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Delta Nu Alpha Transportation Fraternity

Journal of Transportation Management

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Contact Information
Delta Nu Alpha Administrator
1720 Manistique Avenue
South Milwaukee, WI 53172

admin@deltanualpha.org

www.deltanualpha.org

Delta Nu Alpha Membership Information
See back page for form.

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Global Supply Chain Management

Journal of Transportation Management

Editorial Policy

The primary purpose of the JTM is to publish managerial and policy articles that are relevant to academics, policymakers, and practitioners in the transportation, logistics and supply chain fields. Acceptable articles could include conceptual, theoretical, legal, case, and applied research that contributes to better understanding and management of transportation and logistics. Saying that, our policy requires that articles be of interest to both academics and practitioners, and that they specifically address the managerial or policy implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to transportation and logistics activities, or to related policy matters, would be inappropriate for the *JTM*. Articles related to any and all types of organizations, and of local to global scope, will be considered for publication.
Acceptable topics for submission include, but are not limited to, broad logistics topics, logistics and transportation related legal issues, carrier management, shipper management of transportation functions, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, transportation operations, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics, purchasing and materials management, and supply chain management, are acceptable as long as they are related to transportation and logistics activities.

Submissions from practitioners, attorneys or policymakers, co-authoring with academicians, are particularly encouraged in order to increase the interaction between groups. Authors considering the submission of an article to the *JTM* are encouraged to contact the editor for help in determining relevance of the topic and material.

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Revised March 15, 2013

From the Editor...

Welcome to the Spring/Summer, 2012 issue of the Journal of Transportation Management!

This issue of the Journal contains two articles on various aspects of supply chain security, an article comparing logistics strategies across developed and developing economies, an article on reverse logistics, and finally an article on the evolution of U.S. low cost airlines.

The first article explores the types of supply chain security strategies that firms are employing, while the other and fifth article on supply chain security examines the role of various stakeholders in supply chain risk. The third article compares logistics strategies and outcomes in Ghanaian and U.S. firms. The article tests the Bowersox/Daugherty logistics/supply chain management typology model and its relationship with critical success factors in supply chain management. The fourth article studies reverse logistics and in a Chinese context. The article hypothesizes that returns management orientation, internal collaboration, and information support are important predictors of reverse logistics performance. The fourth article assesses the strategic evolution of U.S. low cost airlines in a post 9/11 environment. The authors use an accounting variance methodology to examine the strategies of the various low cost airlines.

At the Journal, we are continuing to make a number of changes that will improve the visibility of JTM, and improve its position in the supply chain publishing world. These include registering and updating journal information with several publishing guides, placing the journal content with the EBSCO, Gale and JSTOR databases faculty have access to, and placing abstracts of all past journal articles on an open area of the DNA Journal web page. We are in the process of uploading all past issues to these various sites. Full journal article PDF's continue to be available to subscribers on the web page at www.deltanualpha.org with the password: dna4education.

I look forward to hearing from you our readers with questions, comments and article submissions. The submission guidelines are included at the end of this issue's articles and I encourage both academics and practitioners to consider submitting an article to the Journal. Also included in this Issue is a subscription form and I hope you will subscribe personally, and/or encourage your libraries to subscribe.

John C. Taylor, Ph.D.
Editor, Journal of Transportation Management
Chairman, Department of Marketing and
Supply Chain Management
School of Business Administration
Wayne State University

UNDERSTANDING SUPPLY CHAIN SECURITY STRATEGY

Zachary Williams
Central Michigan University

Jason E. Lueg
Mississippi State University

Sean P. Goffnett
Central Michigan University

Stephen A. LeMay
University of West Florida

Robert L. Cook
Central Michigan University

ABSTRACT

In the post-9/11 environment, organizations are acutely aware of the need to secure their supply chains from risks of being a target of, or an unwilling participant in, a terror attack. However, supply chain security (SCS) comes at a cost and increasing levels of protection have increasing levels of costs to the firm. So some firms engage in strategic initiatives to secure the supply chain (SC) while others do not; and each firm engages in varying degrees of activities to ensure SCS. Therefore, in this study, the researchers sought to explore what types of SCS strategies exist. The researchers analyze 162 responses to a SCS survey completed by executives from a broad range of firms and industries and identify three general SCS strategies: Advanced, Laggards, and Compliant. Implications for researchers and practitioners are presented.

INTRODUCTION

The events of September 11, 2001 were a catalyst for change in many supply chain operations. Supply chain security issues and initiatives have affected numerous firms (Yang and Wei, 2013). At a minimum, firms want to protect their property and investments. From a larger perspective, firms want to protect society. Clearly, no firm wants its name permanently linked to the next 9/11-like attack. However, Supply Chain Security (SCS) can be difficult to understand and ultimately implement. SCS is unique because if it is working well, it remains virtually invisible. As a result, little is known about SCS strategies.

Understanding strategy is at the core of supply chain research (Christopher et al. 2006; Tokman et al. 2007) and it is through firm strategy formulation that cost/benefit considerations are weighed (Tang, 2006). But supply chains, particularly those that are multimodal, are vastly complex (Scholliers et al. 2012), where a multitude of firms in any given network will employ a myriad of strategies. As a result, academicians have dedicated efforts to understanding them, and in some cases guiding them. Research on supply chain strategies has examined the relationship between corporate strategy and SCM (Hofman 2010); logistics strategies (Autry et al. 2008) and logistics activities in relation to firm performance (Lynch et al. 2000); postponement versus speculation (Pagh and Cooper 1998); and changes to strategy based on environmental factors (Atwater et al. 2010).

Most research on SCS strategies falls into the latter category: changes to strategy based on environmental factors. The stream of research on SCS strategies is growing. Empirical work has led to a greater understanding of SCS strategies in the food industry (Whipple et al. 2009) and in transportation (Voss et al. 2009b). Empirical research has also uncovered antecedents to implementing SCS practices (Williams et al. 2009a), SCS as an organizational culture (Williams et al. 2009b), and the development of a SCS orientation (Autry and Bobbitt 2008), among others.

Williams et al. (2008) reviewed the literature on SCS and highlighted several issues related to this research. First, there are few empirical studies on SCS, but SCS practices and strategies may be difficult to capture because firms avoid discussing SCS. This may be because firms want to conceal their practices to keep them secure, but it may also be because they want to conceal that they have no real strategy and no real practices.

Second, research on SCS has a narrow scope and focuses on few industries, often only one industry. The industries most often studied are those most likely to engage in SCS, so it may not present a holistic view of SCS. For example, Whipple et al. (2009) focus on the food supply chain. This excellent study, while insightful, gives results only for the food industry and the findings may not apply elsewhere. In addition, Martens et al. (2011) use food firms as a control variable in their research, which might indicate that food firms have lower levels of perceived security performance than do other firms. However, most firms and most industries have likely been affected by SCS, whether they welcome the effects or not; the number of security practices and government programs are evidence of this. Thus, a broader cross section of industries will give a better perspective on SCS, what firms are doing, and how SCS affects outcomes.

Third, SCS practices are often prescribed based on norms that lack a research foundation. For example, Helferich and Cook (2002) suggest firms approach SCS the way the Federal Emergency Management Agency (FEMA) approaches disaster management. FEMA prepares for disruptions through planning, mitigation, detection, response, and recovery; a layered approach that goes beyond deterrence and prevention. Sarathy (2006) and Sheffi (2005b) support a different kind of layered approach, one where each layer of security enclosed still another, so if the first is breached, a second or third still remains to protect the chain. This normative work is an important step in developing a research foundation on SCS. It establishes a point from which empirical work can begin and offers important starting points for practitioners who are trying to figure out what to do next in a climate that has changed radically after 9/11.

Given the gaps in previous research, along with recent calls for more strategic supply chain research (Fawcett, Waller, and Bowersox 2011), the current study has the following objectives: first to analyze primary survey data from respondents representing a broad range of firms and industries and second; to determine what SCS strategies, if any, exist among the broad range of firms. The following sections review literature on SCS and SC strategy and present the methods and analysis used in the study before discussing the results and implications for researchers and practitioners.

LITERATURE REVIEW

This literature review highlights the key points in SCS research that are tied to the objectives of this study. It is not intended to be a comprehensive review of SCS literature. For a comprehensive review of the SCS literature, readers are referred to Williams et al. (2008).

SCS Research

SC management requires security because of the complexity, dependence, and extended trust and commitment between SC partners (Sarathy

2006); and although individual firms have created SCS measures within the firm, these measures fail to address the rest of the SC (Sheffi 2005a). Unfortunately, to date, the logistics and SCM literature have been slow to provide help in understanding SCS and best practices (Closs and McGarrell 2004; Hale and Moberg 2005). In summarizing existing SCS literature, Rice and Spayd (2005) suggest that three themes emerge: little empirical evidence, many examples of reaction to past events, and no investigations into current corporate responses.

SCS Strategy

It would be hard to argue that SCS should be initiated as an organizational strategy (Trunick 2005), but SCS strategies remain remarkably clear. The normative work from the earliest part of the century is partly responsible for this. When Helferich and Cook (2002), described the need for SCS strategy in terms of FEMA's approach to disasters, they laid out a clear path for those in need of immediate help and security. This and other early work on the subject (e.g., Sheffi 2005a) foreshadowed some strong empirical work.

Martens et al. (2011) surveyed 62 executive-level supply chain personnel and found that proactive security approaches, internal and external security planning, vulnerability of nodes, and measuring security performance are all significant influencers of security effectiveness. Their finding also indicates that the control variable of "firm type" leads to effectiveness outcomes and that firms involved in the food industry find lower levels of perceived security effectiveness than do firms in other industries.

Also, in a comprehensive analysis of 199 respondents (which remains as one of the largest data sets in SCS research), Voss et al. (2009b) evaluated the strategic security nature of the firm, internal and external approaches to SCS, and perceived security performance; and found two clusters—high and low performing supply chains—that related to security performance. They found when firms place more importance on security they also perceive more security implementation and better security performance.

Voss et al (2009a) examined 130 responses in a conjoint analysis concerning supplier selection and SCS. Their responses came from purchasing managers, members of the Institute of Supply Management (ISM) and the American Purchasing Society (APS). They found differences in buyer preferences for security versus price and delivery reliability along two characteristics: 1) domestic versus international sourcing; and 2) concern or lack of concern over previous incidents experienced by the firm. For domestic sources, buyers chose price over security, although the results were mixed—importance scores supported this result, but market simulations did not. In the simulations, buyers who were concerned about prior incidents did trade price for higher levels of security. For domestic sources, buyers unequivocally chose high reliability over advanced security, even if they were concerned about prior incidents.

For international sources, buyers were more likely to choose advanced security over price and even to choose advanced security over delivery reliability. Voss et al. (2009a) suggest that the price/reliability dichotomy for choosing suppliers remains strong and that security does not overwhelm either. Firms seeking the lowest price may move away from security if it adds to costs. Firms seeking high delivery reliability may choose in favor of advanced security, but only if it does not compromise delivery reliability in domestic trade. In international trade, buyers may compromise delivery reliability for advanced security. The authors noted that these results may not apply in other industries (Voss et al. 2009a).

Williams et al. (2008) expanded on the dichotomous, internal-external approach to strategy. They found four major categories of strategic focus in SCS: firms that stress intra-

organizational activities (internal), firms that stress inter-organizational activities (external), firms that stress both (combination), and firms that ignore SCS altogether.

Elements of SCS Strategy

Security techniques and tactics range from purchasing mandated requirements for supplier security, to locks and RFID tags, to security audits, and participation in government programs like C-TPAT (e.g., Voss et al. 2009b). The following represent some of the most important security practices discussed in the literature.

SCS Culture

Arguably, SCS culture may be the most important and most heavily researched area in the field (e.g., Rice and Spayd 2005, Quinn, 2003, Christopher and Peck, 2004; Sheffi, 2005b; Williams et al. 2009b). Previous research has shown the need for creating a SCS culture (Sheffi 2002; Sheffi 2005b) and for rewarding such buy-in (Whipple et al. 2009). Failure to reward buy-in to the SCS culture can allow security programs to become stale (Quinn, 2003) or to be abandoned. Williams et al. (2009b) suggest a culture of security is critical to SCS. Practitioners have responded similarly. For example, Schneider International, a leading transportation and 3PL provider, boasts of building a culture of security in their overall effort to secure the SC (Ritchey 2010). In the current study, SCS culture is defined as the overall organizational philosophy that embraces and projects norms and values that protect the SC and engage employees in protecting the SC (Williams et al. 2009b).

Security Communication

SCS depends on the efforts of many firms throughout the SC (Closs and McGarrell 2004), so firms must communicate to share vital information. As a result, to build security, firms must develop communication strategies to share that information (Closs et al. 2008). When supply chains have communication plans in place and share security related information, increased security cooperation and reduced risks are likely to result (Manuj and Mentzer, 2008). The sharing of critical information can be used proactively (to prevent a security breach) or reactively (to minimize a breach or assist in response).

Examples of communication and information sharing include: setting security expectations and sharing these expectations among SC partners; developing a common security communication infrastructure (e.g., EDI requirements, GPS, RFID technology); sharing real-time SCS monitoring/detection status information (e.g., Homeland Security Advisory System); providing feedback from security audits; providing communications that direct SC efforts in a coordinated response to a security threat; and sharing communications that enable SC partners to begin recovery from a disaster (Helferich and Cook 2002).

Organizations that are working together in the physical flow of goods rely on one another for sharing and disseminating information. Security requirements have increased information sharing and communication expectations. Security communication is defined as the ability for all SC members to grant, share, and transmit critical information to one another to ensure that the SC will be protected.

Operational Modification

Goods now flow through the supply chain in a different way because firms have adopted SCS strategies. These changes, labeled operational modifications, have been necessary to secure the supply chain. A wide range of activities have been modified for security. Examples of operational modification include reducing or increasing the amount of inventory held at a given stocking location. For instance, some firms are increasing all inventory levels as a safety precaution while others are only increasing "critical supplies." Other firms have decentralized inventory by adding inventory stocking locations to reduce risk. Sheffi (2002) proposed the notion of a dual inventory system.

In this system, a small amount of inventory designated as strategic emergency stock is held and only used in extreme situations to keep operations running. These modifications to inventory policies have a resulting impact on transportation decisions as well.

Other firms have made drastic changes to manufacturing operations. Williams (2008) suggests that some firms are moving to JIT manufacturing models to reduce inventory levels. The reduced levels of inventory provide less opportunity for security breaches. However, Martha and Subbakrishna (2002) suggest that JIT operations results in extra risk because a disruption may lead to a production shutdown and, as a result, customer dissatisfaction and defection. Also, some firms are developing redundant production capabilities for critical products or contingency production capability (Helferich and Cook 2007). Regardless, the notion is the same: firms are making changes so they can feel more secure.

Transportation operations have seen security changes as well. Some firms have made decisions to change modes to improve shipment security. Rather than reduce cost and introduce potential security breaches, some shippers have switched to speedier, safer modes, such as air, for their shipments. Recent pirate attacks on ocean shipments and the resulting insurance increases have accelerated this practice. Williams (2008) also provides examples of shipments of caravans (deploying a group of trucks out at once) and increased usage of truckload shipments (fewer touch points) as other operational changes to transportation. Overall, operational modification is defined as changes to core SC activities, including operational procedures, manufacturing, inventory levels, and/or transportation in an effort to create SCS.

Access Restriction

Access restriction is an SCS activity that involves limiting where, when, and how people can enter SC facilities, use SC equipment, or touch materials, equipment and facilities (Min, 2012). This is in congruence with other research and initiatives (e.g., ISO 28001: 2007) that mentions tactics such as: controlled access points, employee verification, special doors and gates, card readers, visitor procedures, finger ID, gate passes, and limiting access for both internal and external personnel. This activity can be described as knowing who has access to what at all times, thus resulting in increased security. Access restriction can be considered critical because it provides a better understanding of who is entering SC facilities, where they can go once inside, what is being brought into SC facilities, and what information and materials are getting out. Specifically, this may include restricting the access of visitors, vendors, truck drivers, and even in some cases, a firm's own employees. By allowing unknown people only in known areas, firms are reducing the possibility of any unauthorized personnel introducing contraband into the supply chain. Therefore, access restriction helps secure an organization by letting everyone know who and what enters their physical locations.

Security Services

Increasingly, firms have become interested in outsourcing security activities. These outsourcing security initiatives are a key to the way that firms create SCS. Most firms lack expertise in security, so they seek partners who have the expertise. The rationale is much the same as for outsourcing other logistics or SC activities. Security firms have the expertise in one or more areas of security; firms in most other industries do not have people with this level of expertise.

Many firms outsource security services for special situations (escorting high-value shipments) or for guarding facilities and transportation full-time. Steinman (2004) found that half of 103 senior executives in his survey of transportation firms would hire firms that specialize in physical security services. Williams (2008) found that these security firms might provide armed secure transport, helicopter

escort of truck shipments, off-duty police and ex-military personnel at facilities, employee or candidate background check services, and installation of monitoring equipment. Partnering with these firms helps to create a secure supply chain. External security services are defined as the outsourced protection of the SC to firms or people who specialize in such protection.

Security Inspection

The process of inspection can be viewed as assuring that everything is in the proper order and operating condition to permit the secure operation of the SC. Examples of inspections include: physical inspection of goods, tampering inspections, and tiered inspections. These inspections are conducted by using human efforts and technology, such as metal detectors. This process is intended primarily to prevent SC disruptions.

Inspection is a broad security effort. For manufacturers and retailers, inspection could be evaluation of inventory and inspection of deliveries. For manufacturers, inspection could be the evaluation of production activities to ensure no contraband has been introduced into those operations. For transportation providers, inspection may be verifying the physical contents and quantity of shipments and assuring that no contraband is being moved. SCS Inspection is defined as checking products, operations, and processes to prevent security breaches.

METHODOLOGY

Following is a discussion of the measurement variables and the sample collection.

Measures

In this study, a survey instrument used new construct measures for the independent variables of security communication, operational modification, access restriction, security services, and security inspection. Another independent variable used in the study, Supply Chain Security Culture (SCSC), was a previously developed scale (Williams et al. 2009b). In addition, demographic (respondent's job title, annual sales revenue for the firm, in what industry the organization operates, and the firm's position in the SC) and firmographic (SCS breaches, SCS responsibility, and SCS focus) data were collected about each respondent's firm. The firmographic data was collected in order to better understand any possible security strategies.

There were several dependent variables captured in the survey. The purpose of capturing these variables was to understand and explain differences in SCS security strategies. As a result, three dependent explanatory variables were captured. For the variable *security breach*, respondents were asked to indicate the degree to which their firm had suffered a serious supply chain breach (1=Strongly Disagree; 7=Strongly Agree). This single item was then split into high security breach (responses of 6 or 7), medium security breach (3, 4, or 5) or low security breach (1 or 2). For *SCS responsibility* respondents were asked to self classify their firms' attitude on responsibility of SCS by indicating if SCS was their own (internal) responsibility or the responsibility of all supply chain partners, including governments (external). This internal/external dichotomy is consistent with prior research (c.f., Williams et al. 2008; Voss et al., 2009b; Martens et al. 2011). Finally, for *SCS focus* respondents were asked to classify their firms' attitude as either being primarily focused on preventing SCS breaches or on responding to security breaches once they occurred. This dichotomy is similar to prior suggestions on prevention versus response as general security approaches (c.f., Mitroff and Alpaslan 2003; Arntezen 2010).

The items for each of the measures (except for demographics and firmographics) are found in Appendix A. All scaled items used a 7-point Likert-type response scale (1=Strongly Disagree; 7=Strongly Agree). Although it is beyond the scope of the study presented here, all these measures were grounded in initial qualitative research and subjected to the steps presented in

Churchill (1979). This includes a review of all the measures by panels of academic experts and practitioner experts. The survey was refined based on the expert panel comments and then pretested through a survey of supply chain and logistics professionals who were alumni of a university based in the Midwestern United States. The pretest produced 65 responses, a 30% response rate and allowed the researchers to establish the performance of items and constructs before launching the main data collection.

Sample Collection and Characteristics

The sample was obtained from the Council of Supply Chain Management Professionals (CSCMP). Due to the sensitive nature of the topic (security) it was suspected that there would be a low response rate since people in charge of security are not inclined to talk about it or to respond to surveys about it. Therefore, a goal was to solicit many respondents in order to obtain as many usable responses as possible. Also, given the strategic-level nature of the research topic, respondents in executive and managerial roles with relatively large amounts of responsibility and knowledge of the questions being asked were targeted. Responses from titles such as CEO, VP, Director, and Manager were sought. The sample purchased from CSCMP included 2,996 individuals who met these criteria. When, organizational redundancies were eliminated (i.e., cleansing the contact database so that only one respondent per firm was asked to complete the survey), a sample of 1,753 firms remained. In total, 62 usable responses (a 3.5% response rate) were obtained from the CSCMP sample. This response rate, while low, is similar to other research using the CSCMP database (e.g., Lewis 2006).

This small number of responses prompted the researchers to get another sample from a marketing research firm. The same criteria as with the CSCMP database was used: one response per firm from an executive working in an applicable industry (manufacturing, carriers, 3PLs, warehousers/distributors, and retailers). This original sample included 3,500 firms. After eliminating overlap with the first sample and firms in non-targeted industries (i.e. consultants), the final sample size was 2,774. From the adjusted sample, there were 100 usable responses (a 3.6% response rate).

Two tests had to be run with the data before analysis. First, the main question with the separate samples was whether or not the data should be combined as one group. An ANOVA was conducted for the items across the samples and the results indicated no significant differences existed between the two samples. Thus, the data sets were combined into a final dataset of 162 useable responses, representing 162 unique firms, with no redundancies. The number of useable responses from respondents at this level (C-level), from exclusive firms, concerning this topic, compares favorably to other research on this topic (e.g., Voss et al. 2009a, b; Martens et al. 2011). Next, the database was then divided into two groups (early and late) based on the electronic time stamps that were recorded upon submission. Differences between early and late respondents were evaluated using ANOVA. The ANOVA results suggest that non-response bias was not an issue with this study. Finally, although missing data was not an issue with this study, a handful of missing values were replaced using mean values.

The overall sample characteristics are found in Table 1. The job title of the respondent is most often a Director (25.3%), VP (24.1%), or Manager (21.6%). Of the named categories, respondents are most often found in Consumer Packaged Goods (24.2%), Electronics (9.3%), or Medical/Pharmaceuticals (6.8%). But it should be noted that the largest industry category is Other (36.0%). Relative to SC company role, the largest group of respondents identify themselves as manufacturers (45.7%) and the second largest as 3PLs (19.1%). Annual sales in dollars are most often greater than one billion (36.9%).

TABLE 1
OVERALL SAMPLE CHARACTERISTICS*

Variable	n	%
Job Title		
President/CEO	19	11.7%
C-Level	13	8.0%
EVP/SVP	12	7.4%
VP	39	24.1%
Director	41	25.3%
Manager	35	21.6%
Industry		
Automotive	6	3.7%
Medical/Pharmaceutical	11	6.8%
Apparel/Textiles	7	4.3%
Electronics	15	9.3%
Industrial Products	8	5.0%
Consumer Packaged Goods	39	24.2%
Chemical/Plastics	9	5.6%
Appliances	3	1.9%
Agriculture	5	3.1%
Other	58	36.0%
SC Position		
Manufacturer	74	45.7%
Carrier	11	6.8%
Wholesaler/Distributor	15	9.3%
Freight Forwarder	4	2.5%
3PL	32	19.1%
Warehouser	8	5.6%
Retailer	11	6.8%
Other	7	4.3%
Annual Sales		
$1-$1M	2	1.3%
$2M-$25M	28	17.5%
$26M-$100M	29	18.1%
$101M-$1B	42	26.3%
Greater than $1B	59	36.9%

* N=162

RESULTS AND FINDINGS

Psychometric Properties

To assess unidimensionality, a factor analysis using PCA and Varimax Rotation (Netemeyer, Bearden, and Sharma 2003) was conducted. Once construct unidimensionality was confirmed, scale reliability using Cronbach's alpha in SPSS was examined. The resulting alpha values range from .837 to .960 (see Appendix A), which exceed Nunnally and Bernstein's (1994) recommended guideline of .70. After unidimensionality and reliability of each construct was confirmed, PCA with Varimax Rotation was used to assess validity of the constructs. As Appendix A shows, all items loaded on the constructs as expected. Furthermore, all items correspond to one and only one factor, with most factor loadings well above .70. This offered evidence of validity. The assessment of the psychometric properties suggested sound measurement so the next step was to explore security strategies.

Cluster Analysis

Since the primary purpose of this study was to determine whether SCS strategies exist, a three-step cluster analysis process was used to evaluate security strategies. Cluster analysis is often used in strategic SC and logistics research (e.g., Autry et al. 2008; Whipple et al. 2009). Cluster analysis groups respondents on similarity, while maximizing the dissimilarity between clusters (Hair et al. 2006). If the sample is heterogeneous (i.e., clusters exist), then the clusters will be described using attitudinal and firmographic variables, which is consistent with prior research using this technique (e.g., Williams et al. 2011)

The cluster analysis was conducted on the six key security variables (SCS culture, security communication, operation modification, access restriction, security services, and security inspection) that emerged from the literature review. A multiple step clustering process follows the suggestion of previous research (i.e., Reynolds and Beatty 1999). This was done

because no statistical techniques can determine the appropriate number of clusters, so the process remains to some extent subjective.

In the first step, it is suggested that the appropriate number of clusters should be approximately between n/60 and n/30, where n is the size of the sample (Lehmann 1979). Using the n/60 to n/30 rule of thumb, three to six clusters is deemed to be appropriate for this analysis (162/60 and 162/30).

In the second step, hierarchical cluster analysis was used to identify the number of clusters, based on Ward's method, with a squared Euclidian distance measure. This method is recognized for its ability to maximize homogeneity within clusters, while at the same time maximizing heterogeneity between clusters (Aldenderfer and Blashfield 1984) and is recommended because it results in clusters with the smallest sum of squares error (Arabie and Huber 1994). The largest percentage change in the agglomeration schedule was evaluated for clusters between three and six (which were determined in the first step). According to this result, the largest change in the agglomeration schedule comes when three clusters are merged into two. This indicates that a three cluster solution may be most appropriate for this sample.

Finally, the last step was to identify clusters using a non-hierarchical technique (K-means). Non-hierarchical techniques do not use a step-wise function like hierarchical techniques. Instead, this procedure assigns cases to clusters once the optimal number of clusters (seeds) has been identified (Hair et al. 2006). Cases are classified by moving the cases into groups when they are close to the mean vector of a group (Landau and Everitt 2004). The numbers of clusters determined during the hierarchical stage were used as seed points for the K-means process. The K-means cluster analysis yielded three clusters of 31, 71, and 60 respondents in each.

The case membership of the clusters was saved in SPSS as a new variable. This allowed for further analysis in determining an appropriate number of clusters. According to Hair et al. (2006), all clusters should be significantly different on all clustering variables. With three clusters established, a test was conducted to determine if the clusters differed on all the clustering variables. A one-way ANOVA was used with the three clusters as independent variables and all SCS activities as the dependent variables. At the .001 level of significance, the ANOVA results indicated that there were significant differences among the clusters on the clustering variables. This finding indicates that a three cluster solution represents unique SCS strategies. Results from the ANOVA are presented in Table 2.

TABLE 2
ANOVA RESULTS FOR CLUSTER DEVELOPMENT

Security Variables	P-Value	Cluster 1 Means	Cluster 2 Means	Cluster 3 Means
SCSC	0.000	2.88	5.77	4.29
Op Mod	0.000	4.67	6.15	5.87
AR	0.000	4.62	6.57	6.18
SS	0.000	2.23	4.69	2.87
Inspect	0.000	3.42	6.31	5.56
Comm	0.000	3.30	5.84	5.07

With clusters developed, and different security strategies revealed; demographic variables, along with attitudinal variables, were analyzed to describe each cluster.

Cluster Interpretation

For discussion purposes, each cluster was named. The cluster name was developed from the "theme" of the cluster as assessed through the variable means. Naming clusters based on themes of the groupings follows best practice in supply chain and logistics research (e.g., Williams et al. 2011). Based on the results, the clusters were labeled as: 1) The "Laggards"; 2) The "Advanced"; and 3) The "Compliant". Table 3 shows demographic descriptions of each cluster. Additional descriptions of the clusters follows.

Cluster 1: The "Laggards"

These firms represent 19.1% of the sample and are comprised primarily of manufacturers (61.3%); are in the consumer package goods (CPG) industry (12.9%); and have sales of $26M-$100M (33.3%). The slight majority view SCS as an internal responsibility (55.2%); have a response focus (58.6%); and overwhelmingly do not feel that they have experienced a serious SCS breach (80.0%). In terms of security perceptions, this cluster had the lowest scores on all six SCS strategy elements, in comparison to other segments. As a result, this group is named the "Laggards" for discussion purposes.

Cluster 2: The "Advanced"

This cluster represents the largest portion of the sample at 43.8%. This cluster is mostly comprised of manufacturers (33.8%) and 3PLs (25.4%); are involved with CPG industry (28.2%); and have annual sales in excess of $1B (39.4%). The vast majority view SCS as the shared responsibility of all supply chain partners (78.9%); have a prevention focus (93.0%); and is the cluster with the greatest perception that their firms have experienced a serious SC breach (8.5% have a high perception and 25.4% have a medium perception). In terms of security perceptions, this cluster had the highest scores on all six SCS strategy elements, in comparison to other segments.

Cluster 3: The "Compliant"

This cluster is the second largest part of the sample with 37.0%. In this cluster, 51.7% identified themselves as manufacturers; as with the previous two clusters, the majority are in the CPG industry (25.4%). In terms of sales, 40.7% have sales of greater than $1B. The majority view SCS as the shared responsibility of all supply chain partners (71.7%); have a prevention focus (75.0%); and is the cluster with the lowest percentage of serious supply chain breach (1.7%). Firms in this cluster scored in the middle on all attitudinal scores related to SCS, in comparison to other segments.

DISCUSSION OF RESULTS

The first goal of this research was to understand if more than one approach to SCS exists. The cluster analysis reported here supports this finding; the categories that emerged from the analysis follow a proactive (Advanced), do the minimum necessary (Compliant), or try to do as little as possible (Laggard) approach. An interesting finding is that there is good representation across the three clusters relative to annual sales, industry, and SC position. That is, the three strategies identified are not exclusive to any particular industry, SC position, or firm size; rather, each strategy is found in practice regardless of demographics. This supports the generalizability of these findings. Also, within cluster rankings of activities do not vary much between the three groups (i.e., Advanced and Compliant both rank Access Restriction as number one; Laggards and Compliant rank Inspection as number three; all three clusters rank Communication, SCS Culture, and Security Services as number four, five, and six, respectively). However, the groups vary significantly on the intensity in which they do each activity.

Laggards have likely given little thought to engaging in holistic security activities and may

TABLE 3
CLUSTER DEMOGRAPHIC PROFILES*

Variable	Cluster		
Annual Sales	**Laggards (N = 31; 19%)**	**Advanced (N= 71; 44%)**	**Compliant (N = 60; 37%)**
$1-1M	0.0%	0.0%	3.4%
$2M-25M	16.7%	22.5%	11.9%
$26M-100M	33.3%	14.1%	15.3%
$101M-1B	26.7%	23.9%	28.8%
$1B+	23.3%	39.4%	40.7%
Industry			
Automotive	3.2%	4.2%	3.4%
Medical/Pharmaceutical	6.5%	4.2%	10.2%
Apparel/Textiles	0.0%	7.0%	3.4%
Electronics	9.7%	9.9%	8.5%
Industrial Products	6.5%	5.6%	3.4%
CPG	12.9%	28.2%	25.4%
Chemical/Plastics	6.5%	7.0%	3.4%
Appliances	3.2%	2.8%	0.0%
Agriculture	3.2%	2.8%	3.4%
Other	48.4%	28.2%	39.0%
SC Position			
Manufacturer	61.3%	33.8%	51.7%
Carrier	9.7%	7.0%	5.0%
Wholesaler/Distributor	3.2%	11.3%	10.0%
Freight Forwarder	0.0%	5.6%	0.0%
3PL	16.1%	25.4%	15.0%
Warehouser	3.2%	7.0%	3.3%
Retailer	3.2%	7.0%	8.3%
Other	3.2%	2.8%	6.7%
SCS Responsibility			
Responsibility is Ours	44.8%	21.1%	28.3%
Responsibility of All	55.2%	78.9%	71.7%
SCS Focus			
Prevention Focus	41.4%	93.0%	75.0%
Response Focus	58.6%	7.0%	25.0%
Security Breach			
High Perceived SC Breach	3.3%	8.5%	1.7%
Med Perceived SC Breach	16.7%	25.4%	25.0%
Low Perceived SC Breach	80.0%	66.2%	73.3%

view SCS as a necessary evil. These firms had the lowest scores for each SCS strategy element. It is likely that this group views SCS as a forced requirement as opposed to a strategic activity. This is supported by the fact that, of the SCS strategy elements, Operational Modification is ranked highest by Laggards. These modifications might be required of the Laggards by their supply chain partners. It may even be that these firms attempt to avoid SCS altogether. This segment did indicate a low perceived security breach to their supply chain, which may contribute to this stance on SCS strategy. Some firms simply do not or cannot justify SCS costs and gamble that a SC breach is a low risk for them. Further, if SC partners are implementing SCS, some partner firms may not feel an obligation to spend resources on security. For instance, many U.S. ports have not taken an aggressive approach to SCS initiatives (Thibault et al. 2006); thus, many shipping organizations have indicated taking little security efforts (Rice and Spayd 2005). Furthermore, Laggards might not be as involved with complex SCs and thus view SCS as their own issue and are less expectant of others assuming responsibility for SCS. It also may be why these firms are primarily focused on responding to rather than preventing security breaches.

The firms that fall into the Compliant group have different tendencies in regard to SCS. Compliant tend to comply with accepted security practice. They have most likely seen the Advanced-cluster firms develop some SCS practices and then have attempted to emulate some of those best practices – just not to the degree to which the proactive firms have. These firms may also be suppliers to Advanced firms, making it necessary for them to comply with proactive practices imposed by their customers. Interestingly, this cluster has the lowest perception that they have experienced a serious supply chain breach. This adds support to the perception that these firms might be "forced" to be compliant by external partners. In addition, these firms are more prevention focused than Laggards but not to the degree that Advanced are. The firms within this group are about 'average' or 'middle of the road' in their approach to SCS. They are not the proactive firms like the Advanced group, but they are doing more than the bare minimum for SCS.

Advanced approach security proactively. This group is dedicated to a holistic SCS approach as they scored highest in all security activities. It is likely that this group of firms is capable of dedicating many resources to enhancing SCS with Access Restriction and Inspections ranked as the most important. This is most likely because these firms experience the highest perception that a high security breech has already occurred in their SCs. Thus these firms are heavily prevention focused and view SCS as the responsibility of all SC members – not just their own. Perhaps this perception of shared responsibility for SCS causes these firms to collaborate more with supply chain partners and, therefore, they are both required to and, in turn, require others to integrate many SCS elements into their strategies.

CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

This section addresses the academic and managerial contributions of the research, some research limitations, and suggestions for future research.

Contributions to Literature

Although this is an exploratory study, it does make contributions to the body of knowledge by advancing the understanding of SCS and related strategies. First, this research describes SCS strategies that organizations implement to create security in the SC. It has been suggested that firms need to approach SCS from a strategic perspective (Sarathy 2006). Unfortunately, academic research has not provided specific strategic options for firms to adopt in order to secure their supply chain. This research is one of the first to identify and describe detailed activities and overall SCS categories and is consistent with prior strategy research in developing a strategy taxonomy (e.g., Galbraith

and Schendel 1983; Hawes and Crittenden 1984; Lassar and Kerr 1996; Autry et al. 2008; Ashenbaum and Terpend. 2010; Keller et al. 2010).

Contributions to Practice

Managers can benefit through identification of the strategies discovered in this research. Managers can identify what category their organizations fall into and then assess their strength within that strategy cluster. This research identifies three main ways that firms can approach securing the supply chain. These approaches were named: Advanced, Compliant, and Laggards. As mentioned earlier, no firm wants its reputation associated with a catastrophic event, especially if the post-event investigation might find that they could have done something to prevent it, but chose not to do so. No organization wants the label "Laggard" after the fact.

Limitations and Future Research

The sensitive nature of this study most likely resulted in the low response rate; however, a higher response rate might have yielded different findings so this response rate should be noted as a limitation of the current study. Furthermore, other SCS strategy activities could provide alternative results. Future studies might investigate other types of SCS strategy elements, such as government programs (C-TPAT).

In this sample, the Advanced and Compliant clusters had the majority of their firms classified as having annual sales in excess of $1B while the Laggard majority was $26M-100M. Are Laggard firms Laggards because they have fewer firm resources to deploy towards SCS or are they simply too small to require such advanced practices? Are Advanced firms larger because they have more advanced SCS practices or are they simply able to spend more on SCS because they are larger? Future research needs to address a causal relationship of security practices on performance to answer "does security cause performance"? In addition, the use of the firmographic variables of SCS responsibility and SCS focus presented interesting results here and should be evaluated further. Also, future research may validate the security strategies presented here in another sample. Finally, additional research should empirically address the drivers of supply chain security strategies. In other words, what forces predict membership in a particular security strategy cluster?

RESEARCH CONCLUSIONS

As supply chains become increasingly global, firms must adopt strategies for the secure flow of goods from raw material to end consumer. Furthermore, as security issues are increasing in importance to many end consumers, this will likely force all SC members to take a new look at security measures to ensure consumer satisfaction; but these measures will come at a cost to both firms and consumers. The findings of this study will assist organizations as they develop strategies for the implementation of SCS practices.

APPENDIX A
SCALES/ITEMS, SCALE RELIABILITY, AND FACTOR ANALYSIS

Scale/Item (Scale Alpha)	Item Mean	Std. Dev.	Item-to-Total	λ
Operation Modification (α = .951)				
Thinking about our supply chain strategy, our company makes changes to…				
…the way our supply chain operates.	5.72	1.192	.882	.875
…specific supply chain activities.	5.81	1.076	.941	.904
…how our supply chain operates with suppliers.	5.76	1.074	.879	.893
Access Restriction (α = .837)				
Thinking about our supply chain strategy, our company…				
…creates restricted access areas at our facilities.	6.05	1.341	.673	.713
…creates designated areas where visitors are allowed within our facilities.	6.13	1.211	.748	.802
…strictly controls all access to our facilities.	5.98	1.266	.681	.827
Security Services (α = .849)				
In regard to our supply chain strategy, our company…				
…chooses to work with specialized security firms to create supply chain security.	3.93	1.794	.831	.845
…creates security in the supply chain by working with external security firms.	4.06	1.849	.808	.844
…chooses to place the responsibility of supply chain security on external security firms.	2.65	1.434	.556	.805
Inspection (α = .934)				
Thinking about our supply chain strategy, our company…				
…checks for any contraband in our product/services to prevent them from being distributed.	5.58	1.675	.835	.812
…takes efforts to check for potential security breaches before our product/service is delivered.	5.42	1.583	.868	.798
…diligently looks at products and processes before being delivered to prevent security breaches.	5.43	1.619	.888	.807

APPENDIX A
SCALES/ITEMS, SCALE RELIABILITY, AND FACTOR ANALYSIS
(Continued)

Communication (α = .951)				
In regard to our supply chain strategy, our company makes sure…				
…our supply chain members keep us informed of new supply chain security developments. (Adapted from Morgan and Hunt 1994)	5.19	1.424	.851	.740
…our supply chain members communicate their supply chain security expectations clearly. (Adapted from Knemeyer et al. 2003)	4.91	1.455	.869	.782
…our supply chain members let each other know as soon as possible of any unexpected problems with supply chain security. (Adapted from Anderson and Narus 1990)	5.13	1.45	.877	.809
…our supply chain members agree to share critical information among all chain members to ensure supply chain security.	4.99	1.46	.822	.827
…to communicate with other supply chain members to ensure supply chain security.	5.12	1.469	.906	.821
SCS Culture (From Williams et al. 2009b) (α = .960)				
Thinking about our supply chain strategy, our company…				
…creates a supply chain security focus among all employees.	5.01	1.69	.852	.854
…makes sure that supply chain security is the first thing on the mind of all employees.	4.11	1.77	.857	.855
…makes supply chain security the norm for all employees.	4.68	1.70	.923	.908
…dedicates efforts to create a supply chain security-focused workforce.	4.70	1.78	.906	.871
…makes sure that all employees are vigilant toward supply chain security.	4.84	1.70	.906	.889

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AUTHOR BIOGRAPHIES

Zachary Williams is Associate Professor of Marketing and Logistics at Central Michigan University. He received a Ph.D. in Marketing at Mississippi State University. His primary research interests are in the areas of supply chain security and supply chain segmentation. E-Mail: Zac.williams@cmich.edu

Jason E. Leug is Professor of Marketing at Mississippi State University. He received a Ph.D. in Marketing at The University of Alabama. His professional experience includes positions in the banking industry in both operations/compliance and commercial lending. His research and teaching interests are in the areas of supply chain management, retailing, and strategy. E-Mail: Jlueg@cobilan.msstate.edu.

Sean P. Goffnett is Assistant Professor of Marketing and Logistics at Central Michigan University. He received his Ph.D. from Eastern Michigan University with concentration in Quality Management. His research interests include supply chain talent management, humanitarian logistics, supply chain security, leadership, process improvement and innovation. E-Mail: sean.goffnett@cmich.edu

Stephen A. LeMay is Associate Professor of Marketing at The University of West Florida. He received a DBA in Transportation at University of Tennessee, Knoxville. He has been a research, speaker, and consultant in marketing and logistics for over twenty-five years, which has primarily focused on logistics personnel. E-Mail: Slemay@uwf.edu

Robert Lorin Cook is Professor of Marketing and Logistics at Central Michigan University. He received a Ph.D. in Marketing at Michigan State University. His primary research interests are in the areas of supply chain design, applying information system technologies to logistics systems and logistics education. E-Mail: Robert.cook@cmich.edu

A COMPARISON OF LOGISTICS STRATEGIES AND INTEGRATION IN THE U.S. AND GHANA

Michael A. McGinnis
The Pennsylvania State University – New Kensington

John E. Spillan
University of North Carolina at Pembroke

Ali Kara
The Pennsylvania State University – York Campus

King Obed Domfeh (dok)
Nuistodok Consultants Kumasi-Ghana

ABSTRACT

This manuscript empirically compares logistics strategies and outcomes in Ghanaian and U.S. firms to test the underlying factor structure and measurement equivalences of the Bowersox/Daugherty model and its relationship with critical success factors. A structured questionnaire was used to gather data from Ghanaian and American logistics managers. Using confirmatory factor analysis (CFA), we compared the three dimensions of Overall Logistics Strategy (OLS) - Process Strategy, Market Strategy, and Information Strategy – in the two countries. A structural equation model (SEM) was then used to assess the impact of OLS on perceived organizational competitiveness in the two countries. Although the economic, political, and cultural dimensions of the two countries differed substantially, the relationships among the constructs used were similar. Data from both countries provided strong support for the dimensionality of the Overall Logistic Strategy (OLS). In addition, it was found that OLS, when combined with Logistics Coordination Effectiveness (LCE) and Customer Service Effectiveness (CSE), contributes to organizational effectiveness (COMP) in both the countries studied. This research provides insights into comparative logistics in two completely disparate economies and provides support for the Bowersox/Daugherty logistics/supply chain management typology. The manuscript also provides insights into comparative logistics/ supply chain management that have not been previously reported through empirical research.

INTRODUCTION

In comparison to cross-cultural research in other disciplines, a review by Luo, Van Hoek, and Ross (2001) suggests that the cross-cultural study of logistics has received little attention. Luo et al. (2001) argued that modern logistics concepts and practices have mainly been developed in Western country environments. Research into cross-cultural logistics has lagged behind considerably while manufacturing and distribution operations have become increasingly global, and trade among developed and emerging economies has increased significantly over the last several decades. This lack of attention has resulted in little scholarly and practitioner knowledge about similarities and differences in logistics/supply chain management among countries that vary in size, population, culture, and work force composition. As a result, the authors suggest that cross-cultural logistics/supply chain management research has the potential to enrich our understanding of logistics/supply chain management strategy commonalities and differences among disparate economies. Such studies could provide insights into logistics/

supply chain management that would facilitate improved coordination and increased efficiencies in global logistics/supply chain management.

The role of logistics/supply chain management has evolved and become an integral part of firm's strategic planning processes (Carter, Pearson and Peng, 1997). Globalized markets offer significant opportunities but also offer challenges as firms locate manufacturing and distribution facilities around the world, but also conduct buying selling activities with a wide range of developed, emerging, and less developed countries.

Since consumer buying requires goods and services to be available at the right time, at the right price and in the right place; effective logistics and supply chain management becomes essential to business success. Bowersox and Daugherty (1987) developed a typology that studies important logistics management activities. This typology included process (cost management), marketing (simplifying transactions faced by customers), and information (coordinate logistics activities among suppliers and customers) strategies. This framework provides one approach for empirically assessing cross-cultural logistics/ supply chain strategies.

It is well known that logistics and supply chain management is considered a critical success factor in international markets. Therefore, cross-cultural logistics studies have the potential to enrich understanding of practitioners, teachers, and researchers of logistics and supply chain management systems and strategies as they are applied in different national environments in order to contribute to firm competitiveness. For more than two decades, a large body of empirical research has investigated the potential of the Bowersox/Daugherty (1987) typology and presented evidence to validate its usefulness as a framework for studying logistics strategy in the United States and Canada. However, given the mature nature of the Western markets as compared to the dynamism and growth of the emerging markets, comparative research should provide a broader understanding of logistics and supply chain management across economies and cultures.

For this study the authors investigate the applicability of the Bowersox/Daugherty typology in market environments of two completely distinct economies, the United States of America (USA) and Ghana. Specifically, we examine the role of Overall Logistics Strategy (OLS) on organizational competitiveness (COMP) through Logistics Coordination Effectiveness (LCE) and Customer Service Effectiveness (CSE) using a confirmatory factor analysis and a structural model. We assess the validity of three dimensions of the Bowersox and Daugherty typology that comprises OLS and their relationship to LCE, CSE, and COMP in Ghana and the USA.

The manuscript is organized into the following five sections. The next section presents an overview of the characteristics of the United States and Ghana. The following section reviews relevant literature and develops the research hypothesizes. The third section describes the methodology for collecting and analyzing the empirical data. The final two sections address discussions and conclusions of the research and then focus on the relevance and implications of the findings.

TWO DIFFERENT CONTEXTS: GHANA AND THE USA

Ghana and the United States vary in size (the United States is over forty times as large), population (the United States is about 12 times as large), percentage of urban population (the United States' is much greater), makeup of the labor force (a greater percentage of the United States' workforce is services oriented and less is in manufacturing and agriculture), gross domestic product (the United States is 200 times that of Ghana), and the United States is considered to be less corrupt. Table 1 summarizes these results.

TABLE 1
SELECTED COMPARISONS OF THE UNITED STATES AND GHANA*

Category	Ghana	United States
Area (sq km/sq miles) (Slightly smaller than Oregon)	238,533/92,435	9,826,675/3,807,983
Population	25,241,998 est.	313,847,465 est.
Percentage of Population Urban	51% (2010)	82%
Make up of Labor Force	Agriculture: 28.3% Industry: 21.0% Services: 50.7%	Agriculture: 0.7% Industry: 20.3% Services: 79.1%
Gross Domestic Product	$74.77 billion est.	$15.06 trillion est.
Climate	Tropical	Varied
Railroads (km/miles)	947/588	224,792/139,683
Paved Roads (km/miles)	9,955/6,186	4,374784/2,718,438
2011 Public-sector Corruption Index. An indication of domestic public corruption (Higher number > less corrupt).	3.9: 69 of 182 countries.	7.1: 24 of 182 countries.
2011 Bribery Index. An index of likelihood to bribe in host countries when engaging in international trade.	Not Available	8.1: 10 of 28 counties Comparable to France and Singapore

* Sources
- Categories "Area" through "Paved Roads": United States Central Intelligence Agency World Factbook (www.cia.gov, 2012). Accessed June 20, 2012.
- Categories "2011 Public-sector Corruption Index" and "2011 Bribery Index": Transparency International (www.transparency.org). Accessed June 20, 2012

As shown in Table 2, the cultural dimensions of these two economies differ greatly in terms of Hofstede's national work culture dimensions. In general, the United States culture is much lower on Power Distance (less tolerant of unequally distributed power), lower on Uncertainty Avoidance (less comfortable in unstructured situations), much higher on Individualism (more likely to be concerned with self rather than group), and much higher on masculinity (emphasis on a work focus and career aspirations). By contrast, the culture of Ghana is summarized as more tolerant of unequally distributed power, more comfortable in ambiguous situations, more collectivistic, and less focused on work as an ends.

TABLE 2
ANOVA RESULTS FOR CLUSTER DEVELOPMENT

Security Variables	P-Value	Cluster 1 Means	Cluster 2 Means	Cluster 3 Means
SCSC	0.000	2.88	5.77	4.29
Op Mod	0.000	4.67	6.15	5.87
AR	0.000	4.62	6.57	6.18
SS	0.000	2.23	4.69	2.87
Inspect	0.000	3.42	6.31	5.56
Comm	0.000	3.30	5.84	5.07

The contrast between Ghana and United States is striking. The United States is a large developed economy with a culture that is relatively individualistic, less focused on rules, more focused on work as a goal, and decisive. By contrast, Ghana is a small less developed economy with a culture that is relatively authoritarian, more focused on rules, places greater emphasis on personal relationships, and is less goal driven. The comparison of Ghana and the United States provides an opportunity to evaluate the impact of economic and cultural dissimilarities on logistics/supply chain management strategies and its impact on logistics/supply chain management coordination, customer service, and organizational competitiveness.

Ghana and Supply Chain Management

As a developing country Ghana has enormous growth potential. Accra, its capital city, is a main port that has a developing infrastructure for expanding trade activities. Ghana is a politically stable nation located on the west coast of Africa, and Ghana is bordered by Togo on the east, Cote d'Ivoire on the west and Burkina Faso to the north.

As shown in Table 1, Ghana's geographic area consists of a total area of 239 square kilometers (92,100 square miles) and has a population of 23 million. About 90.7% of the population is represented by eight ethnic groups. They are Akan (45.3%), the Mole-Dagbon (15.2%), the Ewe (11.7%), the Ga-Dangme (7.3%), the Guan (4%), the Gurma (3.6%), the Grusi (2.6%), and the Mande-Busanga (1%) tribes. Although relatively small, Ghana's Gross Domestic Product (GDP) has been increasingly steadily, from $32.27 billion in 2007, to $35.83 billion in 2009 (*CIA World Factbook*, 2010).

Ghana is a country rich in natural resources. Primary mineral exports include gold, diamonds, manganese ore, bauxite, and timber. Agricultural exports include cocoa (it is the primary cash crop and provides almost one-third of its export revenues), shea butter, coconuts, and coffee. Ghana has almost twice the per capita output of its neighboring countries.

Goods and services in Ghana generally use the traditional channels of distribution including wholesalers, agents and distributors, retailers, and individual street traders. Although some suppliers produce and sell directly to government entities and other businesses manufacture or process goods and sell directly to local residents or export the goods. According to one of the coauthors, commercial activities are concentrated in the Accra-Tema, Kumasi, Takoradi and Cape-Coast areas. Because Ghanaian's are very entrepreneurial the economy includes a high percentage of individual proprietorships.

One of Ghana's expert scholars has stated that Ghana will not resolve its economic development problem unless it develops a viable and sustainable supply chain management system. This is a main factor that is key to Ghana's future development. With its extensive raw material and export commodities, Ghana has the potential of accelerating its growth through supply chain management efforts (Biondo, 2009). It is one management function that could take Ghana from an underdeveloped country to a developing country. The key to attaining this goal is focusing attention on developing an effective supply chain management infrastructure (Nuwati, 2010).

LITERATURE REVIEW AND HYPOTHESES

A review of the literature identified eleven studies that have demonstrated a progression of thought and analysis which provides the foundation for the research reported in this manuscript. These studies are summarized as follows:

- Bowersox and Daugherty (1987) used personal and telephone interviews to identify three primary logistics thrusts: process strategy, which emphases cost control; market strategy, which concentrates on the reduction of complexity customers' face; and information strategy, which centers on the coordination of information within the firm and throughout the channel.
- McGinnis and Kohn (1990) used mail questionnaires in research that identified Logistics Coordination Effectiveness (LCE), Customer Service Effectiveness (CSE), and Organizational Competitive Responsiveness (COMP) as dependent variables useful for assessing logistics strategy effectiveness.
- McGinnis and Kohn (1993) identified logistics strategy clusters based on the Bowersox/Daugherty typology variables and discussed the variability of LCE, CSE, and COMP among those clusters.
- Clinton and Closs (1997) identified six commonalities of advanced logistics organizations and concluded they have a common objective of managing the logistics process. They concluded that the richness of logistics strategy variables warrant further research
- Kohn and McGinnis (1997a and 1997b) concluded that logistics strategy was stable between 1990 and 1997; and two dimensions (a) management of logistics flows, coordination, and complexity and (b) focus on efficiency, control, and cost reduction comprise logistics strategy. They further concluded that LCE, CSE, and COMP appear to relate to logistics strategy.
- McGinnis and Kohn (2002) used factor analysis to identify two independent variables, one comprised of PROCSTR and INFOSTR and one comprised of MKTGSTR. They concluded that the two independent variables contributed to LCE.
- Autry, Zacharina, and Lamb (2008) used cluster analysis to identify two logistics strategies, Functional Logistics and Externally Oriented Logistics. These two dimensions were similar, but not identical, to the Bowersox/Daugherty typology.
- McGinnis, Kohn, and Spillan (2010) conducted a longitudinal study of logistics strategy using data from 1990, 1994, 1999, and 2008. They concluded that LCE and COMP were good measures of logistics strategy outcomes.
- Spillan, Kohn, and McGinnis (2010) empirically compared logistics strategies of small and large USA manufacturing firms. They found that logistics strategies in small and large United States manufacturing firms did not differ substantially. They also concluded that the six strategies (PROCSTR, MKTGSTR, INFOSTR, LCE, CSE, and COMP) had been replicated, appear to fit

the construct name, and have adequate levels of reliability for further research into logistics/supply chain management.

- Kohn, McGinnis, and Kara (2011) applied confirmatory factor analysis and structural equation modeling to assess logistics strategy and its relation to logistics strategy outcomes. They found that PROCSTR, MKTGSTR, and INFOSTR comprise Overall Logistics Strategy (OLS), and to the extent that LCE is effective and CSE is clear, then OLS would contribute to COMP.

Subsequent research has focused on cross-cultural comparative empirical research into logistics/supply chain management strategy. These two studies are discussed as follows:

- McGinnis, Spillan, and Virzi (2012) compared the results of research into Guatemalan logistics with findings of previous research into United States firms by using a questionnaire that had been translated and back translated into Spanish. The fundamentals of logistics strategy in Guatemala were found to be similar to United States firms. However, it was found that Guatemalan logistics managers placed less emphasis on process strategy but greater emphasis on market and information strategies to achieve logistics coordination effectiveness, customer service commitment, and organizational competitive responsiveness.
- McGinnis, Harcar, Kara, and Spillan (2012) compared logistics/supply chain management in the United States, Guatemala, and Turkey using empirical data gathered from these three countries that differed in size, economies, and cultures. Structural equation modeling was used to assess three dimensions of logistics/supply chain strategy and three outcome variables. The three dimensions (Process Strategy, Market Strategy, and Information Strategy) held for the model of Overall Logistics Strategy (OLS). The relationship of OLS with three dependent variables (Logistics Coordination Effectiveness, Customer Service Commitment, and Organizational Competitiveness) held for two of the three countries. Insights for those interested in comparative logistics/supply chain management strategies are provided. The Bowersox/Daugherty typology was found to be useful for cross-cultural research into logistics/supply chain management.

Overall, the eleven single-culture studies and two cross-cultural studies of supply chain logistics indicate that further cross-cultural research would increase the understanding of logistics/supply chain management. An opportunity occurred that provided for research into logistics/supply chain management in Ghana. This country is attractive for this research because it is located in Africa, a continent that has not been included in previous logistics/supply chain management cross-cultural research, and differs substantially in terms of its size, population, economy, and culture from other countries studied to date.

Based on the literature review and the results of previous studies, a structural model depicting the overall logistics strategy is linked to process, market, and information strategy as conceptualized by Bowersox and Daugherty (1987). Also, this model shows the link between overall logistics strategy and company/division competitive responsiveness. In this conceptualization, we emphasize that the hypothesized effect on competitive responsiveness (COMP) is through logistic coordination effectiveness (LCE) and customer service effectiveness (CSE). Therefore, we offer the following hypotheses:

H1: Overall Logistics Strategy (OLS) positively influences Logistics Coordination Effectiveness (LCE) in both country environments studied.

H2: Logistics Coordination Effectiveness positively influences Customer Service

Effectiveness (CSE) in both country environments studied.

H3: Customer Service Effectiveness (CSE) positively influences Company/ Division Competitive Responsiveness (COMP) in both country environments studied.

If the hypothesized relationships are supported then it would suggest that OLS, LCE, and CSE are necessary for COMP regardless of the country environment. This would require organizational commitment to OLS, LCE, and CSE in order to achieve COMP across the globe.

RESEARCH METHODOLOGY

Measures and Questionnaire Development

To conceptualize the factors of our research model, we used scales adapted from McGinnis, Kohn, and Spillan (2010). The questionnaire was divided into three parts. In the first part, the overall logistics strategies of the companies were measured by three dimensions; process strategy, market strategy and information strategy. Respondents were asked to determine their level of agreement with three statements each for process, market and information strategies for their company /division on a five point -type scale (1 = definitely agree, 5=definitely disagree). In the second part of questionnaire respondents were asked to respond to three questions regarding logistics coordination effectiveness using similar Likert scale measures (1 = definitely agree, 5=definitely disagree) as was done in the first part of the questionnaire. In the third part of the questionnaire, respondents were asked to respond to seven questions relating to customer service commitment (three questions) and company/division competitiveness (four questions). Again, Likert Scales were used.

Data Collection

Although the data for the US study had been collected at four different time periods, the 1999 data was used as the dataset because the sample size (N=172) was the largest of the four data sets. This would reduce the likelihood that further analysis would be compromised in the smaller data sets due to chance variation. Identically worded questions were used to collect data for each of the six constructs. The subjects were logistics managers in United States manufacturing firms who: (a) were members of the Council of Supply Chain Management Professionals (CSCMP) – previously the Council of Logistics Management (CLM), (b) were employed by manufacturing firms, and (c) held job titles of manager or higher. The data collection procedure is described in McGinnis and Kohn (2002).

The targeted population for the research comprised businesses in Kumasi, a city in Ghana. The sample consisted of businesses located in areas convenient to one of the co-authors. Four hundred and fifty businesses were sampled. Since Ghana had been a British colony the questionnaire was administered in English via personal interviews. Three hundred and forty-nine (349) businesses participated, a response rate of 77.6%. Because three hundred and thirty-two (332), or 73.8% of all businesses contacted and 95.1% of all respondents, had annual sales of less than the equivalent of US$ 1,000,000, the balance of the analysis is based on those 332 firms.

The three independent variables and three dependent variables used in this research are presented as Table 3. Included in Table 3 are the items for each variable and the scale reliabilities in the United States and Ghana. Previous research (Kohn and McGinnis, 1997b) has concluded that the six variables are valid when studying logistics strategy using logistics managers in manufacturing firms for subjects.

ANALYSIS AND RESULTS

The first step was to check the construct reliabilities for both countries studied. Table 3 shows comparative average construct reliabilities.

TABLE 3
SCALE ITEMS

Scales/Items*	Reliability Coefficients (Alphas) USA	Ghana
Scale 1: Process Strategy (PROCSTR)	**0.574**	**.619**
1. In my company/division, management emphasizes achieving maximum efficiency from purchasing, manufacturing, and distribution.		
2. A primary objective of logistics in my company/division is to gain control over activities that result in purchasing, manufacturing, and distribution costs.		
3. In my company/division, logistics facilitates the implementation of cost and inventory reducing concepts such as Focused Manufacturing and Just-in-Time Materials Procurement		
Scale 2: Market Strategy (MKTGSTR)	**.741**	**.568**
1. In my company/division, management emphasizes achieving coordinated physical distribution to customers served by several business units.		
2. A primary objective of logistics in my company/division is to reduce the complexity our customers face in doing business with us.		
3. In my company/division, logistics facilitates the coordination of several business units in order to provide competitive customer service.		
Scale 3: Information Strategy (INFORSTR)	**.568**	**.693**
1. In my company/division, management emphasizes coordination and control of channel members (distributors, wholesalers, dealers, retailers) activities.		
2. A primary objective of logistics in my company/division is to manage information flows and inventory levels throughout the channel of distribution.		
3. In my company/division, logistics facilitates the management of information flows among channel members (distributors, wholesalers, dealers, retailers).		
Logistics Coordination Effectiveness (LCE)	**.708**	**.678**
1. The need for closer coordination with suppliers, vendors, and other channel members has fostered better working relationships among departments within my company.		
2. In my company logistics planning is well coordinated with the overall strategic planning process.		
3. In my company/division logistics activities are coordinated effectively with customers, suppliers, and other channel members.		
Customer Service Effectiveness (CSE)	**.680**	**.626**
1. Achieving increased levels of customer service has resulted in increased emphasis on employee development and training.		
2. The customer service program in my company/division is effectively coordinated with other logistics activities.		
3. The customer service program in my company/division gives us a competitive edge relative to our competition.		
Company/Division Competitiveness (COMP)	**.661**	**.440**
1. My company/division responds quickly and effectively to changing customer or supplier needs compared to our competitors.		
2. My company/division responds quickly and effectively to changing competitor strategies compared to our competitors.		
3. My company/division develops and markets new products quickly and effectively compared to our competitors.		
4. In most of its markets my company/division is a (1=very strong competitor, 5=very weak competitor).		

*Except for item 4 of COMP, 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.

Although some of the reliability scores were below the suggested levels in the literature, in general we can make a case that these scores are satisfactory for testing and validating the structure reported in Kohn, McGinnis, and Kara (2011). In addition, as coefficient values are relatively receptive to the number of items in the constructs, particularly when constructs have fewer than 10 items, as in the case of this research, it is common to find coefficient alphas around 0.50 (Pallant, 2007). Table 4 shows a comparison of variable scores between the USA and Ghana respondents. The means of all six variables were significantly different between the USA and Ghana respondents. Possible explanations of these differences are discussed later in the manuscript.

TABLE 4
COMPARISON OF MEANS OF SCALE SCORES*:
LARGE USA MANUFACTURING FIRMS & GHANA MANUFACTURING FIRMS

Scales**		USA	Ghana	Significant mean difference at alpha = 0.05?
Process Strategy (PROCSTR)				
	N	172	332	
	μ	2.33	3.54	YES
	σ	0.706	0.737	
Market Strategy (MKTGSTR)				
	N	172	332	
	μ	2.54	3.36	YES
	σ	0.848	0.737	
Information Strategy (INFORSTR)				
	N	172	332	
	μ	2.77	3.42	YES
	σ	0.717	0.797	
Logistics Coordination Effectiveness (LCE)				
	N	172	332	
	μ	2.58	3.34	YES
	σ	0.730	0.788	
Customer Service Commitment (CSC)				
	N	172	332	
	μ	2.51	3.22	YES
	σ	0.743	0.808	
Company/Division Competitiveness (COMP)				
	N	172	332	
	μ	2.40	3.23	YES
	σ	0.589	0.597	
KMO Measure of Sampling Adequacy		0.832	0.770	
Bartlett's Test of Sphericity		.000	.000	

*Scale Scores = (Sum of item scores of items in that scale) / (Number of items)
**Scales: 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.

With the intention of evaluating whether the correlations among variables are suitable for factor analysis, we examined the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-MSA) (Kaiser, 1970). Table 4 shows the results for KMO tests for sampling adequacy and Bartlett's test for sphericity for the two datasets, Ghana and USA, as well as the mean scores for the constructs in both countries. The value of KMO-MSA was 0.832 for the US sample, and 0.770 for the Ghanaian sample, indicating the data were appropriate for factor analysis. All KMO results were above .50, which is the minimum cut off for factor analysis. Additionally all levels of significance for Bartlett's test for sphericity were less than .005 for both datasets. KMO results along with the Bartlett results indicate the datasets were suitable for factor analysis.

Confirmatory Factor Analysis

To confirm the underlying factor structure, the authors conducted CFA on both datasets using AMOS. We assessed the goodness of the fit of the models using various fit indices discussed in previous studies, including the $\div^2$ statistic, normed fit index (NFI), non-normed fit index, (NNFI), comparative fit index (CFI) goodness of fit index (GFI); Standardized Root Mean, Square Residual (SRMR); and Root Mean Square Error of Approximation (RMSEA). The two-step approach suggested by Anderson and Gerbing (1988) was used to first examine the measurement model and then the structural model. In the measurement model, the hypothesized relationship between the nine logistics strategic orientations and the three first order factors were examined to understand how well the relationships fit the data. In the structural model, we examined the relationship between the three first order factors (PROCSTR, MKTGSTR, and INFORSTR). The findings supported the underlying factor structure of the 19 items with correlated factors.

The results of the estimation of the first order factor model revealed very strong results for all datasets used as indicated by several different measures ($\div^2$ USA= 31.058, and $\div^2$ GHANA=71.991). While the p-value for the U.S. dataset was insignificant, indicating a very good fit, corresponding p-values for the Ghana sample were significant. However, we think this was due to the sample size difference since the chi-square test is sensitive to large samples and has a tendency to become significant. Other goodness of fit indexes for both countries indicated a good fit (GFI USA=0.962; CFI USA=0.970; GFI GHANA=.954; CFI GHANA=.917).

The normalized chi-square (chi-square/degrees of freedom) of the CFA model was smaller than the recommended value of 3.0, the RMR was smaller than 0.05, and the RMSEAs were small (RMSEA USA=0.049; RMSEA GHANA=0.082). Accordingly, the results showed that all loadings in the model were significant, leading us to conclude that the relationships between the items and latent factors were confirmed by the datasets obtained from the two countries. Figure 1 shows the results.

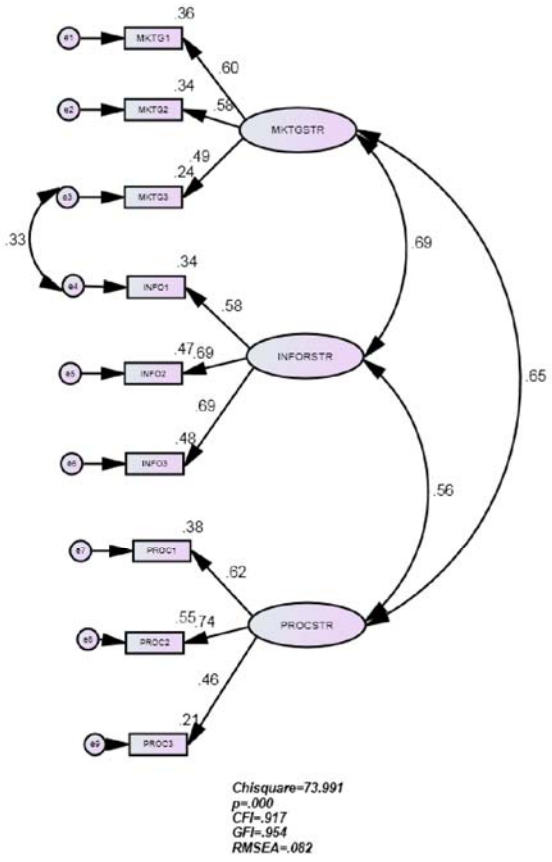
Structural Models

The structural model was used to test the hypotheses of all six factors tested in the measurement model. The hypothesized structural models for both datasets are shown in Figure 2. Inspection of Figure 2 revealed that the all linkages were significant and the directions of relationships were as hypothesized for the US and Ghana datasets. Figure 2 also displays standardized coefficients for the linkages, R^2 values for the variables, as well as correlation coefficients between two sets of measurement variables. Finally, the values for Chi-square, GFI, CFI, and RMSEA values all point to good model fit in both datasets.

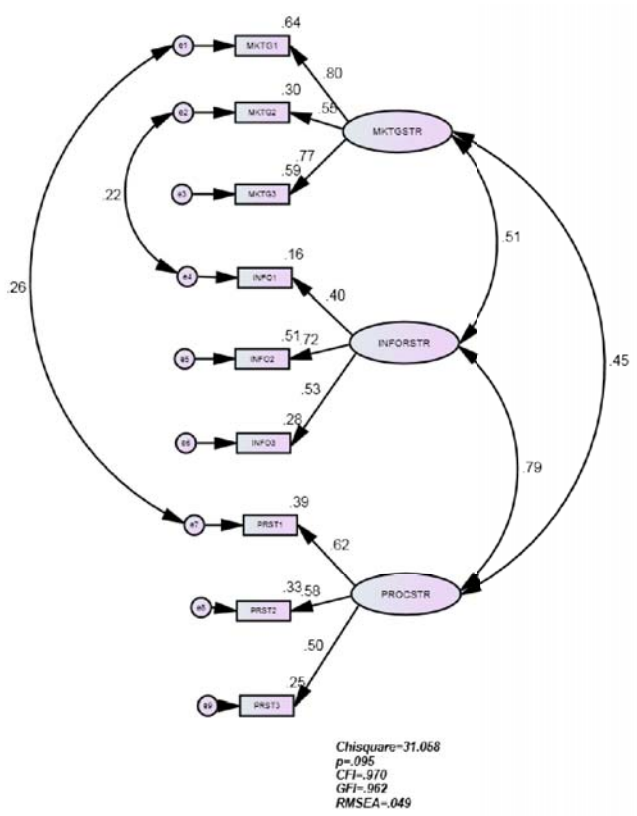
A final analysis conducted in this study sought to ascertain whether logistics strategies were homogenous (or heterogeneous) for the United States and Ghanaian respondents. To assess this issue SPSS 16.0's two-step cluster analysis was used to group the independent variables

FIGURE 1
FIRST ORDER CONFIRMATORY FACTOR ANALYSIS FOR OVERALL LOGISTICS STRATEGY

A. Ghana Data



B. USA Data

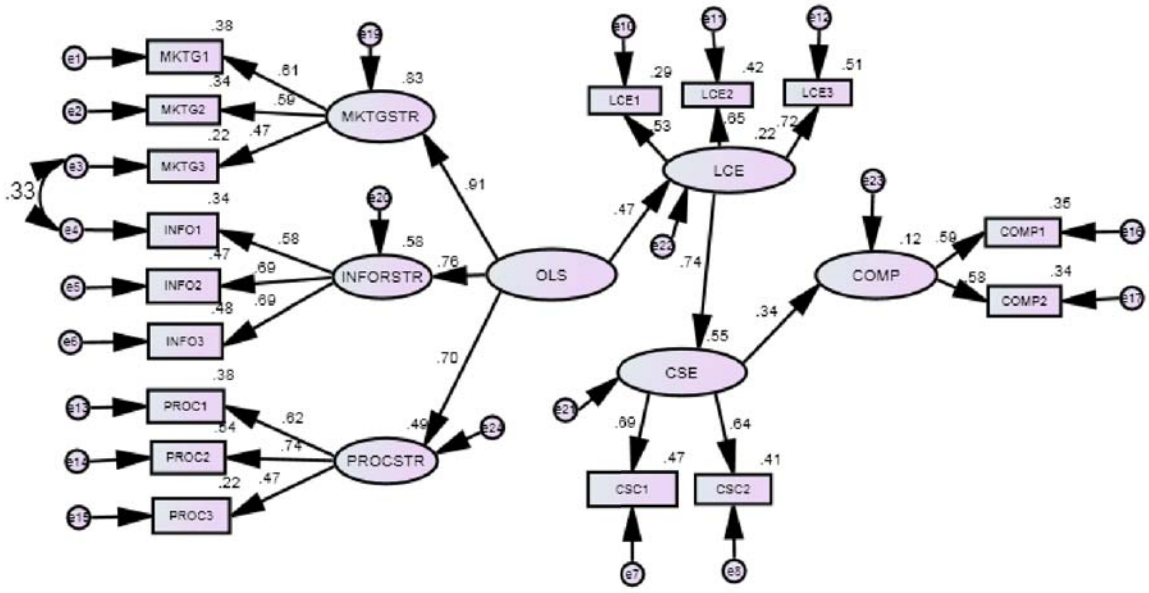


(PROCSTR, MKTGSTR, and INFORSTR) into "strategy clusters". As shown in Table 5, both sets of respondents grouped into two strategy clusters. For the USA respondents the clusters with lower values for the independent values were named "Intense Logistics Strategy" and the other cluster named "Passive Logistics Strategy." For the Ghana respondents the clusters were named "Passive Logistics Strategy" and "Inactive Logistics Strategy" respectively. Inspection of Table 5 provides an array of insights into comparative USA and Ghana logistics strategies, as indicated by the respondents. First, both sets of respondents were grouped into two strategy clusters. However, 71.4% of the USA respondents grouped into "Intense Logistics Strategy" and 28.6% of USA respondents were grouped into "Passive Logistics Strategy." By contrast, 46.1% of the Ghana respondents grouped into "Passive Logistics Strategy" and 53.9% grouped into "Inactive Logistics Strategy."

Further examination of the independent variables (PROCSTR, MKTGSTR, INFORSTR) suggest that USA respondents placed substantially greater priority on the components of Overall Logistics Strategy with much better outcomes in the dependent variables LCE, CSE, and COMP. The disparity in the results may be attributed to three issues discussed in the literature review: traditional channels of distribution, the large number of individual proprietorships (compared to corporations), and a primal supply chain. This observation is not intended to reflect on Ghana or its people.

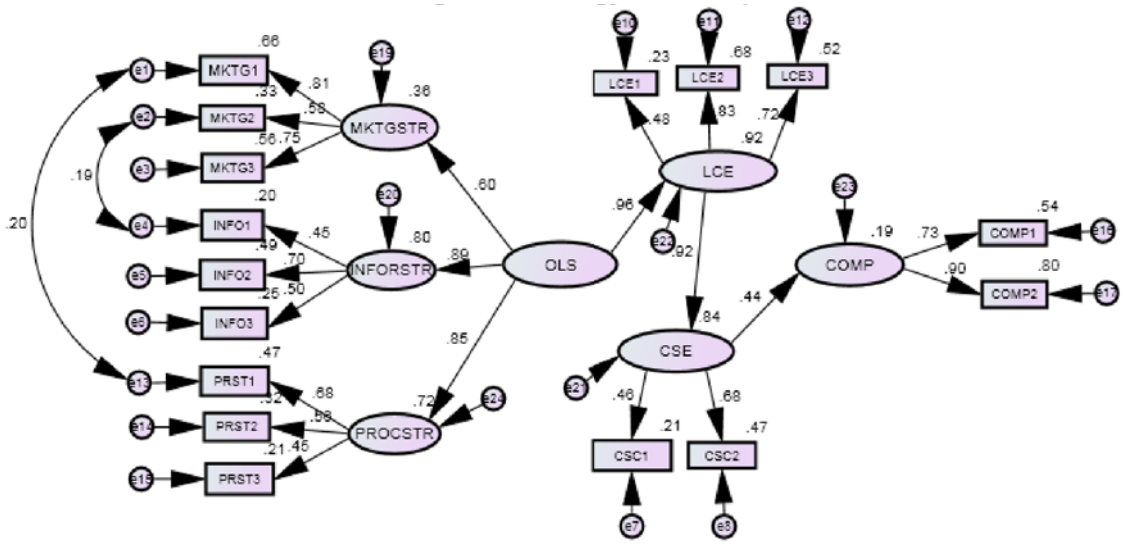
FIGURE 2
SEM FOR OVERALL LOGISTICS STRATEGY AND COMPETITIVENESS

A. GHANA DATA



Chisquare=162.867, p-value=.000, GFI=.941, CFI=.935, RMSEA=.045

B. USA DATA



Chisquare=125.971, p-value=.022, GFI=.916, CFI=.960, RMSEA=.043

TABLE 5
COMPARISON OF CLUSTER ANALYSES RESULTS OF LOGISTICS STRATEGIES:
National Sample of Large US and Ghanaian Manufacturing Firms

	USA (n=172)		Ghana (n=332)	
	Intense Logistics Strategy (n=105, 61.0%)	Passive Logistics Strategy (n=67, 39.0%)	Passive Logistic Strategy (n=153, 46.1%)	Inactive Logistics Strategy (n=179, 53.9%)
PROCSTR				
μ	1.941	2.940**	3.137	3.89**
σ	0.467	0.574	0.731	0.541
MKTGSTR				
μ	2.213	3.060**	2.776	3.866**
σ	0.743	0.741	0.568	0.429
INFORSTR				
μ	2.403	3.446**	2.902	3.862**
σ	0.524	0.589	0.715	0.563
LCE				
μ	2.270	3.072**	3.120	3.523**
σ	0.547	0.713	0.749	0.774
CSE				
μ	2.313	2.841**	2.039	3.456**
σ	0.662	0.753	0.713	0.809
COMP				
μ	2.318	2.534*	3.137	3.300*
σ	0.580	0.582	0.634	0.564

Scales: 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.
Notes: ** mean differences are significant at alpha = 0.01; * mean differences are significant at alpha = 0.05.

Rather, the results shown in Table 5 most likely reflect logistics/supply chain strategies that are appropriate for an economy in the early stages of emergence.

DISCUSSION AND CONCLUSIONS

These findings suggest that the Bowersox/ Daugherty dimensions of logistics strategy are appropriate in economies that differ dramatically in terms of size, stage of economic development, and culture. Furthermore, these results suggest that the assumed links between overall logistics strategy (OLS) and organizational competitiveness (COMP) may vary among cultures.

As shown in Figures 1 and 2, the models for logistics strategy and logistics strategic outcomes for Ghana and USA respondents indicate a high level of consistency in terms of the relationships for PROCSTR, MKTGSTR, and INFOSTR to OLS, and the relationship of OLS to COMP through LCE and CSE. Overall, the methodology, based on the Bowersox/ Daugherty typology, is appropriate for the comparative study of logistics/supply chain management strategy in a wide range of economies.

Examination of Table 5 further reveals that a cluster analysis of the Ghana and USA data results in two different overall logistics

strategies. For the USA respondents the two logistics strategies identified were "Intense Logistics Strategies" and "Passive Logistics Strategies." The two strategies identified for the Ghana respondents were "Passive Logistics Strategy" and "Inactive Logistics Strategy." As shown earlier in Table 4, mean values of all six variables were significantly lower (higher factor scores) for Ghana respondents compared to United States respondents. Possible explanations for the different intensities of logistics strategies in the two samples may be due to annual revenue. However, a comparison of small and large United States firms (Spillan, Kohn, and McGinnis, 2010) did not reveal substantial differences in variable means based on firm size. Other possible explanations for the substantial differences between Ghana and United States respondents could be (a) differences in levels of competition faced by Ghana respondents, (b) differences in culture (higher power distance, higher uncertainty avoidance, low commitment to the organization, less emphasis on work as an end), (c) fewer competitive pressures, (d) an economy that is more local, rather than national or global, in focus, (e) product/service considerations that place less pressure on logistics/supply chain management, (f) greater competitive advantage from non-logistics/supply chain considerations such as personal relationships and relationship strengths, (g) less national and international trade by the subjects, and (h) less pressure from customers and suppliers. Three issues mentioned in the literature search were traditional channels of distribution, a high percentage of individual proprietorships, and the lack of a viable supply chain management system.

Overall, the results reported in this manuscript suggest that the Bowersox/Daugherty framework provides a strong framework for studying and explaining logistics/supply chain management in two large, dissimilar, economies. In other words, this study validates the dimensionality of the Bowersox/Daugherty measurement model for overall logistic strategy in a cross-cultural environment. Moreover, this study also confirms the relationships identified in the structural model with respect to the relationship among Overall Logistics Strategy (OLS), Logistics Coordination Effectiveness (LCE) and Customer Service Effectiveness (CSE), and perceived organizational competitiveness.

RELEVANCE AND IMPLICATIONS

The research reported in this manuscript suggests that the fundamentals of USA and Ghana logistics strategies are similar in nature but not in scope. In addition, the results indicate that the Bowersox/Daugherty typology is an appropriate typology for studying logistics/supply chain management strategy across two dissimilar cultures. These results should provide some comfort to trainers/faculty teaching logistics/supply chain management to cross cultural audiences. While there are some differences, the framework of logistics/supply chain management appears to be independent of country/cultural environment. This finding is consistent with the findings of McGinnis, Spillan, and Virzi (2012) and consistent for two of the three firms studied by McGinnis, Harcar, Kara, and Spillan (2012).

For practitioners, these finding suggest that the fundamentals of logistics/supply chain management do not vary greatly in different countries/cultures. The implication is that logistics' contributions to organizational success cannot be achieved in isolation. As suggested in the results "Overall Logistics Strategy", "Logistics Coordination Effectiveness", and "Customer Service Effectiveness" imply broad coordination at many levels of the organization including operations, marketing & sales, and service, procurement, technology, human resource management, and the firm' infrastructure. Successful logistics strategies have three requirements: a balance of efficiency, customer responsiveness, and coordination throughout the value chain.

In other words, the effects of overall logistics strategy (OLS) on firm competitiveness become

much clearer when firms effectively coordinate their logistics activities (LCE) and implement effective customer service operations(CSE). This does not suggest that other issues, such as local customs, negotiation approaches, and the structure of agreements, will be similar to the extent that logistics/supply chain management appears to be. Finally, those conducting comparative research into logistics/supply management should find that identifying subjects and conducting research requires the collaboration of researchers in the subject country.

SUGGESTIONS FOR FUTURE RESEARCH

This study is part of a series of studies exploring the practices of logistics/supply chain management in other countries/cultures from a perspective of uncovering their impact on customer service and organizational competitive responsiveness. Further research into logistics and supply chain management may benefit from expanding the understanding of logistics/supply chain management decision making by including antecedents and moderating factors (such as competition, market turbulence, and differences in business environment) into the design. In addition to further study of logistics/supply chain management in other nations/cultures, additional insight could be gained by examining the relevance of the Bowersox/Daugherty typology to nonmanufacturing industries including retailing, healthcare, financial services, transportation firms, and food service. These industries may provide a different perspective on the process, market, and information strategy in different environments. Finally, future studies should try to synthesize the accumulated knowledge generated in these cross national studies into a more inclusive framework that provides a conceptual roadmap of the impact of logistics/supply chain management strategies on critical organizational success factors such as global competitiveness and profitability.

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AUTHOR BIOGRAPHIES

Michael A. McGinnis, CPSM, C.P.M. is Associate Professor of Business at Penn State University New Kensington Campus. He holds B.S. and M.S. degrees from Michigan State University and a D.B.A. degree from the University of Maryland. His research areas are purchasing, logistics strategy, negotiations, and supply chain management. E-Mail: mam47@psu.edu

John E. Spillan is Associate Professor of Business Administration at the University of North Carolina at Pembroke, School of Business. He received a M.B.A. degree from the College of Saint Rose in Albany, New York and a Ph.D. from the Warsaw School of Economics. His research interests center on Crisis Management, International Marketing, Entrepreneurship and International Business with specific interest in Latin America and Eastern Europe. E-Mail: jspillian@uncp.edu

Ali Kara is Professor of Marketing at Penn State University York Campus. He holds a doctorate from Florida International University, Miami, Florida and an MBA degree from the University of Bridgeport, Connecticut. He has published numerous articles in *Journal of Marketing Research, Journal of Advertising, International Journal of Research in Marketing, European Journal of Operations Research, Omega, Journal of Small Business Management, Industrial Marketing Management, Journal of Global Marketing,* and *International Journal of Logistics Management*. In addition, Ali has made several national/international conference presentations. He currently teaches several marketing courses at Penn State York. E-Mail: axk19@psu.edu

King Obed Domfeh (dok) is Chief Executive Officer of NUISTODOK Consultants in Kumasi, Ghana. E-Mail: kodomfeh2000@yahoo.co.uk

THE ROLE OF RETURNS MANAGEMENT ORIENTATION, INTERNAL COLLABORATION, AND INFORMATION SUPPORT IN REVERSE LOGISTICS

Enping (Shirley) Mai, Ph.D.
Haozhe Chen, Ph.D.
Kenneth Anselmi, Ph.D.
East Carolina University

ABSTRACT

While reverse logistics has gained significant interest in recent years, the research on its antecedents is still far from comprehensive. The current study utilizes data collected from China to empirically test a conceptual model that is developed based on the resource based view of the firm. It is proposed that returns management orientation, internal collaboration, and information support are important predictors of reverse logistics performance. The structural equation modeling analysis supports these proposed relationships. Furthermore, the current study also confirms the positive relationship between a firm's reverse logistics performance and market performance.

INTRODUCTION

There is an increasing appreciation of the importance of reverse logistics in recent years due to the value related to effective reverse logistics management. Improving reverse logistics can reduce supply chain costs and create revenue and profit at the same time. Reverse logistics has created a growing industry by running returns backwards through the supply chain. Bloomberg Businessweek calls reverse logistics "from trash to cash" (Anonymous, 2008). As an example, when Lenovo outsources its reverse logistics process to GreenDust, the company is able to reap significant value from the refurbished products (CRN Network, 2012).

Reverse logistics is defined as "the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal" (Rogers and Tibben-Lembke, 2001, p. 130). As reverse logistics looks into situations when the resource or material goes at least one step back in the supply chain, return products are processed moving from the typical end destination of customers back to the distributor or to the manufacturer. In other words, all business processes and activities after sale of the product are part of reverse logistics. Every manufacturer, distributor, reseller and retailer is involved in reverse logistics in order to develop efficient solutions. While reverse logistics encompasses a wide range of processes and activities such as recycling and reuse (of both products and materials), repair services, disposal, etc.; returns management is often considered a critical element of reverse logistics. Returns management refers to the management of returned products for the purpose of capturing value or proper disposal. Returns management is the focus on the current study.

Studies in the reverse logistics literature have examined various industries, including automobiles (Daugherty, Richey, Hudgens and Autry, 2003), computer hardware (Ravi, Shankar and Tiwari, 2005), retailing, and third-party logistics (Chen, Tian, Ellinger and Daugherty, 2010; Bernon, Rossi and Cullen, 2011). Several researchers have examined modeling perspectives for reverse logistics (Rogers, Melamed and Lembke, 2012). Empirical work on reverse logistics includes using qualitative discussion data (Ravi, Shankar and Tiwari, 2005; Bernon, Rossi and Cullen, 2011), case

studies (Fleischmann et al., 1997) and quantitative survey data (Daugherty, Richey, Hudgens and Autry, 2003; Richey et al., 2005). An early review of reverse logistics literature is provided by Carter, Craig and Ellram (1998).

While extant research has started to explore the antecedents of reverse logistics, our literature review reveals that the number of factors examined is still very limited compared to the much better studied forward logistics. Therefore, the current study is undertaken to explore more meaningful antecedents of reverse logistics. In particular, our study proposes and examines three important antecedents – returns management orientation, internal collaboration, and information support. In addition to investigating their relationship with reverse logistics performance, we also try to confirm the positive relationship between reverse logistics and a firm's market performance.

The remaining sections of the paper are organized as follows. First, existing supply chain and logistics literature is reviewed to identify some of the key drivers of reverse logistics and a conceptual framework drawing upon relevant theories is proposed. Next, detailed research hypotheses are developed and tested. After discussing the study results, conclusions and implications of this study are discussed.

LITERATURE REVIEW AND CONCEPTUAL DEVELOPMENT

With the growing awareness of reverse logistics (e.g. Autry, Daugherty and Richey, 2001; Daugherty, Myers and Richey, 2002; Ravi, Shankar and Tiwari, 2005; Richey, Genchev and Daugherty, 2005; Bernon, Rossi and Cullen, 2011), and its contribution to firm performance (Lambert and Burduroglo, 2000; Fugate, Mentzer and Stank, 2010); understanding the key drivers of reverse logistics performance, and the relationship to market performance, has become a high priority.

Scholars have proposed a wide range of factors that might impact reverse logistics. Autry, Daugherty and Richey (2001) have examined six reverse logistics-related goals performance measures and eight satisfaction measures of reverse logistics service, and how they are influenced by industry, firm size, sales volume, and internal or external assignment of responsibility for disposition. They found that performance is significantly impacted by sales volume, while industry characteristics significantly impact satisfaction. A further study with the same data revealed that information system (IS) support does not have an immediate impact on reverse logistics performance. However, commitment between buyer and seller for maintaining the reverse logistics program moderates this IS support to performance linkage (Daugherty, Myers and Richey, 2002). Furthermore, relationship commitment mediates the relationship between trust and reverse logistics performance (Daugherty, Richey, Hudgens and Autry, 2003), and resource commitment makes reverse logistics programs more efficient and more effective (Richey, Genchev and Daugherty, 2005). Recently, some researchers have provided empirical evidence, especially exploratory studies using qualitative research designs, in broad industry categories such as computer hardware (Ravi, Shankar and Tiwari, 2005), retailing and third-party supply chain companies (Bernon, Rossi and Cullen, 2011). A summary of several recent empirical studies examining reverse logistics' antecedents is listed in Table 1.

In the current study, we take the resource-based view of the firm (RBV) to identify other understudied antecedents of reverse logistics. RBV suggests that effective use of a firm's unique resources can lead to sustained competitive advantage (Barney, 1991). *Resources* have generally been defined as the assets, processes, information, skills, knowledge, etc. of a firm which enable the firm to develop and implement strategies to improve efficiency and effectiveness (Barney, 1991; Grant, 1991). As such, resources can be tangible or intangible.

TABLE 1
PREVIOUS EMPIRICAL RESEARCH RELATED TO REVERSE LOGISTICS PERFORMANCE

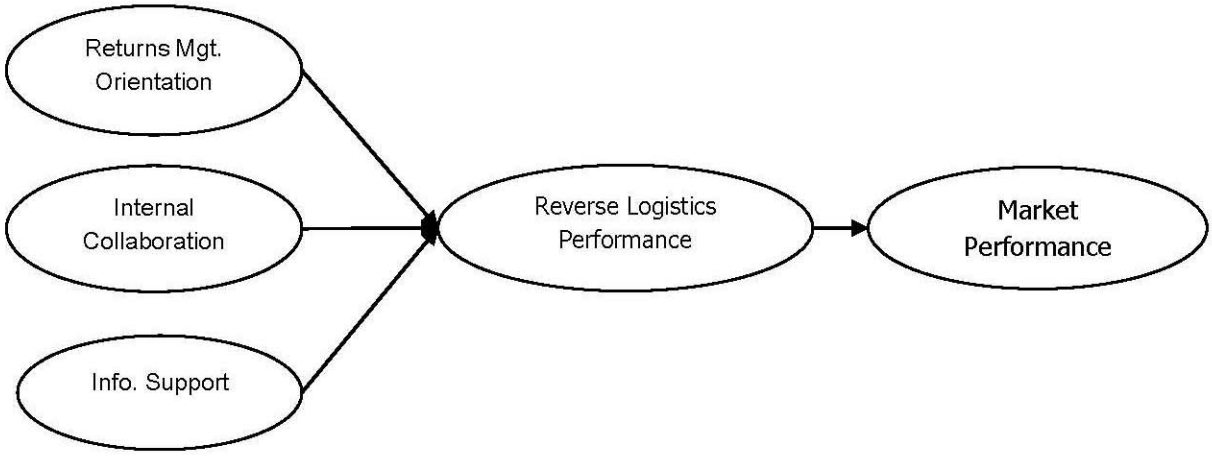
Study	Method	Data	Key Findings
Autry, Daugherty and Richey (2001)	t-test	Telephone interviews and 71 mail surveys	Reverse logistics-related performance is significantly impacted by sales volume, while industry effects significantly impact satisfaction.
Daugherty, Myers and Richey (2002)	Multiple regression	Telephone interviews and 71 mail surveys	The greater the commitment between buyer and supplier for maintaining the reverse logistics program, the greater the value of information system support arrangements to every aspect of performance.
Ravi, Shankar and Tiwari (2005)	Interpretive structural modeling (ISM)	Discussion with six experts	Environmental concern is the primary cause of the initiation of reverse logistics practices in computer hardware supply chains.
Richey, Genchev and Daugherty (2005)	Factor level results followed by between-item results	Pilot interviews and 117 mail surveys in the automotive aftermarket industry	Resource commitment makes reverse logistics programs more efficient and more effective. However, the resources must be used in such a manner as to develop innovative capabilities/approaches to handling returns.
Bernon, Rossi and Cullen (2011)	Qualitative research motivated by a grounded theory approach	Nine group discussions with an average of 18 supply chain managers from different retail sectors and specialist third-party logistics companies	Three overarching management dimensions, i.e. operational performance, organizational integration and management reporting and control, are proposed to manage retail reverse logistics operations.

In line with Mentzer et al.'s (2001) emphasis on supply chain orientation's importance to supply chain management, we believe that a firm's returns management orientation is also a critical resource that will impact reverse logistics performance. Because of the inherent challenges related to reverse logistics, it can be expected that a high level of internal collaboration within the firm can help better align and allocate necessary resources and transform inputs to outputs. Lastly, although the relationship of information support and reverse logistics has been studied before, because of the critical role of information in effective reverse logistics, we intend to reexamine information support as a type of intangible resource in the current research context. Thus, we propose a conceptual model as shown in Figure 1.

Return Management Orientation

In Mentzer et al.'s (2001) seminal article, the concept of *supply chain orientation* is proposed and defined as the recognition by an organization of the systematic, strategic implications of the tactical activities involved in managing the various flows in a supply chain. It is argued that supply chain orientation is critical to successful supply chain management implementation. Similarly, we believe that as a management philosophy and an intangible resource, a firm's returns management orientation has direct impact on its reverse logistics performance. Here we define *returns management orientation* as the recognition by a firm of the strategic importance of returns management to its overall business operations and performance. The focus here is on a firm's

FIGURE 1
CONCEPTUAL FRAMEWORK



orientation but not necessarily its actual actions and behavior.

Previously, researchers have studied the impact of inter-departmental customer orientation on reverse logistics performance (Voss, Calantone and Keller, 2005). Moore, Williams and Moore (2008) once defined returns management orientation as a proactive internal orientation toward the return of goods and services. But their idea was based on consumer perceptions of the firm rather than from the perspective of the firm. In contrast, we propose and examine returns management orientation from a firm strategic point of view because we believe a firm's orientation directly influences its actual strategy formulation and implementation. For example, a growing number of firms no longer perceive returns as extra burdens and they are placing an emphasis on managing returned products as revenue or profit opportunities (Blumberg, 1999). Recognizing the importance of reverse logistics, firms have worked to develop more efficient distribution and channel systems to handle product returns. The development of these distribution systems is the direct result of the directions and guidelines from a firm's top management on how they view returns management, which is referred as return management orientation.

RBV suggests that unique allocation and use of resources is the source for enhanced capabilities and performance (Barney, 1991; Grant, 1991). In the reverse logistics context, when a firm recognizes the importance of returns management and views it as a high priority, it is more likely to invest sufficient resources in this area. Consequently, we can expect that the firm will have better reverse logistics performance. Therefore we propose that:

H_1. A firm's returns management orientation is positively related to reverse logistics performance.

Internal Collaboration

Collaboration can be viewed as an intangible firm resource that can have positive impacts on organizational performance, because collaboration in essence is the type of mechanism embedded in a firm that facilitates the effective alignment of other firm resources. The advantages of collaborations have been discussed by numerous researchers in the supply chain literature (Frohlich and Westbrook, 2001; Christopher, 2005; van Hoek, Ellinger and Johnson, 2008; Daugherty et al., 2009). While supply chain collaborations may occur either internally or externally, the current study focuses on the internal collaboration only due to its exploratory nature. Similar to inter-firm collaboration discussed in previous work (Sanders, 2007; Chen, Daugherty and Landry, 2009; Richey), *internal collaboration* can be defined as a mutually shared process *within* a firm where two or more departments display

mutual understanding and a shared vision, and closely work together to achieve collective goals.

Internal collaboration involves two important aspects of activities: information sharing and process coordination (Chen, Tian, Ellinger and Daugherty, 2010). First, previous research has examined the importance of strong information support to solve planning complexities in the supply chain (Hernández, Poler and Mula, 2011). Due to the nature of information uncertainty of the return products, it is difficult for logistics managers to act proactively and predict upcoming reverse logistics activities. Under these circumstances, decision making information sharing among multiple functional areas becomes crucial.

Second, process coordination is a critical aspect of internal collaboration. Empirical evidence has shown that one of the key drivers of retail reverse logistics volume is poor internal collaboration (Bernon, Rossi and Cullen, 2011). For instance, poor internal coordination between marketing, procurement, and logistics leads to significant levels of returns. Furthermore, returned products are increasingly becoming obsolete. As Fawcett and Magnan (2002) pointed out, many firms are still either working independently or at a low level of cross-functional internal collaboration. As mentioned before, returned products usually engage the issues such as uncertainty, unpredictability, and nonstandard conditions. Thus, it can be expected that effective coordination among relevant internal functional areas can help employees with different expertise address these issues together as a team.

Combining the above discussed two aspects of internal collaboration in the reverse logistics context, we thus propose that:
H_2. Internal collaboration within a firm is positively related to its reverse logistics performance.

Information Support for Returns Management

Information support has gained wide attention in not only management and information system (e.g., Pettinger and Bawden, 1994), but also in other business areas such as product management (e.g., Pehliven and Summers, 2008), human resource management (e.g., Murdick and Schuster, 1983), decision making (e.g., Chorba and New, 1980), and logistics (e.g., Whipple, Frankel and Daugherty, 2002).

In the logistics literature, information support has long been viewed as a critical resource leading to improved firm performance (Mentzer and Firman, 1994; Closs, Goldsby and Clinton, 1997). Information support for returns management plays a particularly important role in the area of reverse logistics. Past research has identified information support's impacts on reverse logistics performance - both economic performance and service quality-related performance (Daugherty, Richey, Genchev and Chen, 2005).

Only with strong information support, can a firm make sound reverse logistics related decisions. By capturing the wealth of information related to the returned products, firms will have the ability to determine the issues and take appropriate actions to address them effectively and efficiently. While the entire process of reuse, repair, refurbishing, recycling, remanufacturing or redesign returns from the end user may create additional value, firms need to recognize the importance of having a sophisticated information support system to facilitate an effective return process management. The lack of an efficient and accurate information support system to authorize, track and handle returns can be a disaster in any firm. Customer relationships could be damaged. A firm's reputation and customer relationships could be seriously jeopardized. Hence, in line with previous research, we propose that:
H_3. A firm's information support for returns management is positively related to its reverse logistics performance.

Reverse Logistics Performance and Market Performance

The connection of logistics performance and firm market performance has been widely recognized in extant literature (Mentzer and Konrad, 1991; Langley and Holcomb, 1992; Lambert and Burduroglo, 2000; Fugate, Mentzer and Stank, 2010). Fugate, Mentzer and Stank (2010) suggested that logistics performance consists of three dimensions: efficiency, effectiveness and differentiation. Here *efficiency* refers to how well the resources expended are utilized (Langley and Holcomb, 1992). *Effectiveness* is the extent to which the logistics functions' goals are accomplished (Mentzer and Konrad, 1991). *Differentiation* means comparing results of logistics activities to competitors (Langley and Holcomb, 1992). When a firm achieves excellent performance on all three dimensions, it can be expected that its market performance will be improved accordingly.

No matter the company size or the industry, reverse logistics could be a key component of logistics activities. While most of today's firms are still struggling with reverse logistics management, those companies that do excel on reverse logistics enjoy a significant advantage. For example, reduced costs, recaptured value, improved customer relationships and customer loyalty can all contribute to the firm's performance in the market. Therefore:

H_4. A firm's reverse logistics performance is positively related to its market performance.

METHODOLOGY

Data Collection

Data were collected in China using Dillman's (1978) approach to survey design and questionnaire administration. Multi-item reflective measures were adapted or developed as necessary to evaluate the proposed constructs (Churchill, 1979). A preliminary questionnaire draft was reviewed by eight US researchers and practitioners who are experts on the topic of interest. Their inputs were used to modify the questionnaire. Then, the English version of the survey was translated to Chinese with the help of five Chinese-native experts (all hold either a PhD in business or an MBA from the USA). The three different versions of the translation were consolidated to into one questionnaire, which was then back-translated into English. This back-translated version was compared with the original version to ensure equivalency of the questionnaires in different languages.

A preliminary list of potential survey participants were randomly selected from the China Enterprises Directory. Executives in supply chain, logistics, and operations were targeted because of their in-depth knowledge of their firms' reverse logistics practices and processes. Each potential respondent was contacted via phone to confirm contact information for mail delivery. Surveys were sent to 500 individuals with follow-up phone calls at two-week intervals. In the designated data collection period, a total of 146 survey responses were received. Nineteen responses were excluded from the analysis because of the following reasons: (1) too much missing data in the response; or (2) the respondent's position within his/her firm was not considered appropriate to respond to the survey questions. Therefore, the data collection resulted in an effective response rate of 25.4% (127/500).

Non-response bias was tested in two ways. First, early responses were compared with late responses for all items using the approach suggested by Armstrong and Overton (1977). Second, all participants were compared with 30 randomly selected non-participants on ten non-demographic questions in the survey using ANOVA (Mentzer and Flint, 1997; Lohr, 1999). Neither method indicated significant differences, suggesting that non-response bias was not a threat in the current study.

Measurement Scale Development

The final questionnaire was comprised of multi-item reflective measures either adapted from existing scales or developed as necessary to evaluate the constructs of interest (Churchill,

TABLE 2
CONSTURCT MEASURMENT AND DESCRIPTIVE STATISTICS

Constructs and Measurement Items	Mean	Std. Dev.
- *Returns Management Orientation* (Cronbach's Alpha = 0.895, Composite reliability = 0.898)		
Please indicate how the returns management is viewed within your company.		
RO1. Returns management is a big burden for our company.	4.89	1.48
RO2. We will try our best to stop customers from initiating a return. (reverse coded)	5.14	1.51
RO3. Returns are inevitable; therefore we need to take a proactive attitude.	5.50	1.36
RO4. Returns are a great source to identify improvement opportunities, therefore we should utilize this source properly.	5.41	1.44
RO5. If effectively managed, returns management will contribute to our company' long-term growth.	5.37	1.35
RO6. Returns management is a great approach to developing superior customer relationships.	5.44	1.18
- *Internal Collaboration* (Cronbach's Alpha = 0.908, Composite reliability = 0.911)		
Source: Stank, Daugherty, and Ellinger (1999)		
Please indicate your level of agreement with the following statements regarding your firm's internal collaboration.		
Within our company, different departments		
IC1. ... work together to achieve goals collectively.	5.62	1.12
IC2. ... develop a mutual understanding of responsibilities.	5.35	1.14
IC3. ... share ideas, information, and/or resources.	5.22	1.14
IC4. ... work together as a team.	5.06	1.31
IC5. ... conduct joint planning to anticipate and resolve operational problems.	5.30	1.21
- *Information Support* (Cronbach's Alpha = 0.902 , Composite reliability = 0.909)		
Source: Whipple, Frankel, and Daugherty (2002)		
Please indicate your level of agreement with the following statements regarding your company's reverse logistics related information support.		
IS1. Our company has relevant information available to support reverse logistics decision-making.	4.09	1.67
IS2. The information regarding reverse logistics in our company is accurate.	3.94	1.54
IS3. The information regarding reverse logistics in our company is provided in a timely manner.	3.93	1.48
- *Reverse Logistics Performance* (Cronbach's Alpha = 0.907, Composite reliability = 0.909)		
Source: Fawcett and Smith (1995)		
Please compare your firm's reverse logistics performance in the last year to major competitors.		
RP1. Overall reverse logistics performance	4.40	1.12
RP2. Reverse logistics productivity	4.64	1.24
RP3. Reverse logistics cost reduction	4.37	1.17
RP4. Reverse logistics timeliness	4.72	1.19
RP5. Reverse logistics reliability and consistency	4.81	1.11
- *Market Performance* (Cronbach's Alpha = 0.893, Composite reliability = 0.896)		
Source: Claycomb et al. (1999) and Jaworski and Kohli (1993)		

Table 2 Continued

Please compare your firm's market performance in the last year to major competitors.		
Our firm's market performance in last year compared to major competitors		
MP1. Sales volume	5.31	1.05
MP2. Profit margin	5.27	1.01
MP3. Return on investment (ROI)	5.17	1.25
MP4. Customer satisfaction	5.09	1.54
MP5. Overall firm competiveness	5.44	1.38

1979). All survey items used a seven-point Likert-type scale. Table 2 provides detailed information about these measurement items and related basic descriptive statistics.

Since no existing measurement was identified during review of the literature, a returns management orientation scale was developed following the approach suggested by Churchill (1979). First, relevant literature was reviewed and utilized as the foundation to capture the essence of returns management orientation with the new scale. Then, interviews with industry experts provided an additional basis for item generation and modification. The final survey included six items related to returns management orientation. Exploratory factor analysis indicates that they load on one factor. The means for the six items ranged from 4.89 to 5.50 (1 = strongly disagree, 4 = neutral, and 7 = strongly agree), indicating a fairly high level of returns management orientation among responding firms.

The scale for internal collaboration within responding firms was adopted from Stank, Daugherty, and Ellinger (1999). These items were anchored at 1 = strongly disagree, 4 = neutral, and 7 = strongly agree. The range of means for the measurement items of internal collaboration were 5.06-5.62, also reflecting a fairly high level of collaboration across different departments within the responding firms.

Information support for the returns management construct was assessed using items adapted from Whipple, Frankel, and Daugherty (2002). The means for the three items ranged from 3.93 to 4.09 (1 = strongly disagree, 4 = neutral, and 7 = strongly agree), indicating a low level of information support for returns management within the firms. This might be due to the challenges related to collecting and using returns information.

The measure for reverse logistics performance was adapted from Fawcett and Smith (1995). Respondents were asked to evaluate their firms' reverse logistics performance relative to their major competitors. The mean responses of measurement items ranged from 4.37 to 4.81 (1 = much worse, 4 = about the same, and 7 = much better). Compared to respondents' returns management orientation, it appears that respondents are not very positive about their companies' actual reverse logistics performance.

Market performance was measured using items adapted from Jaworski and Kohli (1993) and Claycomb, Droge and Germain (1999). Because accurate performance data were not publicly available for most Chinese companies, subjective measures of performance are considered appropriate in this situation (Dess and Robinson, 1984). Further, in existing literature, Ketokivi and Schroeder (2004) concluded that reliability and validity of perceptual performance measures are satisfactory based on their multitrait multimethod analysis. Respondents were asked to indicate the performance of their firms in the past year compared to the performance of their major competitors in certain areas (1 = much worse, 4 = about the same, 7 = much better). The mean values for the four items ranged from 5.09 to 5.44, indicating a slightly better market

performance for the respondents relative to their major competitors.

Measurement Scale Assessment

As shown in Table 2, Cronbach's alpha values were calculated for each scale and all values exceeded the suggested 0.7, demonstrating a high level of reliability (Nunnally, 1978). The constructs' reliability was further tested with the approach recommended by Fornell and Larcker (1981), which does not assume all loadings are the same. Again, all composite reliability values were well above the suggested 0.7 level. A confirmatory factor analysis (CFA) using maximum likelihood estimation was also conducted with AMOS 20.0 to assess and validate the constructs (Gerbing and Anderson, 1988). All latent variables were allowed to correlate with each other. Results of the CFA measurement model are shown in Table 3. Important fit indices examined include chi-square/degree of freedom ratio (CMIN/DF), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The relative chi-square value (CMIN/DF) of 1.683 falls into the recommended range of 3-1 (Bollen and Long, 1993). The current model has a CFI value of 0.923, above the suggested 0.9 threshold value (Bentler, 1990). The RMSEA value of 0.074 is also within the suggested range (less than 0.08) for good model fit (Browne and Cudeck, 1993). The critical indices demonstrate good fit between the measurement model and the data.

TABLE 3
MEASUREMENT MODEL TEST RESULTS

Measurement Items	Standardized Weight	Critical Ratio
RO1	0.762	(Fixed)
RO2	0.708	8.067
RO3	0.715	8.160
RO4	0.796	9.220
RO5	0.828	9.643
RO6	0.811	9.413
IC1	0.801	(Fixed)
IC2	0.849	10.887
IC3	0.905	11.844
IC4	0.814	10.289
IC5	0.723	8.812
IS1	0.794	(Fixed)
IS2	0.950	12.101
IS3	0.880	11.420
RP1	0.728	(Fixed)
RP2	0.794	8.858
RP3	0.749	8.329
RP4	0.878	9.836
RP5	0.921	10.297
MP1	0.853	(Fixed)
MP2	0.805	10.892
MP3	0.849	11.840
MP4	0.820	11.218
MP5	0.642	7.898

Fit statistics: Chi-square = 407.321 ($df = 242$, $p < 0.001$), CMIN/DF = 1.683, CFI = 0.923, RMSEA = 0.074.

Convergent validity is supported when factor loadings demonstrate that the measurement items load significantly on their designated latent variables (Anderson, 1987). The standardized regression estimates in Table 3 provide evidence of construct validity. All item loadings for each of the constructs are significant at 0.05 level with critical ratio (CR) values larger than 1.96.

According to Hair et al. (1998), factor loadings of 0.50 or greater are considered practically important, and factor loadings of 0.50 for a sample size of 120 are considered statistically significant. Therefore, all five constructs thus have met the convergent validity requirements (Gerbing and Anderson, 1988).

Discriminant validity assesses whether two or more constructs are the result of a single underlying construct (Devellis, 1991). Anderson and Gerbing's (1988) approach was taken and this test was performed for one pair of factors at a time because a non-significant value for one pair of factors can be obfuscated by being tested with several pairs that have significant values. All unconstrained models had significant lower chi-square values than the constrained models, suggesting that all five constructs of interest possess discriminant validity. In addition, average variance extracted (AVE) of all the constructs exceeded the shared variances (squared correlations) between each pair of the constructs, further supporting the discriminant validity of the constructs (Fornell and Larcker, 1981).

Hypothesis Testing Results

The proposed conceptual model was tested with structural equation modeling (SEM) by using AMOS 20.0 software. Results are presented in Table 4, and key indices suggested satisfactory model fit with CMIN/DF = 1.853, CFI = 0.902, and RMSEA = 0.076. Path coefficients, standardized regression weights with relevant CRs and p-values were then examined to test the hypotheses. H1 examines the relationship between returns management orientation and reverse logistics performance. The results supported the hypothesized positive linkage with standardized regression weight = 0.316, CR = 3.161, and $p = 0.002$. H2 evaluates the relationship between internal collaboration and reverse logistics performance, and the analysis supports this hypothesized relationship (standardized regression weight = 0.446, CR = 4.272, and $p < 0.001$). The SEM analysis also yielded significant results for H3, which confirms the positive relationship between information support and reverse logistics performance (standardized regression weight = 0.334, CR = 3.369, and $p < 0.001$). Finally, the

TABLE 4
STRUCTURAL MODEL RESULTS

Path	St. Weight	CR	*p*	Note
H1: Returns Management Orientation → Reverse logistics Performance	0.316	3.161	=0.002	Supported
H2: Internal Collaboration → Reverse Logistics Performance	0.446	4.272	<0.001	Supported
H3: Information Support → Reverse Logistics Performance	0.334	3.369	<0.001	Supported
H4: Reverse Logistics Performance → Market Performance	0.469	4.722	<0.001	Supported

Fit statistics: Chi-square = 453.928 ($df = 245$, $p < 0.001$), CMIN/DF = 1.853, CFI = 0.902, RMSEA = 0.076.

positive relationship between reverse logistics performance and market performance is supported by H4 test results (standardized regression weight = 0.469, CR = 4.722, and $p < 0.001$).

DISCUSSION AND IMPLICATIONS

The above discussed hypothesis testing suggest that all proposed relationships are supported with the empirical data collected from China. Building upon existing research, our study does make several important contributions regarding the antecedents of reverse logistics.

First, we conceptualized and operationalized a new concept related to reverse logistics: returns management orientation. While Mentzer et al. (2001) proposed a similar concept – supply chain orientation – in the general supply chain management context, the new returns management orientation is specific for the reverse logistics context. Our empirical test suggests that the newly developed measurement scale is reliable and valid. Furthermore, the hypothesis testing indicates that returns management is a significant predictor of reverse logistics performance. This result has important implications for both researchers and practitioners. The newly conceptualized construct provides a new avenue for scholars to explore the factors that may influence reverse logistics. The result also suggests that establishing an organizational level of recognition of the importance of returns management can help firms achieve better reverse logistics performance.

Second, we propose that internal collaboration is helpful for improving reverse logistics performance and this is supported by our empirical testing. It is widely recognized that reverse logistics is more challenging than forward logistics due to the uncertainties involved. However, extant literature has not examined cross-functional collaboration's impact on reverse logistics. Our study made the first attempt to empirically investigate this relationship, and the result shows that by fostering collaborative relationships across functional areas within a firm, it is more likely to achieve better reverse logistics performance. The reason could be that collaboration helps relevant departments to more effectively align the firm's resources, jointly develop unique capabilities, and share the responsibilities in tackling reverse logistics related challenges.

Third, reliable and accurate information is critical to effective reverse logistics management. Although our responding firms demonstrated a relatively low level of information support for returns management, the study results do confirm that the firms that have better information support can achieve improved reverse logistics performance. Therefore, our study not only confirmed this positive relationship in the China context, it also reemphasizes the importance of information support.

Lastly, the positive relationship between a firm's reverse logistics performance and market performance is confirmed in our empirical study. This should be encouraging news for managers, because the effort put into reverse logistics improvement is likely to result in enhanced overall firm market performance, which is the ultimate goal of any firm.

CONCLUSIONS AND LIMITATIONS

Our research contributes to the body of knowledge on reverse logistics by examining several key antecedents of reverse logistics performance. Our study brings these factors to researchers and managers' attention and they present great opportunities to improve a firm's reverse logistics management. However, some limitations of the current study should also be discussed. First, we only examined the impact of internal collaboration due to the exploratory nature of the study, but external collaboration may also be a key factor for reverse logistics. Because today's logistics (including reverse logistics) activities often occur across firms, the collaborative relationships between supply chain partners should also be a relevant factor. Second, our study only used survey data that are based on

managers' perceptions. While we have made efforts to ensure reliability and validity, it is still worthwhile for future research to incorporate other methods and triangulate the current study.

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BIOGRAPHIES

Enping (Shirley) Mai is Assistant Professor of Marketing and Supply Chain Management at East Carolina University. Her current research interests include customer base analysis, relationship marketing, retailing and quantitative models in marketing. Her research articles have been published in several academic journals including *Journal of Business Research*, *Journal of Statistical Planning and Inference*, and others. E-Mail: maie@ecu.edu.

Haozhe Chen is Assistant Professor of Marketing and Supply Chain Management at East Carolina University. He has published over twenty articles in *Business Horizons*, *Industrial Marketing Management*, *The International Journal of Logistics Management*, *The International Journal of Physical Distribution & Logistics Management*, *Journal of Business Logistics*, *Journal of Transportation Management*, and *Transportation Research: Part E*. His industry background includes eight years managerial experience in international trade business. E-Mail: chenh@ecu.edu.

Kenneth Anselmi is Associate Professor of Marketing and Supply Chain Management at East Carolina University. His research interests include supply chain relationships, governance, and performance. He has published in academic journal including *Journal of Business Logistics*, *Journal of Business Research*, and others. He spent eighteen years in industry in product and general management, in both consumer and industrial markets. E-Mail: anselmik@ecu.edu

THE PHYSICAL DISTRIBUTION SECURITY SYSTEM: WHO IS AFFECTING THE VULNERABILITY OF GOODS TRANSPRTATION?

Luca Urciuoli
Cross-Border Research Association
University of Lund, Sweden

ABSTRACT

The purpose of this study is to explore the vulnerability of physical distribution networks to antagonistic threats. Previous research identifies globalization and Just in Time (JIT) as the main causes of vulnerability. However, cargo crime has always existed, even before the identification of these trends. In this explorative study new factors are brought to light. In particular, it appears that stakeholders' dynamics are influencing the level of security.

INTRODUCTION

The vulnerability of supply chains to antagonistic threats, and more specifically their distribution networks, has become a major concern for managers (Spekman and Davis, 2004; Hintsa, 2011). This concern is supported by available statistics stating that industries are losing significant amounts of money and brand image due to theft, counterfeiting and pilferage of goods stored at terminals or in transport. For instance, statistics recently released by the European Union (EU) Parliament indicate that stolen lorries and goods in the EU add up to some E8.2 billion per year (European Parliament, 2007). In the United States (U.S.) the Federal Bureau of Investigation (FBI) has reported cargo theft in the range of $10-30 billion per year (Anderson, 2007). Counterfeiting is also a major concern for industries costing approximately $176 billion per year (Rodwell, et al., 2007).

The insecurity of supply chains is also of concern to governments. Recent terror events around the world (New York 2001, Madrid 2004 and London 2005) have increased the fear that: 1) products moved in supply chains could be contaminated or substituted with life-hazardous ones, 2) distribution chains could be used to smuggle nuclear weapons or terrorists, and 3) vehicles transporting dangerous goods or weapons for mass destruction could be used as a weapon against sensitive targets (Rice and Spayd, 2005). As a consequence, governments are actively working to secure their borders and inland transportation systems by setting policies and standards that ultimately demand supply chain companies operate under heightened security (Sheffi, 2001).

Previous research points out the importance of risk management approaches to deal with supply chain security (Giunipero and Eltantawy, 2004; Spekman and Davis, 2004). Spekman and Davis (2004) identify six categories of supply chain related risks and illustrate how to classify them. Giunipero and Eltantawy (2004) emphasize the importance of risk management approaches to evaluate end-to-end technology solutions. Some authors have developed supply chain security frameworks and illustrated future research needs (Autry and Bobbitt, 2008; Williams et al., 2008). Autry and Bobbitt (2008) have developed a framework to address how companies approach the mitigation of supply chain security by means of supply chain risk management. Williams et al. (2008) performed a literature review to categorize Supply Chain Security (SCS) factors and to identify a research agenda focusing on intra-organizational activities and quantitative approaches, making explicit the linkage between security and efficiency.

Few researchers have undertaken exploratory studies to discover which stakeholders determine the vulnerability of distribution networks to antagonistic threats. Some authors point out globalization and JIT as the main causes of the increased vulnerability (Crone, 2006; Khemani, 2007). Yet security problems in supply chain operations were known to exist for many years before the adoption of globalization and JIT principles. Other authors emphasize the importance of top management commitment, strategic priority, governmental regulation, security partnerships and willingness to pay as facilitators/inhibitors of security (Autry and Bobbitt, 2008; Voss et al., 2009b). However, none of the known authors has attempted to map a framework that shows which stakeholders affect the security of physical distribution networks. Hence, the suggestion for an additional hypothesis about other reasons that may actually be significant factors affecting the insecurity of physical distribution networks.

The purpose of this study is to perform an explorative inquiry to understand which stakeholders are influencing the security of physical distribution chains and most importantly how. By means of observations and semi-structured interviews, a framework for security in physical distribution networks is outlined and the interaction phenomena and dynamics among actors are determined. Finally, this paper discusses management implications and outlines the importance of further research on the physical distribution security topic.

METHODOLOGY

A qualitative methodology is used in this investigation. This method has been chosen because of the explorative nature of this study and also due to the novelty of the research topic in the transportation management literature, and the consequent lack of research constructs (Denzin and Lincoln, 2000; Autry and Bobbitt, 2008). The methodology consisted of three main phases relating to an approach to the literature review, a data collection plan, and methods of data analysis.

Approach to Literature Review

A literature search was performed within available academic journals to investigate previous security research in the fields of supply chain management, and transportation and logistics management. Keywords used for the search were "*transportation security,*" "*supply chain security,*" "*physical distribution security,*" and "*logistics security.*" Other secondary data from the internet as well as from trade magazines were incorporated into the empirical data collection. A preliminary system framework was developed based on the findings in the academic literature. Four main stakeholders, within and outside the supply chain, were identified: supply chain operators (including goods owners, transport and logistics providers), security solutions providers, criminals, and governments.

Data Collection Plan

Non-participant observations were made during a workshop and a seminar organized in Sweden and allowed for a better understanding of how the security problem is perceived by Swedish actors. The workshop was attended by 67 individuals that were divided into groups and encouraged to discuss the factors influencing the insecurity of distribution networks. The seminar was attended by 42 managers. It was soon apparent that the security system was more complicated than the one hypothesized after the literature review. As a consequence, further actors were added to the framework: including law enforcement agencies, insurance companies, voluntary security certification bodies, and contract legislation bodies.

Thereafter, to enhance the comprehension of the roles of these actors in the Physical Distribution Security System (PDSS) and their reciprocal interactions, a total of 16 interviews were conducted, four unstructured and 12 semi-

TABLE 1
DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

	Industry	Position
Respondent 1	Electronics Manufacturer	Security manager
Respondent 2	Transportation	Lawyer
Respondent 3	Road Carrier	Security Manager
Respondent 4	Logistics Service Provider	Global Security Manager
Respondent 5	Food Products	Security Manager
Respondent 6	Pharmaceutical	Security Manager
Respondent 7	Cash Transportation	Security Manager
Respondent 8	Law Enforcement Agency	Police inspector
Respondent 9	Security Certification	International Sales Manager
Respondent 10	Logistics Service Providers	Regional Security Manager
Respondent 11	Security Solution Provider	Commercial Director
Respondent 12	Road Carrier	CEO
Respondent 13	Security Solution Provider	CEO
Respondent 14	Shipping company	Senior Director
Respondent 15	Shipping Company	Corporate Security Manager
Respondent 16	Insurance Company	Claims Manager

structured. The respondents to be interviewed were chosen from a convenience sample of individuals joining a Scandinavian research project dealing with transportation security. Table 1 shows the demographic characteristics of the sample interviewed.

The interviews were completely unstructured in the beginning of the research to gain a better understanding of key topics and add the widest range of possible information. These interviews were meant to let the respondents freely discuss the main causes of the vulnerability of physical distribution networks to antagonistic threats. Once these topics became more defined, semi-structured interviews with more pointed questions were used. The scheme used for the semi-structured interviews is provided in Appendix A. After eight interviews it was clear that the factors highlighted by the respondents corresponded with those identified during the observation sessions. Hence, four more interviews were carried out to ensure saturation of the data before discontinuing data collection (Glaser and Strauss, 1967; Easterby-Smith et al., 1991).

Methods of Data Analysis

Using content analysis, themes and constructs were derived from the interviews and merged with those found in the literature search. To enhance validity of the findings, the following quality criteria were considered during the data collection and analysis: credibility, dependability, transferability and confirmability (Guba and Lincoln, 1989; Lambert et al. 2004; Autry and Bobbitt, 2008). Credibility concerns how the personal constructs of the respondents match the researchers' perceptions. The observations made at the workshop were compared with the results obtained by a consulting firm that was responsible for documenting the workshop. In addition, since recording of interviews was not allowed, the answers provided during the interviews were verbally repeated to the respondents to confirm the interpretation provided by the researcher.

Dependability refers to the temporal stability of the data. The data collection was initiated with unstructured interviews and improved with the development of a semi-structured questionnaire. To enhance the stability of the data, only the

responses from the semi-structured interviews were used in the analysis. Transferability is the ability to apply the results to other contexts. The interviews were performed with managers belonging to a wide set of organizations within and outside Sweden. Likewise, the seminar and workshop where observations were performed included representatives from diverse logistics companies in Sweden. Finally, confirmability is the extent to which the findings reflect the data collected. This was ensured by keeping notes of the data collected at the observations and during the interviews.

LITERATURE REVIEW

The literature scanned in peer-reviewed logistics, transportation and supply chain management journals and conference proceedings is reported in this section by highlighting the main stakeholders that influence the security of distribution networks: 1) supply chain, logistics and transport operators, 2) security solutions providers, 3) criminals, and 4) governments.

Supply Chain, Logistics and Transport Operators

The influence of supply chain, logistics and transport operators is identified by previous research exploring the following factors: globalization and JIT trends, security partnerships, risk sharing among transport purchasers and sellers, and willingness to pay. Globalization and JIT trends are exposing supply chains to higher risks. Moving products within and to foreign countries where companies lack knowledge of local culture, authorities and legislation makes it difficult to protect cargo (Crone 2006; Khemani 2007; Sheffi, 2001). Crone (2006) compares today's globalization strategies to the classic story of the Trojan War where the Trojans "failed to see the risks of what appeared to be a benefit." Just in Time (JIT) trends tighten supply chains in a way that increases the consequences of disruptions and thereby increasing the risks of security incidents in distribution networks (Khemani, 2007). According to an analysis performed by Wilson (2005), JIT manufacturing and deliveries, and streamlined order fulfilment techniques, can reduce in-transit and on-hold inventories but can also severely increase the magnitude of disruptions.

In Autry and Bobbitt (2008) as well as in Voss et al. (2009b) the importance of security related partnerships covering contractual agreements and risk and reward sharing among actors is emphasized. The authors maintain that encouraging collaboration among supply chain members and specifying security requirements in contractual agreements may improve the security of distribution chain assets and operations. In addition, risk sharing and rewards are also fundamental practices to stimulate stakeholders into taking their share of responsibility and working actively with security.

Only one article explored an issue concerning owners' willingness to pay for goods as an inhibitor of physical distribution security (Voss et al., 2009a). According to the authors supply chain firms are not always willing to pay for firms offering advanced security transportation. By means of a survey sent to manufacturing industries in the food sector, the authors demonstrate the positive relationship between concern over security incidents and preferences for advanced security as well as willingness to trade off price for advanced security. The findings show that price, and delivery reliability, is more important than security when contracting suppliers. Hence, security is not a top priority when selecting distribution carriers.

Security Solutions Providers

The importance and the fundamental role of security solution providers to the insecurity of physical distribution are emphasized by several authors. Downey (2004) encourages industry

leaders to identify research and technology resources that can minimize the threats along distribution chains. According to the author, technology can fight the "*asymmetrical threat posed by terrorists,*" which consists of enemies seeking supply chains' weak points instead of trying "*to overcome them by using superior force.*" Sheffi et al. (2003) propose technological solutions for preventive and recovery operations to be implemented in three areas: physical security, information security and freight security. Autry and Bobbitt (2008) point out the importance of security-dedicated communication and technology, i.e. the implementation of GPS monitoring, RFID and similar technologies to monitor and enhance security in supply chains.

Another issue found in previous research is the impact of security solutions on the efficiency of supply chains. Some authors believe that the introduction of security in physical distribution may bring higher efficiency, but others don't. Sheffi (2001) states that security enhancement can also bring "collateral benefits" such as trade facilitation, asset visibility and tracking, faster standard development, etc. Other authors assert that in some cases security measures conflict with the concepts of lean logistics. According to Powanga (2006), basic logistics performance indicators can be expressed as revenues (order fulfilment), operating costs (in transit inventory, transportation, insurance premiums, buffer stock carrying costs), fixed costs (facilities, capital utilization) and working capital (buffer stock levels). Likewise, Mazeradi and Ekwall (2009) show, by means of a survey, how the implementation of the ISPS-code may increase paperwork and slow down processes in port terminals.

Criminals

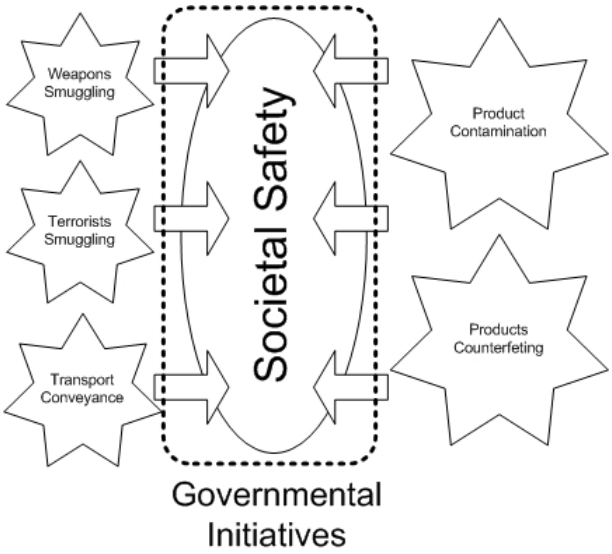
The behaviour of criminal groups targeting physical distribution is also a factor that may discourage the enhancement of security. Ekwall (2009) affirms that diverse typologies of crime may be related to attacks against physical distribution: situational crime, professional crime and crime displacement effects. Situational crime is determined by a rational choice made by weighing diverse factors such as effort, potential payoff, risk of apprehension and punishment, and individual needs. A variation of situational crime is the professional theft that is based on methodical plans and takes advantage of high-tech methods to defeat protection measures (Ekwall, 2009; Ekwall and Lumsden, 2007). Ekwall (2009), according to the principles of the routine activity theory, identifies three elements characterizing cargo theft: a perpetrator, a supply chain (the criminals' target) and the lack of protective measures. Insufficient protection in one of the links of a distribution chain will determine a weak point and the consequent attack (crime displacement effect). Hence, the low protection of distribution chains makes them attractive to criminals. At the same time, the opportunistic behaviour of criminals may discourage operators from protecting their assets.

Governments

Governments are mainly afraid of the terror threats hidden in the vulnerability of supply chains. These hidden threats include the smuggling of weapons or terrorists, contamination or counterfeiting of products and usage of transport conveyances as weapons. Therefore diverse initiatives have been started by governments around the world to prevent catastrophic consequences for society. See Figure 1:

The first security enhancements were implemented in the air sector a few months after the attacks in New York. The sea sector followed almost immediately when a standard framework for the identification and assessment of vulnerabilities in sea transportation and port facilities was included in the International Ship and Port Facility Security Code (ISPS) (Katarelos and Alexopoulos, 2007; Bichou, 2004).

FIGURE 1
THREATS TO SOCIETAL SAFETY



The involvement of governments is mentioned in Sheffi (2001) as well as in Sheffi et al. (2003). According to these authors, the upcoming security regulations for C-TPAT (Customs-Trade Partnership Against Terrorism), the AEO (Authorized Economic Operator) and the ISPS code could force many distribution firms to enhance their security levels.

DATA ANALYSIS

In this section the findings from the literature review are combined with the empirical data collected from observations and interviews. Combining the literature review and the observations, some of the following stakeholders emerged as key players in security. The first section which follows deals with findings from the observations specifically. The second section deals with findings that came directly from interviews of the actors.

Observations

The observations were carried out on the occasion of two events. First, a workshop organized by a Swedish Law Enforcement Agency. And secondly, at a seminar organized by one of the main Scandinavian insurance companies. During these events, issues related to the increasing attacks against distribution networks were discussed and possible solutions were elaborated on. Following are some of the findings that emerged by organizational type. These organizations include several new ones that were brought to light during the workshops and these include law enforcement agencies, voluntary certification organizations, insurance companies, and contract legislation bodies.

Supply Chain, Logistics and Transport Operators
The central role of supply chain, logistics and transport operators is confirmed by the high attendance of representatives at the workshops. However, only the construct related to the "willingness to pay for security" of transport buyers was discussed. The rest of the constructs generated during the literature review were not directly mentioned in the workshops.

Security Solutions Providers
During the workshops the importance of security solutions to protect cargo during transit was highlighted by the participants; however no detailed discussion was undertaken on the topic. On the contrary, secondary data present extensive discussions on this issue. Most of the literature found concerned the "*collateral*

benefits" brought by security investments such as trade facilitation, asset visibility and tracking, faster standard development, etc. (Rice and Spayd, 2005). The same concept of "*collateral benefits*" is discussed by Peleg-Gillai et al. (2006) and Closs and McGarrell (2004). Willys and Ortiz (2004) emphasize that efficiency and security in supply chain transportation are closely interrelated. Since higher security may reduce customs delays so may the higher transparency of information of goods flows reduce shipping costs and time. The same literature acknowledges the difficulty in reliably evaluating security investments. According to Rice and Spayd (2005) return on investments are difficult to estimate because of the complexities in evaluating how well a security solution can prevent a problem from occurring, how frequently this would happen, and how cost savings will be determined.

Government Authorities

The role of governments is mentioned by many authors in previous literature (Closs and McGarrell, 2004; Abbott et al., 2003; Sheffi et al., 2003; Rice and Spayd, 2005; Willys and Ortiz, 2004). All the authors are convinced that authority regulations may disrupt transportation flows due to Customs' delays; even though security will be enhanced. In addition, some authors also point out that the absence of business cases, solid ROIs and clear guidelines from governments, is frightening many operators and may result in declining interest towards the enhancement of distribution security (Lee, 2004; Rice and Spayd, 2005). However, the role of governments was not mentioned in any of the workshops.

Law Enforcement Agencies

The role of law enforcement agencies in preventing attacks, as well as in supporting operators efforts in recovering their shipments, was mentioned in both workshops. During the events, representatives from law enforcement organizations encouraged transportation companies to report cargo theft and improve collaboration with law enforcement. Law enforcement agencies were also criticized by the participants since they don't often prioritize cargo theft among their activities nor do they properly prosecute cargo criminals. The issue concerning the low prosecution of criminals has also been found in articles published in trade journals (Badolato, 2000; Anderson, 2007).

Voluntary Certification Organizations

Many participants to the workshop mentioned the existence of TAPA EMEA (Transported Asset Protection Association) - an organization supporting transportation buyers and sellers with recommendations and guidelines to secure transportation assets (TAPA EMEA, 2008). Participants believed that the implementation of routines and specific technologies suggested by the organization may enhance physical distribution security. Other secondary data mention the International Standards Organization (ISO) certification as a means to enhance supply chain security. The ISO proposes best practices and minimum requirements for supply chain management, recommends technologies (i.e. mechanical locks or electronic seals), and establishes communication standards for radio frequency based security solutions (Liard, 2007; ISO, 2008).

Insurance Companies

The role of insurers concerns the coverage of the risks related to loss or damage of the goods during a transportation assignment. All the mentioned parties involved in goods transportation, including consignors and consignees, LSPs and transport carriers, have the opportunity to buy property or liability insurance, according to what is stated in the contract. Likewise, stakeholders have the option of retaining part of these risks so as to pay lower premiums.

The role of the insurance companies is confirmed in both the events where observations were performed. The data collected actually indicate that many operators blame insurance companies for increased security problems. Managers were expecting not only financial solutions but also practical support in choosing security measures and defining security levels in transport operations. Another finding from the workshops is that if security requirements are not specified in contracts, operators with a risk-seeking attitude can trade off the costs for insurance premiums and excesses with the costs of implementing security solutions.

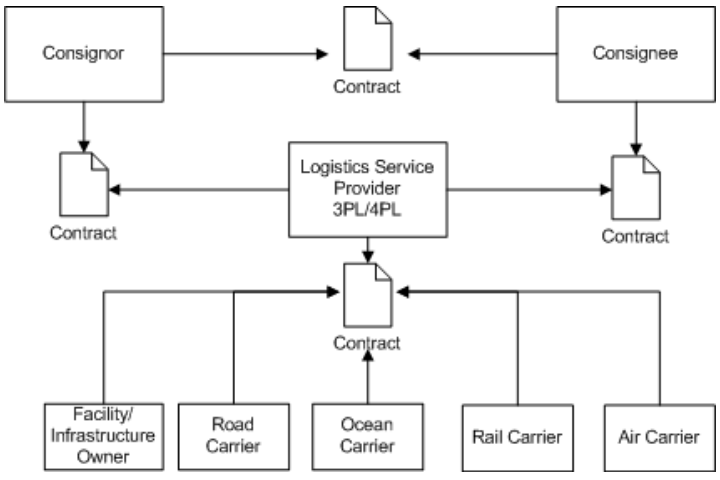
Other secondary data used for the analysis and related to insurance companies concern mostly the procedures to sub-contract carriers, transfer risks as well as current regulations to define cargo liabilities (Stöth, 2004; ICC, 2008; NSAB, 2000).

Contract Legislation Bodies

Participation in the workshops also unveiled the importance of contract legislation in the definition of security requirements in distribution operations. According to secondary literature, the relationships among actors involved in a shipment are regulated by specific laws. While transportation disputes are stated in international conventions and rules (i.e. CIM, CMR conventions), logistics matters concerning such operations as inventory management, labelling or packaging are not put under any convention and are primarily determined by industrial organizations or private agreements (i.e. Incoterms 2000 and NSAB 2000). As has already been mentioned, different agreements have to be executed to move the goods from the consignor to the consignee. See Figure 2 below. These can be performed in verbal or written form (Stöth, 2004).

Existing regulations like Incoterms or NSAB 2000 focus on the transfer of risks among actors and indicate Combiterms as a means to split costs among players. In addition, in case of loss these agreements oblige the reimbursement of the goods invoice value plus 10% for indirect costs (ICC, 2008; NSAB, 2000). In these agreements, nothing is specified about security requirements for transportation assignments and how related costs should be split among actors.

FIGURE 2
CONTRACTUAL RELATIONSHIPS



(Adapted from STÖTH, 2004, pp. 22)

The findings from the observations also reveal that it is crucial to specify security requirements in the contracts between transport buyers and sellers. However, the legislation bodies, today, don't provide any support for this and operators perceive this process as complicated and resource and time demanding. As a consequence, often verbal agreements are preferred by companies.

Interviews of Organizations

The interviews highlighted the following stakeholders as influencing the security of physical distribution networks: 1) law enforcement agencies, 2) supply chain, logistics and transport operators, 3) criminals, 4) contract legislation bodies and 5) other authorities.

Law Enforcement Agencies

The interviews confirmed the relevance of law enforcement agencies in the discussion concerning physical distribution security. According to three of the respondents, the problem faced today is that the amount of theft claims received from transport operators is not high enough to justify an increase of resources to combat criminals. At the same time, transport operators are afraid to show their brands in theft statistics. In addition, they feel that this is only an administrative cost that will rarely lead to cargo recovery.

"Transport operators are afraid to show their brand names in theft statistics and therefore they don't announce the problem to the police that in its turn doesn't have the real picture of the situation".

"Operators are not claiming enough, thus we cannot allocate resources adequately."

"Our company has a good cooperation with the national law enforcement agency. However we know that many thefts are not reported by other companies. This makes it hard to combat cargo theft."

Two respondents also said that to reduce the increase in cargo theft experienced during recent years, Swedish law enforcement agencies must develop programs to increase awareness about the cargo security problem.

"The activities organized by the law enforcement agency have contributed to increase awareness of the cargo theft problem"

"Thanks to the workshops we have had the possibility to come closer to the law enforcement agency and strengthen collaboration"

Finally another problem mentioned in the interviews was that existing laws to prosecute criminals are not strong enough to discourage thieves from taking chances in assaulting cargo moving in distribution networks. As a consequence, it is not only difficult to capture thieves but also to keep them in custody.

"Criminals attack according to a trade-off between risks and revenues. The situation today is that supply chains are easy and profitable targets. At the same time prosecution is not severe enough to discourage perpetrators."

"Once criminals are captured, we can keep them in custody for a limited amount of time. So they are back in business after only few months."

"Prosecution should be more severe to discourage criminals attacking our supply chains."

Supply Chain, Logistics and Transport Operators

The role of supply chain actors, including logistics and transport providers, is also outlined in the interviews. The complexity necessary to develop and formalize agreements among all the actors, especially with the physical carriers (road, rail, sea, and air carriers), or between them (a carrier contracting another carrier) is also discussed in the interviews. Transportation carriers are companies owning fleets of vehicles including vessels, airplanes, trucks, and in some cases even trains (companies are usually state owned). Often, within the road sector, the transport carrier can even be the driver and his vehicle. Therefore the complexity and administrative burden experienced, concerning laws, regulations and standard contracts, makes informal verbal agreements more congenial.

"It happens that some carriers mention and stress the complexity of the contracts or standard agreements. Large industries or LSPs can handle them but often small-medium transport carriers can prefer verbal agreements"

"According to our experience the standard agreements are perceived as too complex and it has happened that carriers prefer verbal agreements"

"We know that in some cases carriers are engaged with verbal agreements"

"As an insurance association we have had cases in which transportation carriers had been engaged with verbal agreements"

Four managers mentioned the difficulties encountered in raising their prices to enhance security. In two of the interviews, the respondents highlighted the fact that goods owners requesting higher security must be willing to pay for it.

"Security costs have to be internalized into our freight rates. Thus it is difficult for us to remain competitive on the marketplace"

"Some customers are willing to pay for extra costs related to security. Thus we increase our prices. In some cases we also perform a negotiation process with the transport carriers to define how security costs, direct and indirect, have to be split"

The interviews also bring to light the influence of insurance companies. According to one of the interviewed professionals, some Scandinavian insurers appear to exert pressure on their customers, denying premium discounts to those retaining risks by purchasing or implementing security measures.

"We have a dialogue with only one insurance company and they are not willing to give us premium reductions. This is nonsensical..."

Two respondents declared that insurances' "excesses" are too high and therefore operators prefer to pay the consequences of a loss themselves instead of investing in security.

"We know that if the loss is lower than the insurance excesses than we prefer to pay it ourselves"

"We have insurances and also our transport carriers do. However we know that companies prefer to pay the losses themselves, since the excesses are too high."

Finally when it comes to application of premium discounts, opinions diverge. Two respondents state that they encounter difficulties in agreeing on discounts. Conversely, three respondents declared that it is possible to have discounts, although in some cases these are too low and affect only the excesses.

Security Solutions Providers

All the interviewed managers agree on the central role of security solutions in the protection of distribution chains. Best practices and technical systems may strongly decrease cargo attacks. Three of the interviewed professionals underlined the importance of using security solutions to combat criminals attacking distribution chains.

"We work intensively with detection sensors to be installed at our facilities and protect them against various threats. These sensors include motion detection or perimeter alarms to be installed at main doors or windows."

"We put a great emphasis on security technologies, and when it comes to the protection of our facilities we want to be a step ahead our competitors"

"Our terminals are highly secured although it is often difficult to have the security budget approved by top management"

Three respondents stated that some security solutions are too expensive.

"We make assessments of technologies 'on offer.' However most of these systems cannot guarantee 100% security and cost too much money. You can imagine the financial implications to implement these systems on a fleet of a hundred vessels"

"As a security manager I get a limited budget to spend on security. Thus it is difficult to buy more advanced technologies"

"… only those companies that have access to money and resources can properly deal with the problem"

Criminals

The perception of the criminals' opportunistic behaviour is also emphasized in previous research. Insufficient protection in one of the links of a supply chain will determine a weak point and the consequent attack (crime displacement effect). Four respondents confirmed this line of reasoning:

"Criminals search for weak points and attack in specific places where they know trucks stop."

"Criminals attack according to a trade-off between risks and revenues. The situation today is that supply chains are easy and profitable targets."

"Security solutions may become ineffective after a while. Criminals learn quickly how to deceive the installed equipment"

"It is very important to set up the best practices very quick. However the situation is very dynamic. This means that if somebody is implementing some practice or measure to avoid attacks than also the criminals will modify their behaviours to overcome the resolutions."

It can be argued that the increased threats and attacks against distribution networks should stimulate companies to increase their security levels: first of all to stop the losses due to theft, and secondly to comply with upcoming mandatory requirements meant to stop terrorists. However, as one respondent commented, this is not happening:

"Statistics show increasing attacks against freight transportation. Nevertheless, for reasons I can't understand, operators don't consider this as a problem and are not seeking adequate protection".

Contract Legislation Bodies

The role of contract legislation is also mentioned in the interviews. All the respondents agree that the specification of security requirements in contracts may enhance security even though it requires both a deep understanding of physical security and achieving an agreement among parties. Only one respondent mentions that contract agreements may be useless, since it is difficult to verify if a carrier is truly following the security measures specified in the contract. As this manager commented, "we request our carriers to install specific security measures, but we don't really know if they follow them or not."

Authority

Many of the interviewed respondents have knowledge of the authority regulations. Seven managers mentioned that they know the AEO, ISPS or C-TPAT initiatives, but only two of them declared that the AEO initiative can influence their security investments.

"We are participating to the AEO initiative set up by the European Commission and are working to gain compliance."

"Yes, we are working to meet the AEO requirements since it is our desire to secure our operations. In addition, it is important to gain compliance to simplify customs inspections and avoid transport delays."

CONCLUSION

The findings from this explorative study show diverse factors that may be responsible for the vulnerability of supply chains and more specifically of their physical distribution systems. Previous research identifies globalization and JIT as the main causes. However, by combining these findings with data collected from secondary sources, observations, and a total of 16 interviews (4 unstructured and 12 semi-structured) performed with key actors in the transport security area, the identification of eight players and their interactions into an integrated Physical Distribution Security System can be outlined. This constitutes an environment in which other stakeholders and reasons are brought to light as significant factors.

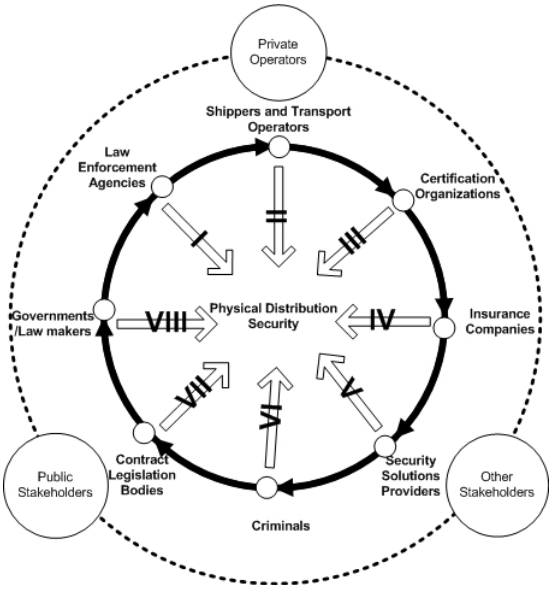
The Physical Distribution Security System is illustrated in Figure 3 below, where each actor is depicted with a Roman Numeral and arrows show the interdependency among the actors and the physical distribution security. Summing up,

the initiatives organized by the first actor (Actor I in the figure), the law enforcement agency, may positively stimulate the development and implementation of cooperative solutions to increase security. However, the behaviours of some distribution operators that don't announce the theft assaults make it difficult for the agency to allocate enough resources to combat cargo crime. At the same time, existing criminal laws are not able to properly prosecute cargo crime, which may discourage some companies to denounce cargo crime. The second actor (Actor II, supply chain, logistics and transport operators) experiences difficulties in defining security partnerships. Existing standard legislative commitments are too complex and at the same time don't support the definition of security requirements. This study confirms that the willingness to pay for secured freight transportation is still too low and the low marginal revenues that are typical of the transportation market make it difficult to afford security investments.

The certification organizations (Actor III, i.e. TAPA EMEA or ISO28000) represent an incentive for distributors to raise their security level and gain access to a network of secure operators. In addition, standards, recommendations, and best practices can support shippers and transport operators in securing their assets and operations. The insurance companies, (Actor IV), seem to have both a negative and positive effect on the security of physical distribution. The negative impact is that it may happen that risk-seeking companies may trade-off insurance premiums and excesses with the implementation of security solutions. Nevertheless, insurance companies may stimulate the enhancement of security by offering premium discounts to distribution operators.

The providers of security solutions are also encountering difficulties (Actor V). While the development of security technologies and services offer the possibility to automate or outsource the processes for enhancing security in a cost effective manner, companies perceive costs as too high. At the same time, absence of business cases and operational standards results in most security solutions being viewed as not mature enough to be fully implemented in physical distribution. The behaviour of

FIGURE 3
THE PHYSICAL DISTRIBUTION SECURITY SYSTEM (PDSS)



criminals may also discourage the enhancement of security (Actor VI). As long as there are weak links or nodes in a distribution chain, attacks will not decrease but will only move from the protected spots. Contract legislation bodies (Actor VII) are today used to define transport assignments as well as cargo liabilities among all the involved stakeholders. However, these don't provide any support for agreed upon security requirements to be adopted. At the same time, it is not possible to verify that physical carriers follow what is stated in the contract. Finally, governments also have a significant role in the enhancement of security in physical distribution (Actor VIII). Many believe that regulations may stimulate operators; however there is still confusion and uncertainty about the costs and related requirements of the authority certifications. Thus many companies are waiting.

Implications, Future Research and Limitations

This manuscript reveals practical implications for managers as well as the necessity to conduct further research. The practical implication of this investigation is to use the framework in Figure 3 to stimulate stakeholders to identify initiatives that could bring mutual benefits and higher security to all the actors identified in the PDSS. The main recommendation is to accomplish this objective by promoting collaboration opportunities that may introduce new driving forces, remove the existing barriers or perhaps turn the barriers into driving forces.

Future research should be oriented to performing more descriptive studies based on empirical data to confirm the hypotheses found in this paper. Is it true, as previous investigations point out, that insecurity in supply chains is merely caused by such factors as globalization and JIT? Or may other inter-organizational relationships complicate the implementation of security measures as well as discourage distribution operators? In terms of limitations, the main data used for the analysis is collected by means of qualitative techniques and is based on a restricted number of interviews. Therefore subjectivity of interpretations as well as limited generalizability of the findings is acknowledged.

Once the factors explaining the vulnerability of supply chains to antagonistic attacks have been clearly identified, normative research should be performed to understand how the stakeholders' goals may be aligned and, thereby, supply chain security improved. Enhancing security within a supply chain requires the involvement of multiple stakeholders that need to agree on a specific degree of protection and thereby specify security requirements in supply or transportation contracts. This process today presents many difficulties for practitioners, and the research challenges concern the development of standard agreements in which security requirements are specified, achievement of consensus, sharing of responsibilities, internalization of security costs as well as risk and cost sharing among stakeholders. Another important aspect is the standardization and harmonization of security across supply chains. As many authors state, "*a supply chain is as secure as the weakest of its links.*" Therefore it is essential that stakeholders speak the same security language and strive to align the protection level of all the nodes and links of a supply chain network. Especially from a technological viewpoint, a standardization process of security technologies has to be initiated.

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AUTHOR BIOGRAPHY

Luca Urciuoli (Ph.D., University of Lund, Sweden) is Research Director at the Cross-Border Research Association (CBRA) in Switzerland. Previously he worked as Project Manager at Volvo Technology where he patented an application for transport security. He earned an MSc Degree in Industrial Engineering at Chalmers, University of Technology in Sweden. His research interests include supply chain/transportation security and information and communication technologies. His papers have been published in diverse conference proceedings and in scientific journals. This paper was written while Dr. Urciuoli was at University of Lund. E-Mail: luca.urciuoli@gmail.com

ASSESSING THE STRATEGIC EVOLUTION OF U. S. LOW COST AIRLINES IN THE POST - 9/11 ENVIRONMENT

Carl A. Scheraga
Paul Caster
Fairfield University

ABSTRACT

It has been suggested in the literature that low-cost airlines have, in varying degrees, departed from the original low-cost model introduced by Southwest Airlines. This study provides a multi-year analysis in the post-9/11 time period, for the years 2004-2009, of the demonstrated strategic positioning choices of U. S. low-cost airlines. The sample utilized is restricted to U. S. low-cost carriers so as not to conflate operating environments. Furthermore, a quantitative methodology is employed to measure effectively these choices and to facilitate inter-airline comparisons. Airlines, as part of their strategic planning process, articulate positions with regard to cost leadership, product differentiation, and growth. Decisions implemented are dynamic and inter-temporal in nature. Managers thus need a multi-period methodology to evaluate the implementation of strategic positions. One such approach is the strategic analysis of operating income utilized in this study.

INTRODUCTION

Michael Porter in his seminal work *Competitive Strategy* (1980) outlines three generic strategies that a firm can pursue in the building of a competitive advantage vis-a-vis its competitors. These three strategies are: cost leadership, product differentiation, and a focused niche that eschews an industry-wide strategy for a narrow market segment. The emergence of the low cost model in the commerical airline industry represents a movement from the predominant product differentiation strategies of U. S. trunk carriers to the low cost model as introduced by Southwest Airlines.

The goal of a differentiation strategy is the creation of a product or service that is perceived industrywide as being unique. This uniqueness allows the firm to command a premium price and therefore higher profit margins. Differentiation can occur along such lines as brand or image, technological innovation, quality of product or service, or customer service, among others. The goal of a cost leadership strategy is the aggressive pursuit of efficient scale facilities, cost reductions from accumulated operational experience and control of overhead, the avoidance of marginal contribution customers, and the minimization of expenditures on research and development, service, sales force, and advertising (Porter, 1980). Thus, the model introduced by Southwest Airlines (see Alamdari and Fagan, 2005) was characterized by fares that were low and unrestricted, high frequency point-to-point flights with no interlining. Flights were single-class with high density unassigned seating without meals or free (alcoholic) beverages or snacks, and purchasable light drinks. Travel agents and call centers (later the Internet) operated with a ticketless format. A single type of aircraft was intensively utilized with flights into and from secondary and uncongested airports in order to facilitate quick turnaround time. Human resource cost effectiveness and productivity was achieved through competive wage rates and profit sharing.

Two points need to be noted here. The focus strategy may be implemented either on the basis of cost leadership or product differentiation in a narrow market segment. As suggested by Alamdari and Fagan (2005), such a strategy would not seem to apply to low cost commercial airlines in the United States. (They note that corporate jet service providers might fall into

this strategic group.) However, there is a second, critically important issue. Porter (1980) notes that a firm that does not develop a viable strategy is "stuck in the middle." While it takes time and effort for a firm to extracate itself from such a situation, it is not uncommon for firms that are stuck in the middle to move back and forth among the generic strategies in an inconsistent manner. Frequently, such behavior leads to failure.

Evolution of the Cost Leadership Model by Airlines and Strategic Groups:The U. S. Case

Strategies chosen by firms are dynamic and evolutionary by the nature of competition. This notion is illustrated in Porter's (1980) admonition as to the risks or vulnerabilites of the cost leadership strategy. Competitors may learn how to implement the low cost model through imitation or investment in state-of-the-art facilities. Carey and Nicas (2011) indicate that this has happened to Southwest Airlines, as other low cost carriers, such as JetBlue Airways and Spirit Airlines have cut into Southwest's competitive advantage. Technological changes or innovations may nullify the advantages that had accrued to the low cost leader through prior learning and investments. The low cost leader may become so preoccupied with cost that necessary product and marketing changes are overlooked. Finally, inflation in costs may erode the profit margins enjoyed by the low cost leader relative to firms pursuing a differentiation strategy.

Button (2009) offers a critical view of the efficacy of the implementation of the low cost model in the commercial airline industry, in a combined analysis of U. S. and European low cost carriers. He suggests that "there are, in addition, reasons to suspect that the model as we have seen it in the past, will need to change to succeed in a dynamic market and, in the short term, to function well in the depressed macro-economic environments..."(pg. 2). Furthermore, he also suggests that where low cost carriers have enjoyed financial success it may be because of the particular markets they have chosen rather than their particular implementation of the low cost model. Specifically, such markets may be chosen to avoid competition (pg. 16).

Thus, there are two important empirical questions to be investigated. The first is whether the low cost model in the commercial airline industry has indeed evolved over time in the context outlined by Porter (1980). The second is how well has the low cost model been implemented.

To date, only Alamdari and Fagan (2005) have undertaken an empirical examination of the evolution of the cost leadership model on the part of commercial airlines designated as low cost carriers. However, their study compared airline low cost strategic models at a single point in time – the year 2001. In correlating model choice to performance this is problematic not only because of the issue of the single year utilized but also because of the extremely confounding event of 9/11. Additionally, similar to Button (2009), their study groups U. S. low cost airlines with European low cost airlines. This makes it very difficult to isolate the endogenous effects of management's strategic choices from the exogenous effects of the operating environment in which airlines conduct business.

Evaluating the evolution of a low cost airline's strategy requires a methodology for classifying carriers using Porter's (1980) generic strategies. Kling and Smith (1995) present a methodology for identifying strategic groups amongst U. S. trunk carriers, Southwest, and the then low cost carrier America West. Their study covered the time period 1991-1993. Airline membership in particular strategic groups was done utilizing the two variables of cost per seat mile and the Airline Quality Rating index calculated by the National Institute for Aviation Research.

The current study focuses on the evolution of the low cost model by U. S. carriers in the post 9/11 timeframe. The period examined is 2004 to 2009. A methodology called strategic variance analysis is used for decomposing operating income into three components: (1) growth, (2)

price recovery, and (3) productivity. The price recovery component assesses a firm's *product differentiation strategy* and the productivity component assesses a firm's *low-cost strategy*. Thus, this framework is very much in the spirit of Porter's (1980) seminal work. Furthermore, the framework allows for the separation of the impacts of endogenous managerial decisions and exogenous industry-wide effects.

STRATEGIC VARIANCE ANALYSIS

Strategic variance analysis combines Porter's (1980) strategies with traditional accounting variance analysis. An accounting variance is the difference between an expected amount and an actual result. Shank and Churchill (1977) illustrate how variance analysis is used to break down net income into revenue and cost components in order to gain further insights into the underlying factors that affected profitability. Shank and Govindarajan (1993) advanced this analysis by tying the accounting variances to Porter's low cost leadership and product differentiation strategies. Then, by examining an organization's mission and strategy, the variances are used to determine the extent to which the organization is fulfilling its mission, or where improvements are needed.

Horngren, et al. (2000, 2006, and 2012) illustrate the use of strategic variance analysis for a fictitious manufacturer of computer chips. In their example, management chooses a cost leadership strategy and the company experiences an increase in profits. Strategic variance analysis is used to determine how much of the increased profitability was due to management's choice of strategy. As explained in Horngren (2012), the growth component measures the change in revenues minus the change in costs due solely to a change in the quantity of output sold. The price-recovery component is based on both changes in selling prices and changes in the cost of inputs. It relates to a company's product differentiation strategy and essentially measures the effectiveness of such a strategy. That is, if management is successful in implementing a product differentiation strategy, they can charge higher prices to compensate for the higher costs associated with such a strategy. The productivity component is directly related to the low cost strategy. It measures the change in profitability by operating the business more efficiently, by either using fewer inputs or by using a less expensive mix of inputs. The variances associated with each component are measured while holding all else equal, thereby isolating the impact of that particular factor. Formulas for each variance are in Appendix A. Also, see Caster and Scheraga (2011) for a more detailed explanation of each component.

Caster and Scheraga (2011) and Mudde and Sopariwala (2008) apply strategic variance analysis to companies in the airline industry. The framework provided by Horngren, et al. (2000, 2006, and 2012) was adapted by Sopariwala (2003) to include the impact of underutilization of capacity. Capacity utilization is particularly important in the airline industry, since management makes changes to the fleet, or may simply ground airplanes, thereby affecting capacity utilization. The framework was also modified due to differences between a service industry and a manufacturer.

Mudde and Sopariwala (2008) use strategic variance analysis to examine the performance of Southwest Airlines for the year ending in 2005. They adapted the Horngren, et al. (2000, 2006, 2012) framework by using cost drivers more appropriate for an airline, such as revenue passenger miles (RPMs) and available seat miles (ASMs). They found that Southwest Airlines continued its success pursuing a cost leadership strategy.

Caster and Scheraga (2011) examine the performance of all of the U.S. network air carriers over two, three-year periods: 2004 through 2006 and 2007 through 2009. They found that each of the network air carriers had significant productivity gains in both periods, as they engaged in major cost cutting to deal first with the tragedy of 9/11 and its severe impact on the airline industry, and later, with the economic

TABLE 1
EXAMPLE: SOUTHWEST – FINANCIAL DATA ($)

	12/31/2003	12/31/2006	12/31/2009
Operating Revenues	5,936,696,000	9,086,299,000	10,350,338,000
Operating Expenses	5,454,620,000	8,152,040,000	10,088,296,000
Flying Operations	1,849,777,000	3,628,760,000	4,573,216,000
Maintenance	671,590,000	767,040,000	1,068,072,000
Depreciation and amortization	385,815,000	514,209,000	617,685,000
User charges	168,467,000	220,567,000	308,705,000
Station expenses	937,762,000	1,261,348,000	1,411,332,000
Aircraft and traffic servicing	1,106,229,000	1,481,915,000	1,720,037,000
Passenger services	451,714,000	605,226,000	738,475,000
Promotion and sales	589,271,000	664,733,000	727,645,000
General & Administrative	386,176,000	475,880,000	626,607,000
Transport related expenses	14,048,000	14,277,000	16,559,000
Operating profit	482,076,000	934,259,000	262,042,000

Data Source: International Civil Aviation Organization, *Financial Data: Commercial Air Carriers, Series F*, Montreal, Quebec, Canada, 2003, 2006, and 2009

TABLE 2
EXAMPLE: SOUTHWEST AIRLINES OPERATIONAL DATA

	12/31/2003	12/31/2006	12/31/2009
Revenue passenger enplanements	74,719,340	96,276,907	101,338,228
Revenue passenger miles	47,929,656,245	67,676,690,192	74,442,676,271
Available seat miles	71,775,738,997	92,642,334,641	97,982,778,511

Data Source: International Civil Aviation Organization, *Traffic: Commercial Air Carriers, Series T*, Montreal, Quebec, Canada, 2003, 2006, and 2009

TABLE 3
EXAMPLE: SOUTHWEST AIRLINES – FUEL DATA

	12/31/2003	12/31/2006	12/31/2009
Total gallons used	1,142,651,100	1,389,937,539	1,427,868,309
Total fuel costs	828,356,287	2,133,012,395	2,891,970,226
Average fuel cost per gallon ($)	0.72	1.53	2.03

Data Source: U. S. Department of Transportation, Research and Innovative Administration, Bureau of Transportation Statistics, *TranStats Database*, Washington, D. C., 2003, 2006, and 2009

recession that began in mid-2008. They also demonstrate how strategic variance analysis is used to rank the performance of companies within an industry segment, and thus how it may be used for benchmarking purposes. In addition, they demonstrate the use of strategic variance analysis over multiple time periods, an important extension given that managements' choice of strategies may take several years before tangible results are achieved.

THE DATA SET

Low cost carriers were identified using the U.S. Department of Transportation, Bureau of Transportation Statistics database. Data had to be available in each of the six years under study. With these criteria, five U.S. airlines remained in the sample: Airtran Airways, Frontier Airlines, JetBlue Airways, Southwest Airlines, and Spirit Airlines. Data for calculation of the variances are retrieved from: the International Civil Aviation Organization, *Financial Data: Commercial Air Carriers, Series F* and *Traffic: Commercial Air Carriers, Series T* and also the U.S. Department of Transportation, Bureau of Transportation Statistics, *Transtats Aviation Database*.

We chose two, three year time periods for the analysis, 2004 to 2006, and 2007 to 2009. We began the study with data from 2004 because it took the airline industry approximately 2 1/2 years for flight activity to recover to pre-9/11 levels (Bureau of Transportation Statistics, 2005). Similar to Caster and Scheraga (2011), we chose three-year timeframes to allow for an appropriate amount of time for managements' strategic decisions to impact profitability.

In addition to the five low-cost carriers, we also calculate composite figures for all five airlines combined, for each three-year period. The composite figures are used for benchmarking purposes and serve as a proxy for the relevant market. Market figures are used to adjust the growth component to separate out exogenous effects from endogenous effects.

RESULTS OF THE STRATEGIC VARIANCE ANALYSIS

First, we illustrate the calculation of variances using data for Southwest Airlines. Table 1 has financial results for Southwest Airlines for the years ending in 2003, 2006, and 2009. Southwest Airlines had operating profits of approximately $482 million in 2003, $934 million in 2006, and $262 million in 2009. Strategic variance analysis is used to determine why annual operating profits increased by $452 million in 2006, then decreased by $672 million in 2009.

Table 2 provides the revenue passenger enplanements, RPMs, and ASMs, used to calculate the variances and Table 3 provides the fuel data used in those calculations. Table 4 reclassifies the financial data into three cost categories used by Mudde and Sopariwala (2008) and by Caster and Scheraga (2011), namely, fuel costs, flight-related costs, and passenger-related costs. Finally, Table 5 provides the calculations, using the data from Tables 2, 3, and 4, from which the strategic variance analysis is performed.

The results of the strategic variance analysis for the three-year period ending in 2006 are presented in Table 6 for all five airlines. Continuing for the moment with the analysis of Southwest Airlines as an example, as stated earlier, the company's annual operating profit increased approximately $452 million in 2006 compared to 2003. Strategic variance analysis reveals that operating profit increased by approximately $600 million due to the growth component. Increased revenues from growth of $2.4 billion more than offset increased costs from growth. Operating profit decreased by approximately $626 million due to the price-recovery component, driven primarily by increased fuel costs. Southwest Airlines was not able to pass all of its increased costs on to its customers by charging higher fares. This result is expected for a company choosing to be a low cost leader. In contrast, operating profit increased approximately $549 million due to

TABLE 4
EXAMPLE: SOUTHWEST AIURLINES – RECLASSIFIED FINANCIAL DATA ($)

	12/31/2003	12/31/2006	12/31/2009
Total operating revenues	5,936,696,000	9,086,299,000	10,350,338,000
Less: Total operating expenses	5,454,620,000	8,152,040,000	10,088,296,000
Fuel costs	828,356,287	2,133,012,395	2,891,970,226
Flight-related costs	2,930,763,713	3,872,379,605	4,748,643,774
Passenger-related costs	1,695,500,000	2,146,648,000	2,447,682,000
Operating income/(loss)	482,076,000	934,259,000	262,042,000

FLIGHT RELATED COSTS

	12/31/2003	12/31/2006	12/31/2009
Flying operations	1,849,777,000	3,628,760,000	4,573,216,000
Less: Fuel cost	828,356,287	2,133,012,395	2,891,970,226
Flying operations (excluding fuel)	1,021,420,713	1,495,747,605	1,681,245,774
Maintenance	671,590,000	767,040,000	1,068,072,000
Passenger service	451,714,000	605,226,000	738,475,000
General and administrative	386,176,000	475,880,000	626,607,000
Depreciation and amortization	385,815,000	514,209,000	617,685,000
Transport related	14,048,000	14,277,000	16,559,000
Total flight-related costs	2,930,763,713	3,872,379,605	4,748,643,774

PASSENGER RELATED COSTS

	12/31/2003	12/31/2006	12/31/2009
Aircraft and traffic servicing	1,106,229,000	1,481,915,000	1,720,037,000
Promotion and sales	589,271,000	664,733,000	727,645,000
Total passenger-related costs	1,695,500,000	2,146,648,000	2,447,682,000

Data Sources: 1) Data Source: International Civil Aviation Organization, *Financial Data: Commercial Air Carriers, Series F*, Montreal, Quebec, Canada, 2003, 2006, and 2009 and 2) U. S. Department of Transportation, Research and Innovative Administration, Bureau of Transportation Statistics, *TranStats Database*, Washington, D. C., 2003, 2006, and 2009

TABLE 5[1]
SOUTHWEST AIRLINES–DATA USED IN STRATEGIC VARIANCE ANALYSIS

	12/31/2003	12/31/2006	12/31/2009
Total operating revenues ($)	5,936,696,000	9,086,299,000	10,350,338,000
Revenue passenger miles (RPMs)	47,929,656,24	67,676,690,192	74,442,676,271
Average revenue per RPM	0.124	0.134	0.139
Revenue passenger miles (RPMs)	47,929,656,24	67,676,690,192	74,442,676,271
Available seat miles (ASMs)	71,775,738,99	92,642,334,641	97,982,778,511
Passenger load factor (%)	66.78%	73.05%	75.98%
Hence, budgeted available seat miles		101,347,366,78	101,904,264,33
Revenue passenger miles (RPMs)	47,929,656,24	67,676,690,192	74,442,676,271
Revenue passenger enplanements	74,719,340	96,276,907	101,338,228
Average revenue passenger miles per passenger ($)	641.46	702.94	734.60
Hence, budgeted revenue passenger enplanements		105,503,732	105,902,204
Number of gallons used	1,142,651,100	1,389,937,539	1,427,868,309
Available seat miles (ASMs)	71,775,738,99	92,642,334,641	97,982,778,511
Average number of gallons per ASM	0.0159197	0.0150033	0.0145726
Total flight-related costs ($)	2,930,763,713	3,872,379,605	4,748,643,774
Available seat miles (ASMs)	71,775,738,99	92,642,334,641	97,982,778,511
Average flight-related cost per ASM ($)	0.041	0.042	0.048
Total passenger-related costs ($)	1,695,500,000	2,146,648,000	2,447,682,000
Revenue passenger enplanements	74,719,340	96,276,907	101,338,228
Average cost per revenue passenger ($)	22.69	22.30	24.15
Revenue passenger (RPMs)	47,929,656,24	67,676,690,192	74,442,676,271
Available seat miles (ASMs)	71,775,738,99	92,642,334,641	97,982,778,511
Idle or unused capacity (ASMs)	23,846,082,75	24,965,644,449	23,540,102,240
Hence, budgeted idle capacity (ASMs)		33,670,676,594	27,461,588,064

Data Sources: 1) International Civil Aviation Organization, *Financial Data: Commercial Air Carriers, Series F*, Montreal, Quebec, Canada, 2003, 2006, and 2009, 2) International Civil Aviation Organization, *Traffic: Commercial Air Carriers, Series T*, Montreal, Quebec, Canada, 2003, 2006, and 2009, and 3) U. S. Department of Transportation, Research and Innovative Administration, Bureau of Transportation Statistics, *TranStats Database*, Washington, D. C., 2003, 2006, and 2009

[1]Budgeted Available Seat Miles from year x to year y = Revenue Passenger Miles (year y) / Passenger Load Factor (year x), Budgeted Revenue Passengers Enplanements from year x to year y = Revenue Passenger Miles (year y) / Average Revenue Passenger Miles per Passenger (year x), and Budgeted Idle Capacity in year y = Budgeted Available Seat Miles (year y) – Revenue Passenger Miles (year y). [See Mudde and Sopariwala (2008).]

TABLE 6
STRATEGIC VARIANCE ANALYSIS 2004-2006

	Aitran	Frontier	JetBlue	Southwest	Spirit	Composite
GROWTH COMPONENT 2004-2006						
Revenue effect	851,316,759	461,813,711	1,021,875,724	2,445,920,681	-917,782	4,899,988,990
Fuel cost effect	-166,119,025	-68,644,066	-150,786,885	-341,283,059	364,527	-783,095,650
Flight-related cost effect	-288,577,893	-165,730,718	-368,595,259	-806,315,495	217,857	-1,639,026,992
Passenger-related effect	-198,212,989	-133,507,046	-259,944,207	-698,546,551	262,463	-1,356,789,039
TOTAL	**198,406,852**	**93,931,881**	**242,549,373**	**599,775,576**	**-72,935**	**1,121,077,310**
PRICE-RECOVERY COMPONENT 2004-2006						
Revenue effect	123,999,241	79,829,289	343,030,276	703,682,319	91,145,782	1,221,707,010
Fuel cost effect	-348,846,166	-204,027,775	-400,609,901	-1,306,337,240	-218,284,811	-2,568,641,310
Flight-related cost effect	-22,410,173	-45,576,335	-34,734,613	-65,444,130	-127,349,361	-267,598,334
Passenger-related effect	-14,147,151	33,986,897	-32,552,106	41,671,686	-823,498	-383,219
TOTAL	**-261,404,249**	**-135,787,923**	**-124,866,344**	**-626,427,364**	**-255,311,889**	**-1,614,915,854**
PRODUCTIVITY COMPONENT 2004-2006						
Fuel cost effect	63,743,117	-45,074,561	-29,832,448	142,538,095	213,057,383	449,393,257
Fuel (ASM) cost effect	15,321,629	55,966,507	-23,178,542	200,426,096	5,361,617	296,098,196
Passenger-related effect	45,974,140	3,815,149	-11,967,688	205,726,865	-11,975,965	326,932,258
TOTAL	**125,038,886**	**14,707,095**	**-64,978,678**	**548,691,056**	**206,443,036**	**1,072,423,710**
CAPACITY UNDERUTILIZATION COMPONENT 2004-2006						
Unused capacities	-8,423,510	-11,348,399	-7,854,281	-24,142,062	-29,245,462	-87,670,145
Available capacities	-386,381,872	-164,643,372	-465,557,329	-852,029,699	4,219,107	-1,885,653,014
Used capacities	288,577,893	165,730,718	368,595,259	806,315,495	-217,857	1,639,026,992
TOTAL	**-106,227,489**	**-10,261,053**	**-104,816,352**	**-69,856,267**	**-25,244,212**	**-334,296,167**

TABLE 7
STRATEGIC VARIANCE ANALYSIS 2007-2009

	Aitran	Frontier	JetBlue	Southwest	Spirit	Composite
GROWTH COMPONENT 2007-2009						
Revenue effect	642,535,846	46,557,147	267,533,937	908,403,948	162,150,926	2,016,041,529
Fuel cost effect	-208,721,910	-14,377,511	-85,099,299	-213,248,197	-53,498,622	-540,772,496
Flight-related cost effect	-211,146,407	-17,404,328	-86,425,648	-282,813,107	-70,216,640	-655,418,204
Passenger-related effect	-129,003,658	-10,954,797	-63,216,726	-214,611,419	-42,389,820	-468,967,575
TOTAL	**93,663,871**	**3,820,511**	**32,792,264**	**197,731,225**	**-3,954,155**	**350,883,253**
PRICE-RECOVERY COMPONENT 2007-2009						
Revenue effect	-194,448,846	-64,866,147	656,621,063	355,635,052	-3,479,926	760,601,471
Fuel cost effect	101,965,659	55,683,950	-7,920,717	-750,330,172	33,659,111	-603,673,984
Flight-related cost effect	-8,677,753	42,753,262	-210,904,708	-496,147,089	87,516,675	-595,981,059
Passenger-related effect	-24,026,889	-7,687,977	-92,396,793	-196,658,975	48,498,898	-293,074,871
TOTAL	**-125,187,828**	**25,883,088**	**345,398,845**	**-1,087,501,184**	**166,194,757**	**-732,128,442**
PRODUCTIVITY COMPONENT 2007-2009						
Fuel cost effect	34,648,449	42,044,792	-47,628,722	88,877,543	24,377,022	149,888,041
Fuel (ASM) cost effect	58,630,944	3,338,915	-21,494,913	115,742,995	-4,058,428	147,149,329
Passenger-related effect	56,899,547	-8,255,226	-61,559,481	110,236,394	-6,216,078	120,699,446
TOTAL	**150,178,940**	**37,128,481**	**-130,683,116**	**314,856,932**	**14,102,516**	**417,736,816**
CAPACITY UNDERUTILIZATION COMPONENT 2007-2009						
Unused capacities	-2,243,040	9,975,525	-53,919,202	-156,890,560	22,612,030	-172,070,803
Available capacities	-192,681,349	-14,835,933	-131,068,439	-223,226,520	-95,079,789	-654,765,028
Used capacities	211,146,407	17,404,328	86,425,648	282,813,107	70,216,640	655,418,204
TOTAL	**16,222,018**	**12,543,920**	**-98,561,993**	**-97,303,973**	**-2,251,119**	**-171,417,627**

gains in productivity. Again, this result is expected for a company choosing to be a low cost leader. Finally, the capacity underutilization component shows a decline in operating profit of approximately $70 million.

Table 7 shows the results of the strategic variance analysis for the three-year period ending in 2009. Southwest Airline's annual operating profit in 2009 was $262 million, a decline of $672 million from three years earlier. The four components of strategic variance analysis yield results similar to the prior three-year period. That is, Southwest Airlines operating profits increased due to growth of the market and due to productivity gains, and decreased due to the price-recovery effect and capacity underutilization. However, the decrease in operating profits due to the price-recovery component of almost $1.1 billion overwhelmed the increases due to the growth and productivity components. As seen in Table 7, prices of inputs, namely fuel costs, flight-related costs, and passenger-related costs all increased at rates much higher than Southwest's fare increases designed to help recover those costs.

Over the years, Southwest Airlines has seen an increase in competition from other airlines that identify themselves as low cost carriers. Strategic variance analysis can be used to rank the relative performance of each of these carriers, on each of the components. Table 8 has the results of the strategic variance analysis for all five airlines for the three-year period ending in 2006. The data are normalized by dividing by billions of RPMs. During this three-year period, all but Spirit Airways had an increase in operating profits due to growth. Airtran ranked first in the growth component, while Southwest Airlines ranked fourth. As expected, all five airlines saw decreases in operating profits due to price-recovery. The increased cost of fuel was especially significant for all five airlines, and increased fares were not sufficient to recover the increased costs. JetBlue Airways ranked first, and thus did the best job of recovering its increased fuel and other costs, while Spirit Airlines ranked fifth. Spirit Airlines had a much higher increase in fuel costs, and also had a very significant increase in flight-related costs compared to the competition. As low cost leaders, one would expect significant gains in operating profits from productivity. In fact, only Spirit Airlines had significant gains in productivity, while gains were more modest for Airtran, Southwest, and Frontier. Surprisingly, JetBlue Airways saw a decrease in operating profits due to productivity. Finally, capacity utilization was negative for all five airlines, but not a significant factor in the change in overall profitability.

Table 9 is similar to Table 8, but covers the three year period ending in 2009. The growth component results are very similar to the prior three year period. Airtran again ranked first and Spirit again ranked fifth, and was the only airline to see a decrease in operating profits due to growth. Table 9 reveals a significant change in price-recovery rankings compared to the prior period. In the prior period, all five airlines saw decreases in operating profits due primarily to increased fuel costs. In the latter period, Spirit Airlines, JetBlue Airways, and Frontier Airlines all experienced a positive impact from price-recovery. Most interesting is JetBlue Airways, which raised fares significantly during this period and more than covered the increased costs of inputs. Spirit Airlines and Frontier Airlines achieved the positive results by decreasing the cost of inputs, particularly fuel costs and flight-related costs. Spirit Airlines also reduced its passenger-related costs during this period. In contrast, Airtran Airways saw a decrease in operating profits due to the price-recovery component. It successfully reduced the price of fuel, but it lowered rather than raised its fares during this timeframe. Southwest Airlines ranked last in price-recovery. Its fare increases were unable to recover its increased cost of inputs, particularly fuel costs. For the productivity component, the rankings were somewhat different, in that Spirit Airlines dropped from first to fourth. JetBlue Airways continued to be a surprise as the only low cost

TABLE 8
NORMALIZED STRATEGIC VARIANCE ANALYSIS 2004-2006

	Aitran	Frontier	JetBlue	Southwest	Spirit	Composite
GROWTH COMPONENT 2004-2006	1	2	3	4	5	
Revenue effect	61,713,785	55,538,492	43,847,309	36,141,257	-200,918	41,592,065
Fuel cost effect	-12,042,326	-8,255,251	-6,470,062	-5,042,845	79,801	-6,647,069
Flight-related cost effect	-20,919,633	-19,931,054	-15,815,925	-11,914,228	47,692	-13,912,382
Passenger-related effect	-14,368,886	-16,055,781	-11,153,855	-10,321,819	57,457	-11,516,691
TOTAL	**14,382,940**	**11,296,406**	**10,407,466**	**8,862,366**	**-15,967**	**9,515,923**
PRICE-RECOVERY COMPONENT 2004-2006	4	3	1	2	5	
Revenue effect	8,988,972	9,600,404	14,718,966	10,397,706	19,953,318	10,370,088
Fuel cost effect	-25,288,610	-24,536,723	-17,189,630	-19,302,617	-47,786,153	-21,803,130
Flight-related cost effect	-1,624,562	-5,481,087	-1,490,415	-967,011	-27,878,880	-2,271,427
Passenger-related effect	-1,025,557	4,087,321	-1,396,767	615,747	-180,277	-3,253
TOTAL	**-18,949,757**	**-16,330,084**	**-5,357,846**	**-9,256,176**	**-55,891,992**	**-13,707,722**
PRODUCTIVITY COMPONENT 2004-2006	2	4	5	3	1	
Fuel cost effect	4,620,876	-5,420,742	-1,280,070	2,106,162	46,641,783	3,814,538
Fuel (ASM) cost effect	1,110,698	6,730,626	-994,560	2,961,523	1,173,747	2,513,339
Passenger-related effect	3,332,764	458,816	-513,517	3,039,848	-2,621,737	2,775,065
TOTAL	**9,064,338**	**1,768,700**	**-2,788,147**	**8,107,534**	**45,193,793**	**9,102,942**
CAPACITY UNDERUTILIZATION COMPONENT 2004-2006	5	2	3	1	4	
Unused capacities	-610,638	-1,364,778	-337,017	-356,726	-6,402,315	-744,161
Available capacities	-28,009,654	-19,800,288	-19,976,437	-12,589,707	923,632	-16,005,791
Used capacities	20,919,633	19,931,054	15,815,925	11,914,228	-47,692	13,912,382
TOTAL	**-7,700,659**	**-1,234,011**	**-4,497,528**	**-1,032,206**	**-5,526,375**	**-2,837,571**

Note: Numbers in shaded areas are rankings, from 1 to 5, of the effect of a component on operating income.

TABLE 9
NORMALIZED STRATEGIC VARIANCE ANALYSIS 2007-2009

	Aitran	Frontier	JetBlue	Southwest	Spirit	Composite
GROWTH COMPONENT 2007-2009	1	4	3	2	5	
Revenue effect	34,776,819	5,377,804	10,312,130	12,202,731	27,303,356	15,086,854
Fuel cost effect	-11,296,933	-1,660,742	-3,280,163	-2,864,596	-9,008,224	-4,046,819
Flight-related cost effect	-11,428,157	-2,010,369	-3,331,288	-3,799,072	-11,823,244	-4,904,759
Passenger-related effect	-6,982,236	-1,265,386	-2,436,697	-2,882,908	-7,137,698	-3,509,474
TOTAL	**5,069,494**	**441,306**	**1,263,982**	**2,656,154**	**-665,810**	**2,625,801**
PRICE-RECOVERY COMPONENT 2007-2009	4	3	2	5	1	
Revenue effect	-10,524,413	-7,492,671	25,309,542	4,777,301	-585,958	5,691,888
Fuel cost effect	5,518,823	6,432,038	-305,305	-10,079,301	5,667,601	-4,517,536
Flight-related cost effect	-469,678	4,938,418	-8,129,349	-6,664,821	14,736,265	-4,459,967
Passenger-related effect	-1,300,439	-888,036	-3,561,446	-2,641,750	8,166,359	-2,193,198
TOTAL	**-6,775,707**	**2,989,749**	**13,313,442**	**-14,608,572**	**27,984,266**	**-5,478,813**
PRODUCTIVITY COMPONENT 2007-2009	1	2	5	3	4	
Fuel cost effect	1,875,324	4,856,583	-1,835,855	1,193,906	4,104,661	1,121,673
Fuel (ASM) cost effect	3,173,360	385,677	-828,524	1,554,794	-683,368	1,101,178
Passenger-related effect	3,079,650	-953,559	-2,372,818	1,480,823	-1,046,678	903,243
TOTAL	**8,128,334**	**4,288,701**	**-5,037,197**	**4,229,522**	**2,374,615**	**3,126,093**
CAPACITY UNDERUTILIZATION COMPONENT 2007-2009	2	1	5	4	3	
Unused capacities	-121,403	1,152,270	-2,078,322	-2,107,535	3,807,467	-1,287,675
Available capacities	-10,428,748	-1,713,695	-5,052,050	-2,998,636	-16,009,760	-4,899,871
Used capacities	11,428,157	2,010,369	3,331,288	3,799,072	11,823,244	4,904,759
TOTAL	**878,006**	**1,448,945**	**-3,799,085**	**-1,307,099**	**-379,049**	**-1,282,787**

Note: Numbers in shaded areas are rankings, from 1 to 5, of the effect of a component on operating income.

carrier to experience a decline in operating profits due to productivity changes. The impact of capacity utilization was not very significant compared to the other components. Airtran Airways and Frontier Airlines experienced gains in operating profitability related to capacity, while the other three carriers experienced decreases similar to the earlier time period.

The growth component is impacted by exogenous changes in the market in addition to endogenous changes brought about by management's strategic decisions. Horngren, Datar and Rajan (2012) provide an adjustment to the growth component to estimate the percentage of change in profitability attributable to management's decisions. Following Caster and Scheraga (2011), we calculate a market adjustment and apply it only to the growth component, since management may choose a blended strategy rather than strictly following a product differentiation or cost leadership strategy. Table 10 provides the results of further analyzing the growth component.

Table 10a shows the calculations for each airline of the endogenous percentage of growth for the three-year period ending in 2006. Using Southwest Airlines as an example, their market grew by 41.2 percent, as measured by the change

TABLE 10a
IMPACT OF ENDOGENOUS STRATEGIES – GROWTH COMPONENT 2004-2006
(12/31/03 - 12/31/06)

	RPMs 2004	RPMs 2006	%Δ2004-	ENDOGENOUS
Airtran	7,157,394,690.01	13,794,596,431.84	92.73	40.58
Frontier	4,664,512,745.57	8,315,200,789.89	78.27	29.60
JetBlue	11,516,971,262.83	23,305,323,597.69	102.36	46.17
Southwest	47,929,656,245.03	67,676,690,191.78	41.20	-33.74
Spirit	4,577,285,154.70	4,567,951,103.06	-0.20	-27,650
Composite	75,958,831,424.48	117,810,669,689.02	55.10	

Endogenous Effect = [%ΔRPMs(2004-2006)$_{\text{Airline i}}$ - %ΔRPMs(2004-2006)$_{\text{Market}}$] / |%ΔRPMs(2004-2006)$_{\text{Airline i}}$|

TABLE 10b
IMPACT OF ENDOGENOUS STRATEGIES – GROWTH COMPONENT 2007-2009
(12/31/06 – 12/31/09)

	RPMs 2007	RPMs 2009	%Δ2007-	ENDOGENOUS
Airtran	13,794,596,431.84	18,475,980,896.56	33.94	60.43
Frontier	8,315,200,789.89	8,657,279,052.83	4.11	-226.38
JetBlue	23,305,323,597.69	25,943,616,840.15	11.32	-18.61
Southwest	67,676,690,191.78	74,442,676,270.58	10.00	-34.30
Spirit	4,567,951,103.06	5,938,864,220.45	30.01	55.26
Composite	117,810,669,689.02	133,629,024,310.53	13.43	

Endogenous Effect = [%ΔRPMs(2007-2009)$_{\text{Airline i}}$ - %ΔRPMs(2007-2009)$_{\text{Market}}$] / |%ΔRPMs(2007-2009)$_{\text{Airline i}}$|

in RPMs. On the surface, this appears to be a strong increase, which resulted in almost $600 million in additional operating profits as shown in Table 6. However, the relevant market as a whole, as measured by the change in RPMs for the composite, increased by 55.1 percent. Therefore, Southwest Airline's growth in this period actually fell short of the overall market growth by almost 13.9 percent. Thus, management's decisions resulted in a 33.74 percent decrease in operating profit due to the growth component. In contrast, JetBlue Airways experienced growth of 102.36 percent in this period, which is 47.26 percentage points better than the overall market, meaning that 46.17 percent of the increase is due to endogenous factors.

Table 10b shows similar adjustments for the three-year period ending in 2009. Table 7 shows that before adjustments, all but Spirit Airlines experienced positive changes in operating profits due to growth. However, after adjusting for exogenous factors, Table 10b shows very different results. Airtran Airways and Spirit Airlines had positive changes from endogenous factors, but Frontier Airlines, JetBlue Airways, and Southwest Airlines all experienced negative changes from endogenous factors. According to Horngren, Datar and Rajan(2012), companies following a cost leadership strategy should experience positive changes due to growth, so these results are somewhat unexpected.

Stage Length, and Domestic Compared to Foreign Operations

Stage length may have an influence on an airline's operating profit. Average stage length is defined as "the average distance between takeoffs and landings" (Caves, Christensen and Trethaway, 1984). As the average stage length increases, the cost per unit may decrease. Caves, Christensen and Trethaway, 1981 and Tretheway (1984) find, however, that the posited effect between average stage length and unit cost is ambiguous. Table 11 shows the average stage length for each airline for 2004, 2006, and 2009. Standard deviation calculations suggest that average stage length is not significant for these five airlines over the period in this study.

The extent to which an airline has international routes compared to domestic routes may have an impact on operating efficiency. Fethi, Jackson and Weyman-Jones (2002) suggest that spatial disparities in the operating environment result when an airline increases its international focus. Although it is difficult to predict the impact of differences in international focus, a priori, some arguments suggest the impact on operating profit may be negative. In structuring bilateral agreements, the international air transport system has tended to focus on small sets of routes, or even individual routes between countries thus hampering global efficiency. Legal, public policy, and tax differences with respect to air transport exist across countries, which may impede operating efficiency. In addition, the level of competition in certain global markets is impacted by airport infrastructure constraints.

The ratio of domestic scheduled RPMs to international scheduled RPMs captures the international focus of an airline. A simple analysis was performed to detect any outliers in the sample utilized in this study. A standard score, the number of standard deviations above or below the mean, was calculated with regard to the degree of dominance of domestic operations. Given the size of the sample, outliers were defined as those observations with standard scores of 2.5 or greater. As can be seen from Table 11, there are no such outliers, which suggests that the impact of an international focus, if any, is minimal for the airlines in the sample.

Fleet Standardization

Brüggen and Klose (2010) suggest various cost advantages to fleet standardization or commonality of aircraft on the part of an airline. Fewer aircraft types in an airline's fleet reduces the number of reserve crews that are needed and increases the carrier's ability to swap crews and reduce the required personnel training.

TABLE 11
AVERAGE STAGE LENGTH (MILES) AND DOMESTIC RPMs AS A PERCENTAGE OF TOTAL RPMs

	Average Stage Length	SDFM	Domestic/Total (%)	SDFM
Airtran 2004	626.97	-0.88	99.16	0.41
Frontier 2004	953.84	0.17	95.03	-1.73
JetBlue 2004	1338.01	1.41	98.93	0.29
Southwest 2004	576.23	-1.04	100.00	0.85
Spirit 2004	1006.95	0.34	98.69	0.17
Airtran 2006	651.95	-0.87	99.65	0.80
Frontier 2006	902.88	0.23	93.05	-0.67
JetBlue 2006	1185.01	1.47	97.83	0.40
Southwest 2006	621.70	-1.00	100.00	0.88
Spirit 2006	886.92	0.16	89.75	-1.41
Airtran 2009	737.25	-0.68	99.07	0.86
Frontier 2009	883.36	0.18	93.70	0.15
JetBlue 2009	1075.13	1.31	87.99	-0.61
Southwest 2009	638.70	-1.26	100.00	0.98
Spirit 2009	931.23	0.46	82.28	-1.38

SDFM = Standard Deviations from Mean

Data Source: International Civil Aviation Organization, *Traffic: Commercial Air Carriers, Series T*, Montreal, Quebec, Canada, 2004, 2006, and 2009

Standardized maintenance processes allow for fewer spare parts and reduced labor costs. Fleet commonality allows for the standardization of ground handling processes, economies of scale realized from the standardization of ground handling equipment, and lower labor costs. Finally, an airline ordering several planes of the same type will typically pay a lower per capita price than its counterpart, which orders a mixture of aircraft from various manufacturers.

This study utilizes the index of fleet standardization developed by De Borges Pan and Espirito Santo (2004) and modified by Brüggen and Klose (2010). This index, the *IPC*, is a composite of several partial indices. Thus:

(1) IPPCC = (no. of aircraft in the family) / (AMF x TFC) where AMF is the number of aircraft models/types in a family and TFC is the number of aircraft in the fleet. Each fleet family with more than one type is given a "bonus" of 0.1. This is necessary, as otherwise fleet families would count as diversified as totally different aircraft (Klose, 2009).
(2) IPPC = (ÓIPPCC) / (no. of families from the manufacturer)
(3) IPC = (ÓIPPC) / (no. of manufacturers)
This index ranges from zero to one. It is inversely proportional to the number of models, fleet families, and manufacturers in an airline's fleet.

The results displayed in Table 12 must be interpreted with care. While there appears to be a range in the levels of fleet standardization, scrutiny is required. Consider Southwest Airlines, whose indices range from 0.3500 to 0.4333. In fact, its fleet is composed of a single aircraft family, the Boeing 737, with the predominant utilization of the 300, 500, and 700 models. Airtran's fleet is, by and large, divided between two Boeing aircraft types, the 717-200 and the 737-700 families. Frontier, for the most part, has a fleet composed of a single Airbus family of aircraft with the A318, A319, and A320 models. Similarly, JetBlue has a fleet composed of two aircraft types, the Airbus A320 and Embraer ERJ190. These observations suggest that none of the low cost carriers in the sample utilized in this study indulged in a diversity of aircraft types. Table 13 presents the details of each carrier's fleet composition.

DISCUSSION AND CONCLUSIONS

Several interesting results were revealed in this study. First, although JetBlue Airways is a self-proclaimed low-cost carrier, it does not behave like one. Companies following the cost leadership strategy should experience greater profitability in the growth component and in the productivity component. Table 8 reveals that JetBlue Airways ranked third in profitability due to growth, while Table 10a reveals that 46.17 percent of that growth was endogenous. Table 9 reveals that JetBlue Airways again ranked third in profitability due to growth, while Table 10b shows that endogenous factors have a negative impact of 18.61 percent. In addition, and even more revealing, was JetBlue Airways ranking last place in productivity in both periods, as shown in Tables 8 and 9. Not only did JetBlue rank last, but also the productivity component was negative in both periods. These are not

TABLE 12
FLEET DIVERSIFICATION INDICES

Carrier	Year	IPC
Airtran	2004	0.3123
Airtran	2006	0.5000
Airtran	2009	0.5000
Frontier	2004	0.3556
Frontier	2006	0.6000
Frontier	2009	0.4333
JetBlue	2004	1.0000
JetBlue	2006	0.5000
JetBlue	2009	0.5000
Southwest	2004	0.3500
Southwest	2006	0.4333
Southwest	2009	0.4333
Spirit	2004	0.5000
Spirit	2006	0.3833
Spirit	2009	0.6000

Data Source: International Civil Aviation Organization, *Fleet – Personnel*, Montreal, Quebec, Canada, 2004, 2006, and 2009

TABLE 13
FLEET COMPOSITION

Carrier	Year	Model	Number	Carrier	Year	Model	Number
Airtran	**2004**	McDonnell Douglas DC9-30	1			Embraer ERJ190	38
		Boeing 717-200	76	**Southwest**	**2004**	Boeing 737-100	14
		Boeing 737-700	4			Boeing 737-300	195
Airtran	**2006**	Boeing 717-200	86			Boeing 737-500	25
		Boeing 737-700	30			Boeing 737-700	169
Airtran	**2009**	Boeing 717-200	86	**Southwest**	**2006**	Boeing 737-300	193
		Boeing 737-700	51			Boeing 737-500	25
Frontier	**2004**	Airbus A318	6			Boeing 737-700	245
		Airbus A319	29	**Southwest**	**2009**	Boeing 737-300	181
		Boeing 737-300	10			Boeing 737-500	25
Frontier	**2006**	Airbus A318	7			Boeing 737-700	303
		Airbus A319	45	**Spirit**	**2004**	Airbus A321	2
Frontier	**2009**	Airbus A318	10			McDonnell Douglas DC9-80	31
		Airbus A319	38	**Spirit**	**2006**	Airbus A319	18
		Airbus A320	3			Airbus A321	6
JetBlue	**2004**	Airbus A320	61			McDonnell Douglas DC9-80	12
JetBlue	**2006**	Airbus A320	91	**Spirit**	**2009**	Airbus A319	26
		Embraer ERJ190	15			Airbus A321	2
JetBlue	**2009**	Airbus A320	109				

Data Source: International Civil Aviation Organization, *Fleet – Personnel*, Montreal, Quebec, Canada, 2004, 2006, and 2009

results typical of a company following a cost leadership strategy.

In Table 8, it can be seen that JetBlue Airways ranked first in the price-recovery component for the three-year period ending in 2006. Although the overall impact on operating profits was negative, it was less negative than for the other airlines in the sample. In Table 9, JetBlue Airways ranked second in the price-recovery component, and the component had a positive effect on operating profits. Taken together, these results suggest that the management of JetBlue Airways is following a product differentiation strategy. A product differentiator is able to charge higher prices to more than recover the higher cost of inputs associated with such a strategy.

A second interesting finding relates to the overall viability of following a low cost strategy over the long term. For the three-year period ending in 2009, the airlines in the sample saw gains in annual operating profits of approximately $351 million due to growth and approximately $418 million due to productivity, as shown by the composite results in Table 7. However, those gains were not enough to cover decreases of approximately $732 million due to price-recovery and $171 million due to capacity underutilization. Increases in both the cost of fuel and in flight-related costs excluding fuel were not offset by increases in airfares. A further look reveals that the composite results were driven by Southwest Airlines, the allegedly low-cost leader of the industry. In fact, it is interesting to note that Southwest Airlines did not rank first for any component of profitability for either period except for capacity underutilization during the three-year period ending in 2006.

A third interesting result is support for the notion that management may not strictly adhere to one strategy over another. The results support the notion of a blended strategy. For example, Table 9 shows that Frontier Airlines, JetBlue Airways, and Spirit Airlines all saw increases in profitability from the price-recovery component for the three-year period ending in 2009. JetBlue achieved the result as a true product differentiator, charging higher fares to recover its higher cost of inputs. Frontier and Spirit actually lowered fares during this period, but they were also able to lower the cost of inputs to increase overall profitability.

Finally, this paper illustrates the usefulness of strategic variance analysis as a methodology for examining the determinants of profitability and tying those determinants to management's strategic decisions.

APPENDIX A
CALCULATION OF STRATEGIC VARIANCES FROM YEAR i TO Year j

The Growth Component

1. Airline Revenues

[*Revenue effect of the Growth Component (i.e., lower expected revenue due to lower RPM)*]

Variance = {Year i revenue/RPM} * {Year j RPMs – Year i RPMs}

2. Fuel Costs

[*Fuel cost effect of the Growth Component (i.e., lower expected fuel costs due to lower RPMs)*]

Variance = {Year i fuel cost/gallon} * {Year i gallons used per ASM} * {Year i actual ASMs – Year j budgeted ASMs}

3. Flight-related Costs

[*Flight-related cost effect of the Growth Component (i.e., lower expected flight-related costs due to lower RPMs)*]

Variance = {Year i cost/ASM} * {Year i passenger load factor} * {Year i actual ASMs – Year j budgeted ASMs}

4. Passenger-related Costs

[*Passenger-related cost effect of the Growth Component (i.e., lower expected passenger-related costs due to lower RPMs)*]

Variance = {Year i cost/passenger} * {Year i revenue passengers – Year j budgeted revenue passengers}

The Price-Recovery Component

1. Airline Revenues

[*Revenue effect of the Price-Recovery Component (i.e., higher revenue due to higher airfares)*]

Variance = {Year j RPMs} * {Year j revenue/RPM – Year i revenue/RPM}

2. Fuel Costs

[*Fuel cost effect of the Price-Recovery Component (i.e., higher costs due to higher fuel prices)*]

Variance = {Year j budgeted ASMs} * {Year i gallons used/ASM} * {Year i fuel cost/gallon – Year j fuel cost/gallon}

3. Flight-related Costs

[*Flight-related cost effect of the Price-Recovery Component (i.e., higher costs due to higher flight-related costs per ASM)*]

Variance = {Year j passenger load factor} * {Year j actual ASMs} * {Year i cost/ASM – Year j cost/ASM}

4. Passenger-related Costs

[*Passenger-related cost effect of the Price-Recovery Component (i.e., higher costs due to higher costs per passenger)*]

Variance = {Year j budgeted revenue passengers} * {Year i cost/passenger – Year j cost/passenger}

The Productivity Component

1. Fuel Costs (a)

[*Fuel cost effect of the Productivity Component (i.e., lower costs due to lower fuel usage per gallon)*]

Variance = {Year j fuel cost/gallon} * {Year j budgeted ASMs} * {Year i gallons used /ASM – Year j gallons used/ASM}

2. Fuel Costs (b)

[*Fuel (ASM) cost effect of the Productivity Component (i.e., lower costs due to higher passenger load factor)*]

Variance = {Year j fuel cost/gallon} * {Year j gallons used/ASM} * {Year j budgeted ASMs – Year j actual ASMs}

3. Passenger-related costs

[*Passenger-related cost effect of the Productivity Component (i.e., lower costs due to higher miles per passenger)*]

Variance = {Year j cost/passenger} * {Year j budgeted revenue passengers – Year j revenue passengers}

The Capacity Underutilization Component

1. Flight-related costs (a)

[*Changes in flight-related costs relating to unused capacities (i.e., higher unit costs to acquire capacity that is unused)*]

Variance = {Year j actual ASMs – Year j RPMs} * {Year i cost/ASM – Year j cost/ASM}

2. Flight-related costs (b)

[*Changes in flight-related costs of available capacities (i.e., lower underutilization due to decrease in available capacity)*]

Variance = {Year i cost/ASM} * {Year i actual ASMs – Year j actual ASMs}

3. Flight-related costs (c)

[*Changes in flight-related costs of used capacities (i.e., higher underutilization due to decrease in capacity used)*]

Variance = {Year i cost/ASM} * {Year j RPMs – Year i RPMs}

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AUTHOR BIOGRAPHIES

Carl A. Scheraga is Professor of Business Strategy and Technology Management in the Dolan School of Business at Fairfield University. His fields of research and teaching include transportation and international logistics, global strategic management, cross-cultural management, and the management of technology and innovation. He has published numerous articles in *Transportation Research Series A, Transportation Research E, Journal of Transportation Management, Transportation Journal, Journal of the Transportation Research Forum, Journal of Public Policy and Marketing, Technology in Society: An International Journal, Journal of Banking and Finance, Global Business and Finance Review, Journal of Investing, Management International Review, International Journal of Advertising, and International Review of Economics and Finance*. He also has published chapters in such volumes as *Japanese Direct Investment in the United States: Trends, Developments and Issues, International Financial Market Integration, and Neuroeconomics and the Firm*. As a co-author, he has received the Transportation Research Forum Outstanding Research Paper Award in 1998 and the Aviation Research Paper Award in 1999. He received his Ph.D. in Economics from the University of Connecticut, an M.A. in Economics and a Sc.B in Mathematics from Brown University. E-Mail: cscheraga@fairfield.edu

Paul Caster is Professor of Accounting in the Dolan School of Business at Fairfield University. His primary research interests include audit evidence and audit decision-making, the financial impact of changes in accounting principles, and analysis of business strategy using strategic variance analysis. He has published articles in *Auditing: A Journal of Practice and Theory, The Journal of Accountancy, Research in Accounting Regulation, The CPA Journal, Issues in Accounting Education, The Journal of Forensic Accounting, The Journal of Accounting Literature, The Quarterly Review of Economics and Business, The EDP Auditor Journal, The Financial Analysts Journal,* and *The Journal of the Transportation Research Forum*. He received his Ph.D. in Accounting from the University of North Texas, an MBA from the University of Chicago, and a B.S. from Lehigh University. E-Mail: pcaster@fairfield.edu

Journal of Transportation Management

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MANUSCRIPT SAMPLE

A FRAMEWORK FOR EVALUATING SUPPLY CHAIN PERFORMANCE

Terrance L. Pohlen, University of North Texas

ABSTRACT

Managers require measures spanning multiple enterprises to increase supply chain competitiveness and to increase the value delivered to the end-customer. Despite the need for supply chain metrics, there is little evidence that any firms are successfully measuring and evaluating inter-firm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate inter-firm performance into value creation has largely contributed to this situation. This article presents a framework that overcomes these shortcomings by measuring performance across multiple firms and translating supply chain performance into shareholder value.

INTRODUCTION

The ability to measure supply chain performance remains an elusive goal for managers in most companies. Few have implemented supply chain management or have visibility of performance across multiple companies (Supply Chain Solutions, 1998; Keeler et al., 1999; Simatupang and

Sridharan, 2002). Supply chain management itself lacks a widely accepted definition (Akkermans, 1999), and many managers substitute the term for logistics or supplier management (Lambert and Pohlen, 2001). As a result, performance measurement tends to be functionally or internally focused and does not capture supply chain performance (Gilmour, 1999; *Supply Chain Management,* 200 I) . At best, existing measures only capture how immediate upstream suppliers and downstream customers drive performance within a single firm.

Table 1 about here

Developing and Costing Performance Measures

ABC is a technique for assigning the direct and indirect resources of a firm to the activities consuming the resources and subsequently tracing the cost of performing these activities to the products, customers, or supply chains consuming the activities (La Londe and Pohlen, 1996). An activity-based approach increases costing accuracy by using multiple drivers to assign costs whereas traditional cost accounting frequently relies on a very limited number of allocation bases.

$$y = a^2 - 2ax + x^2$$

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