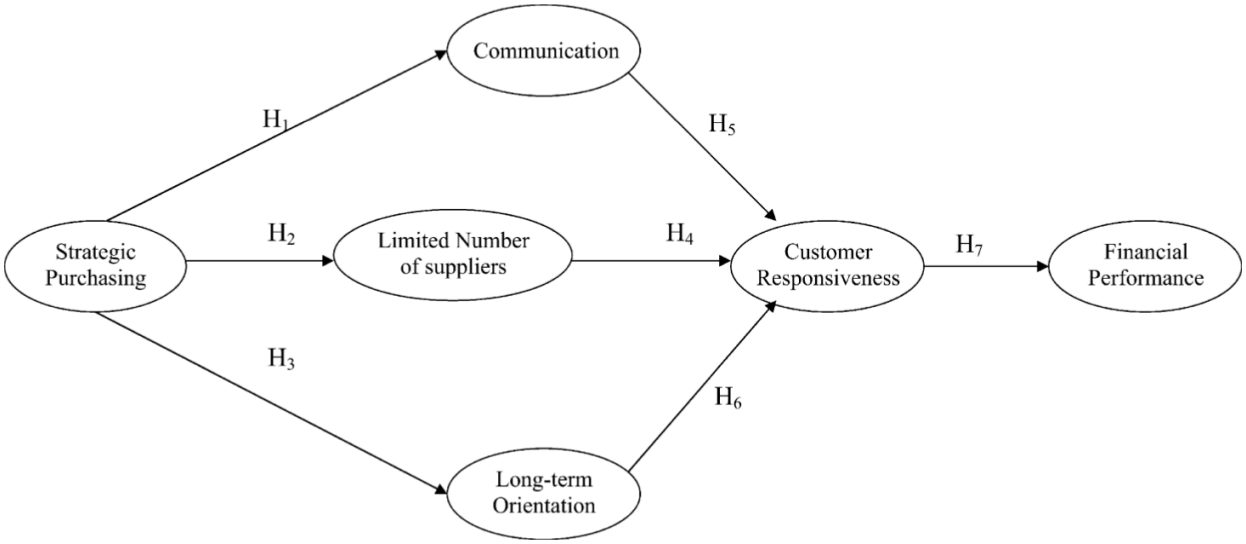

Figure 2. A Model of Strategic Supply Management (Chen et al., 2004)

Chen et al. (2004) proposed the following hypotheses based on the model in Figure 2.

H1: Strategic purchasing will have a positive effect in fostering buyer–supplier communication.

H2: Strategic purchasing will have a positive effect in fostering close relationships with a limited number of suppliers.

H3: Strategic purchasing will have a positive effect in fostering long-term buyer–supplier relationships.

H4: Close working relationships with a limited number of suppliers will have a positive effect on customer responsiveness.

H5: Communication between buyers and supplier will have a positive effect on customer responsiveness.

H6: Long-term relationship orientation will have a positive effect on customer responsiveness.

H7: Customer responsiveness is positively related to buyer firm's financial performance.

Schütz et al., (2019), examined 179 purchasing relationships using savings data and internal client ratings of purchasing knowledge, purchasing integration, and strategic purchasing performance from a large European multinational utility company. Previous supply chain research suggested that higher levels of knowledge positively influenced financial performance (Birou et al., 2011; Fugate et al., 2009; Germain et al., 2001). They showed that purchasing knowledge was a major precursor for both savings and strategic purchasing performance and conclude that high levels of purchasing integration are a true facilitator for savings performance.

Federal Acquisition Regulation (FARs)

There is an extensive list of regulatory and compliance requirements which companies must observe if they are government suppliers. Noncompliance indicates that the government may be assuming additional risk, particularly, if cases where it is only a sole supplier. Federal agencies have the authority to procure products and services in support of their respective missions and activities. Agencies award contracts that specify the government's requirements, price and payment arrangements, and other terms and conditions. FAR states that the federal acquisition system will satisfy the customer in terms of cost, quality, and timeliness of the delivered product or service and states that

the principal customers of the federal acquisition system are the users and line managers acting on behalf of the American taxpayer (FAR 1.102-2, 2022).

The federal acquisition system must be responsive and adaptive to customer needs, concerns, feedback, and the agency head is responsible to contract for authorized supplies and services unless specifically prohibited by another provision of law, authority, or responsibility (FAR 1.601, 2022). The agency head may establish contracting activities and delegate broad authority to heads of such contracting activities to manage the agency's contracting functions.

Due to the requirement for the government to monitor compliance within their supply chain as part of day-to-day risk management, the Services Acquisition Reform Act (SARA) has been established to provide federal agencies with tools to optimize mission performance by creating Senior Procurement Executives (SPE) who are generally responsible for

1. Ensuring that procurement goals align with agencies' missions;
2. Establishing procurement policies;
3. Managing the agencies' procurement activities.

III. Methodology

Chapter Overview

This chapter discusses the study design, variable coding, and the methodology that best meets the requirements to answer the research questions of interest. Logistic regression is discussed as it is used for analyzing data.

Data

The 448th SCMW provides the planning and execution of depot-level repairable and consumable spare parts to sustain Air Force Programmed Depot Maintenance (AFPDM) operations, which includes more than 5,000 aircraft and 16,000 engines. The wing also provides spare parts to sustain a credible and responsive Intercontinental Ballistic Missile capability, a wide range of support equipment, and Space and C3I systems (SCMW, 2022).

The purpose of this study is to understand the effects of the number of authorized suppliers and their contract volume on their delivery performance. To analyze supplier delivery performance, this study uses the data set provided by the 448th SCMW, which contains information for 138 suppliers covering 2,147 contracts. Tables 1, 2, and 3 present the descriptive statistics for the variables in this study.

Table 1. Number of Authorized Suppliers

	Frequency	Percent	Valid Percent	Cumulative Percent
1 or 2 suppliers	1,103	54.10	51.40	51.40
3 or more suppliers	1,044	48.60	48.60	100.00
Total	2,147	100.00	100.00	

Table 1 shows the number of authorized suppliers per contract in two groups, which will be one of two independent variables. 1,103 contracts in one group include one or two authorized suppliers, which comprise 54.1 percent. The remaining 1,044 contracts in the other group have three or more authorized suppliers. These two groups include

similar number of contracts or observations. This variable is a binary independent variable.

Table 2. Delivery Delinquency

	Frequency	Percent	Valid Percent	Cumulative Percent
On Time	413	19.20	19.20	19.20
Delinquent	1,734	80.80	80.80	100.00
Total	2,147	100.00	100.00	

Table 2 shows a measure of delivery performance, which will be the dependent variable in a logistics regression model. Out of 2,147 contracts, only 413 contracts or 19.2 percent were delivered on time. The remaining 1,734 contracts or 80.8 percent were delinquent.

Table 3. Descriptive Statistics on Contract Volume

	N	Minimum	Maximum	Mean	Std. Deviation
Supplier Contract Volume	2,147	1	1,439	88.100	186.398
Valid N (listwise)	2,147				

Table 3 presents descriptive statistics on the contract volume that is the second independent variable. The range of this variable is 1,438 with the standard deviation 186.398 that is more than twice of the mean. This variable shows wide variability.

Logistic Regression

Logistic regression is used to determine if independent variables have effects on the binary dependent variables and is a modification of linear regression for two-group classification. It is derived from the sigmoid function, which assumes that the data is normally distributed. Logistics regression predicts a group or class using a probability value between zero and one, which is easier to work with and interpret. The dependent variable for this logistics regression model is "delinquent," which is coded as "0" for on-time delivery and "1" for late or delinquent delivery. The number of suppliers was also coded as "0" for 1 or 2 suppliers and "1" for 3 or more suppliers to determine if the number of available suppliers has any effect on performance. The mathematical model for logistic regression in this study is defined as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon \quad (1)$$

"y" is the dependent variable that is binary. "β_0" is constant. "β_1" and "β_2" are regression coefficients. "ε" represents error terms.

Summary

This chapter covered the data and model for this study. The variables chosen for this study were explained using descriptive statistics. Lastly, the methodology of logistic regression was reviewed in conjunction with the variables in this study.

IV. Results and Discussion

Chapter Overview

This chapter presents the statistical analysis results relevant to the research questions. The focus is to determine if there is a statistically significant relationship between the delivery delinquency and two independent variables such as the number of authorized suppliers and contract volume. The dataset was analyzed using logistic regression to determine how the number of supplier and their contract volume influenced delivery delinquencies.

Results

Table 4. Model Summary

Step	"-2 Log likelihood"	Cox & Snell R Square	Nagelkerke R Square
1	2,060.965	0.019	0.031

Table 4 shows the validity of the model. Because logistics regression models use a dichotomous variable as a dependent variable, it is not easy to measure the validity using R^2. Logistic regression models are fitted using the method of maximum likelihood that utilizes estimates of the values, which maximize the probability, i.e., 0 or 1 of the data that has been observed. Dichotomous experiments can only have one of two possible values for each experiment. There are several measures intended to mimic the R^2 analysis to evaluate the goodness-of-fit of logistic models, in this case, Cox and Nagelkerke R^2 is included only for reference, but they cannot be interpreted as one would

normally interpret an R^2 as they have many computational issues for binary dependent variables. For logistic regression, classification rates can be decent measures for model fit indices.

The Likelihood ratio is a test of the significance on the difference between the likelihood ratio for the baseline model and the likelihood ratio for a reduced model which is a goodness-of-fit measure for a model. The higher the value of the log-likelihood, the better the model fit. There are several analogies between linear regression and logistic regression. Just as ordinary least square regression is the method used to estimate coefficients for the best fit line in linear regression, logistic regression uses Maximum Likelihood Estimation (MLE) to obtain the model coefficients that relate predictors to the target. After this initial function is estimated, the process is repeated until Log Likelihood does not change significantly.

Table 5. Classification Table

			Predicted		
			Delinquent		Percentage
Observed			On Time	Delinquent	Correct
Step 1	Delinquent	On Time	0	413	0.00
		Delinquent	0	1,734	100.00
Overall Percentage					80.80

Table 5 is another method to evaluate the goodness-of-fit of the logistic regression model. In this table, the observed values for the dependent variable and the predicted values are cross-classified. There were 413 contracts that delivered within the contractual

obligation window and 1,734 contracts that were delinquent. In this case, the model hits the correct classification rate of 80.8 percent.

Table 6. Regression Coefficients

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Supplier Contract Volume	0.001	0.000	6.513	1.000	0.011	1.001
	Number of Suppliers	0.640	0.112	32.517	1.000	0.000	1.896
	Constant	1.068	0.076	198.197	1.000	0.000	2.910

Table 6 shows the constant and number of suppliers is significant at an alpha = 0.01. The number of suppliers is positively associated with delinquent or late delivery. That is, if there are three or more suppliers available that can meet the requirements of a contract, compared to the contracts with one or two suppliers, the odd of delinquency will increase by 1.896 times. Supplier contract volume is significant at alpha = 0.025. Thus, the higher the volume, the higher the delinquent deliveries. As noted previously, there were no missing cases within the dataset.

Supplier relationship management theory suggests it is better to have less suppliers because fostering relationships is simpler, and costs can be reduced due to economies of scale. Lemke et. al. (2000) has promoted the idea that a smaller supply base has many advantages such as volume discounts, lower administration costs, improved quality, and coordination. However, there are risks associated with a single supplier approach such as possible decreases in supplier innovation, increased risk of supply interruptions, greater dependency on the supplier, inability to meet demand, and increased costs due to dominance within the marketplace which in-turn can lead to the supplier having excessive power in the relationship.

In the instances where three or more suppliers exist, the result of this study shows a higher rate of delinquent deliveries. There appears to be a consensus in the multiple sourcing strategy in that the primary focus is on costs and the objective is to create bargaining power in order to drive the costs down (Cousins et al., 2008). Multiple suppliers within the marketplace are useful as a hedge against a single supplier dominating the market while minimizing the risk of supply disruptions due to natural disasters and allowing for more flexibility to deal with unexpected events which could jeopardize capacity. Competition in the marketplace provides an incentive for suppliers to improve cost and can offer the purchaser with more bargaining power i.e., when many suppliers exist, the procurement agent is able to choose the lowest price.

While arguments can be made for both single and multiple suppliers, the result of this study shows that when one or two authorized suppliers are available, the delinquency rates are lower. Multiple suppliers can improve dependency, flexibility, and capacity; however, it can complicate the relationships and increase the resources needed to manage them. With regards to both sourcing strategies, neither consider the regulatory and compliance requirements, which companies must observe if they are government suppliers.

Summary

This chapter presented the results relevant to the research questions. As indicated in the tables in this chapter, delinquency rates are improved when one or two authorized suppliers are available. When three or more suppliers exist, the delinquent delivery tends to increase.

V. Conclusion

Summary of Findings

The result of this study supports the theories on supplier relationships (Carter et al., 2008; Chen et al., 2004; Mills et al., 2018). Madhok and Tallman (1998) hypothesize that greater appreciation of the relationship management process is needed to truly realize the potential value between two firms. This is further supported in supply chain literature, which shows that strong relationships, characterized by cooperation and commitment, lead to superior performance (Prahinski and Benton, 2004; Shin et al., 2000). For large organizations, the emphasis on relationships and people should be considered when developing an organizational procurement structure. Many models focus on organizational planning characteristics such as the multi-contingency design model by Burton et al. (2015), which considers relationships and people when designing organizational structure and the impact it will have in the areas of goals, strategy, coordination, and processes. The bottom line is that relationships matter. By developing close working relationships with a limited number of suppliers and promoting open communication and nurturing long-term strategic relationships, the Air Force can achieve mutual benefits for the parties involved.

Research Questions Answered

RQ 1: Does a higher number of authorized suppliers promote competition and improve supplier delivery performance?

This research has shown delinquency rates are improved when one or two authorized suppliers are available. When three or more authorized suppliers exist, their deliveries tend to be delinquent. Fewer suppliers may allow contracting and procurement officers more time for focusing on improving the quality, efficiency, and overall performance of the core aircraft part suppliers to the Air Force.

RQ 2: Does contract volume affect supplier delivery performance?

This research has shown that supplier contract volume is statically significant at 0.11, meaning that there is a 1.1 percent chance that there is no relationship between delinquent deliveries and contract volume. Thus, the higher the contracted volume, the higher the delinquent deliveries.

Recommendation

The U.S. Air Force (USAF) needs to examine why delinquent deliveries increase as the number of authorized suppliers are three or more on contracts. Contract volume also contributes to the increased delinquent deliveries. When USAF or Defense Logistics Agency (DLA) prepares a contract, volume may be considered for setting a due date.

Future Research

This study includes only two independent variables and assumes that delivery dates are coordinated by considering manufacturing complexity. In addition, this study employs only one supplier performance measure or delivery delinquency. Future studies

can improve the limitations of this study by including additional explanatory variables and various performance indicators.

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14. ABSTRACT
Every year, federal agencies spend over $500 billion to buy a wide variety of products and services, ranging from cutting-edge military aircraft to common office supplies. Supplier performance and sourcing strategies within the Air Force are distinctively complex due to the wide array of weapon systems and limited number of suppliers available within the marketplace. Academics and industry experts agree that the foundation for strong buyer-supplier relationships is a means to achieving superior performance. However, this dynamic can yield varying results when there are a limited number of suppliers available. One of the problems which emerges from the critical need of spare parts is that the delinquent rates

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