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Journal of Transportation Management

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Journal of Transportation Management

OBJECTIVES

Editorial Policy. The primary purpose of the *JTM* is to serve as a channel for the dissemination of information relevant to the management of transportation and logistics activities in any and all types of organizations. Articles accepted for publication will be of interest to both academicians and practitioners and will specifically address the managerial implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to the management of transportation and logistics activities, would be inappropriate for the *JTM*.

Acceptable topics for submission include, but are not limited to carrier management, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics and purchasing and materials management are acceptable as long as they are specifically related to the management of transportation and logistics activities.

Submissions from industry practitioners and from practitioners co-authoring with

academicians are particularly encouraged in order to increase the interaction between the two 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.

The opinions expressed in published articles are those of the authors and do not necessarily reflect the opinions of the Editor, the Editorial Review Board, Delta Nu Alpha Transportation Fraternity, or Georgia Southern University.

PUBLISHING DATA

Manuscripts. Submit the manuscript, along with all tables, figures, and references to the editor by email attachment to kmanrodt@georgiasouthern.edu. Manuscripts should be no longer than 25 double-spaced pages. Guidelines for manuscript submission and publication can be found in the back of this issue.

Subscriptions. The *Journal of Transportation Management* is published twice yearly. The current annual subscription rate is \$50 domestic and \$65 international in U.S. currency. Payments are to be sent to the editor at Southern Center for Logistics and Intermodal Transportation, Georgia Southern University, P. O. Box 8154, Statesboro, GA 30460-8154.

From the Editor...

2008 has certainly been a year of change. It is hard to miss the continued mantra of change as it permeates the news around us.

The *JTM* is not immune to change. One of the biggest changes has been the posting of most former journals on the Internet. Just go to: <http://deltanualpha.org/> and click on the *JTM* link on the left. The site is password protected; please use the following information to enter the site.

User name: jtmarticles

Password: DNA4Education

In addition, much discussion over the past few months has focused on how the *JTM* should be distributed in the future. As you are well aware, printing and mailing a journal is rather expensive. Many journals have gone totally electronic, while others offer both electronic and hard copies to subscribers. One benefit of an electronic version will be the ability to post accepted journal articles immediately after they have been accepted and edited / formatted for publication.

We at the *JTM* are conscious of the need to manage our resources appropriately. As such, we are considering offering the *JTM* in electronic format only.

Should we do this? The decision will be based on what you have to say. If you would accept an electronic version, or prefer a hard copy, please let me know. Your input is critical in helping guide our next steps. Please email me at the address below; I look forward to hearing from you.

This volume has several great articles. Cook, Gibson and Williams look at the development of an effective recruitment strategy that attracts and secures entry-level talent that is essential to corporate performance. Safety continues to be a critical issue, and Swartz and Douglas review the attitudes and behavioral intentions of waste disposal drivers. Grawe, Chen, Mattioda and Daugherty explore the relationship between profit contribution information and firm-wide integration. Understanding the profit contribution of a customer can lead to better decisions. Scott, Voss, Keller and Schlosser examine the effect of interdepartmental customer orientation on time, inventory, and customer service-based performance variables in distribution centers. Finally, Mascaritolo and Holcomb discuss what firms can do to develop resilient supply chains.

In the future, we will be accepting submissions of outstanding undergraduate and graduate papers. Perhaps the paper is a result of an independent study, or master's thesis. I'm currently reviewing an article that was submitted as part of a federal summer research program that explores the

implications of a carbon tax on transportation. It's a timely topic, well documented and written. If you have one to consider, please send it forward. These articles will be viewed as an invited article, and will not require the same rigorous standard of other articles appearing in the *Journal*.

Thanks again to all for your assistance and continued support of the *Journal*.

Best,

Karl

Karl B. Manrodt, Editor

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LOGISTICS AND SUPPLY CHAIN JOB PLACEMENT: THE 2007 PERSPECTIVE

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ABSTRACT

The development of an effective recruitment strategy that attracts and secures entry-level logistics talent is essential to maintain corporate performance. A critical aspect of job placement involves understanding the preferences of students and employers. This research presents results of parallel surveys of U.S. undergraduate logistics, transportation and supply chain student and employer preferences and perceptions regarding employment. Results provided include a demographic respondent profile, their organization/functional area preferences and their perspectives on selected entry-level employment issues. These research results are intended to provide employers, educators and students with information that can be used to improve job placement success.

INTRODUCTION

Six to ten percent of the U.S. workforce is likely to retire by 2010 creating a severe management shortage according to a recent 2010 Talent Readiness Survey (Miller, 2007). As the Baby Boomer generation retires over the next twenty years, labor supply will fall far short of labor demand (Wu, 2007).

In logistics, the management shortage will be exacerbated by the rapid growth of the field (i.e., as logistics management supply decreases, demand for logistics management is increasing). Logistics practitioners and

academics are concerned about the logistics management shortage as evidenced by the recent Logistics Education Summit held at the University of West Florida (Feb., 2008) to determine actions that could alleviate logistics management, student and faculty shortages.

The impending logistics management shortage should be a significant concern to all organizations. Logistics employees are a critical factor in generating sustainable competitive advantage (Daugherty et al. 2000; Richey, Tokman, and Wheeler 2006). Therefore, hiring talented logistics managers can have a significant positive impact on organizational

performance (Lambert and Burduroglu, 2002). Conversely, a shortage of logistics managers in the organization can lead to supply chain disruptions that can devastate organization performance and profitability (Hendricks and Singhal, 2005).

As a result of the current situation, it is essential for organizations to develop an effective recruitment strategy that will attract and retain logistics management at all levels including entry-level managers. A critical aspect of successful entry-level management recruitment involves understanding the perspectives and priorities of the key participants—employers and students.

The purpose of the current research is to present the results of two parallel surveys involving U.S. undergraduate logistics students and logistics employers. These surveys focused on each groups' preferences and perceptions regarding job placement issues. These research results will provide employers, educators and students with information that can be used to improve entry-level logistics management job placement.

The balance of the paper is presented in four sections. First, the background section provides a review of the relevant literature and identifies the need for this research. Second, the research methodology section contains the study design and data collection methods. Third, data analysis and key outcomes are presented in the research results. Fourth, a set of implications and a brief summary are presented.

BACKGROUND

In the past decade, several research studies that focus on human resource issues in logistics have been completed. Some research efforts shed light on career patterns and paths (Le May, 1999; Dischinger et al., 2006) including the annual Survey of Career Patterns in Logistics (e.g., Ginter and LaLonde, 2007).

Additionally, a number of research studies have focused on logistics manager training and retention issues (Cook and Gibson, 2000; Daugherty et al., 2000; Keller, 2002; Autry and Daugherty, 2003; Farris II and Pohlen, 2004; Ellinger, Ellinger and Keller, 2005). Also, some research has been conducted to improve knowledge regarding logistics manager skill requirements, recruitment and selection (Gibson and Cook, 2001; Knemeyer and Murphy, 2001; Razzaque and Bin Sirat, 2001; Myers et. al., 2004; Murphy and Poist, 2006; Richey, Tokman and Wheeler, 2006). However, limited research has been conducted to analyze the perceptions of logistics students regarding employment issues.

Only a handful of research efforts have captured logistics student perceptions. Knemeyer, Murphy and Poist (1999) analyzed undergraduate female logistics majors' perceptions regarding logistics career opportunities. Knemeyer and Murphy (2004) provided marketing student perceptions regarding logistics as a career field. In addition, a few research studies have compared logistics student and employer perceptions regarding employment issues. Gammelgaard and Larson (2001) reported that logistics student and employer perceptions regarding "most important skills for logistics managers" were very similar. Knemeyer and Murphy (2002) compared logistics student and employee perceptions regarding logistics internship issues and found a number of significant differences. Finally, Gibson and Cook (2003) provided insight into logistics student and employer perceptions regarding entry-level employment issues and found several significant differences between logistics student and employer perceptions regarding job selection criteria, the importance of job skills and salary and workload expectations.

Given the limited research pertaining to logistics student perceptions of employment issues, the divergent findings between student-

employer perceptual studies and the fact that perceptions change as the economy and culture change over time, additional and timelier research is required. The current study was undertaken to provide updated knowledge of student-employer perceptions regarding entry-level logistics job issues.

METHODOLOGY

Given the impending shortage of logistics management talent, it is essential for organizations to develop a successful entry-level management recruitment strategy. A critical aspect of a successful recruitment strategy involves the close alignment of student and employer perspectives regarding employment issues. As a result, three research questions guided the research effort: (1) Do employers understand logistics student preferences regarding job selection criteria? (2) Are logistics student—employer perceptions of job salary, benefits and workload requirements similar? and (3) Are logistics students and employers perceptually aligned regarding job and skill requirements?

The researchers developed similar surveys to query logistics students and employers. Research protocols for conducting these mail based surveys followed Dillman's Total Design Method (Dillman, 1978). Key steps included: a review of research studies related to job placement preferences and perceptions (described in the preceding section), survey instruments testing and revision, and data collection and analysis.

Student Survey

A four-page student questionnaire used in a prior study (Gibson and Cook 2003) was reviewed and minimally revised. The updated survey instrument was pre-tested by 67 logistics undergraduate students. Minor revisions were made to improve clarity and ease of completion.

The potential study participants were identified as U.S. bachelor degree candidates from the December 2006—December 2007 timeframe with a primary interest in logistics, transportation, and supply chain management positions. The primary access to this population was through faculty involved in university SCM and logistics programs. Key programs were identified through the Council of Supply Chain Management Professionals (CSCMP) website, as well as information from the 2002 study (CSCMP Website 2007). Faculty contacts were identified through Supply Chain Management Educators' Conferences attendee lists (2005, 2006) and the CSCMP member directory (CSCMP Website 2007).

Faculty members at 24 institutions were contacted via telephone and e-mail about the study. They were asked to administer the student questionnaire to senior-level logistics classes in which the target population could be easily reached. Faculty at 23 different institutions agreed to serve as facilitators. The questionnaires were sent to the appropriate faculty members via email in .PDF format or U.S. mail in printed format with an explanatory cover letter.

Surveys representing 573 students from 20 different institutions were completed and returned. The institutions were: Auburn University, Central Michigan University, College of Charleston, Georgia Southern University, Grand Valley State University, Iowa State University, Michigan State University, Miami University, North Carolina A&T State University, Ohio State University, Southwest Missouri State University, Syracuse University, Texas Christian University, University of Arkansas, University of Memphis, University of North Florida, University of North Texas, University of Oklahoma, University of Tennessee and Western Illinois University.

Employer Survey

As was done with the student survey, updates were made to the employer questionnaire. New questions were added, creating a four-page document. It was pre-tested with a small sample of knowledgeable recruiters. Potential study participants were identified as organizations that recruit and hire U.S. undergraduate students for logistics, transportation and supply chain positions. These organizations were identified by their recruiting activities at multiple universities.

Cover letters and surveys were mailed to 200 logistics recruiters at organizations between December 2006 and February 2007. The cover letter requested participation and return of completed questionnaires via fax. All participants were promised a copy of the comparative student-employer survey results later in the year. A total of 96 completed surveys were returned, a return rate of 48 percent.

Analysis Methods Used

The completed surveys were coded, entered into a PC, and analyzed using Microsoft Access 2007 and Excel 2007. Responses containing nominal and ordinal data were analyzed using frequency counts, percentages, and cross-tabulations. Responses containing ratio data were analyzed using means, medians, and standard deviations.

RESULTS

Survey results are grouped into three categories: demographics, student preferences with related employer perceptions, and

employer preferences with related student perceptions.

Respondent Demographics

A wide variety of students completed the questionnaire. The participants range in age from 20 to 58 years (mean age = 23.0 years). They are geographically well dispersed, including residents of 27 different U.S. states and 14 foreign countries. Additional demographic information regarding the student respondents is presented in Table 1.

The employers represented in the research range from very small organizations to Fortune 500 companies with multiple U.S. locations. The majority of respondents are logistics services providers (motor carriers, railroads, third party logistics firms, etc.) while manufacturers are strongly represented. Individuals completing the survey possess significant expertise on the research topic, with nearly 50 percent having five or more years of recruiting experience. Key demographic data for the employer respondents is presented in Table 2.

Logistics Student Preferences and Employer Perceptions

Students were asked a series of questions regarding their job search activities. General information was sought regarding organization and position preferences, as well as interview activities. Specific issues regarding job selection factors, benefits and compensation, geographic location, and workload levels were also studied. Parallel questions were asked of the employer respondents regarding the specific issues. They were asked to use their

TABLE 1
STUDENT SURVEY PARTICIPANT DEMOGRAPHICS

	Frequency (n=573)	Percentage
Gender		
Male	367	64.1
Female	203	35.4
Not disclosed	3	0.5
Marital Status		
Not married	541	94.4
Married	30	5.3
Not disclosed	2	0.3
Primary Area of Study		
Logistics/Transportation/SCM	474	82.7
Marketing	24	4.2
Business Administration	23	4.0
Finance	18	3.1
Operations Management	14	2.4
International Business	10	1.8
Other	5	0.9
Not disclosed	5	0.9
Graduation Date		
December, 2006	34	5.9
May, 2007	377	65.8
Summer, 2007	74	12.9
December, 2007	43	7.5
May, 2008	25	4.4
Other	12	2.1
Not disclosed	8	1.4

TABLE 2
EMPLOYER SURVEY PARTICIPANT DEMOGRAPHICS

	Frequency (n=96)	Percentage
Type of Organization		
Logistics services provider	56	58.3
Manufacturer	22	22.9
Retail / Wholesale	11	11.5
Other / Not Reported	7	7.3
Number of Employees		
Median	2,354	
Range	2-2,000,000	
Annual Sales		
Median	\$735 million	
Range	\$1 million - \$375 billion	
Respondents' Recruiting Experience		
Median	5 years	
Range	0 to 20 years	

recruiting experiences to predict how students would respond to each question.

Logistics Student Preferences and Employer Perceptions

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General Information

In an effort to understand preferences and potential competition for job openings, students were asked to identify the top three types of organizations they prefer to join and the top three types of positions that they are seeking. Most frequently cited organizations types among their three rankings included logistics services provider (429), transportation service providers (267), and consulting firms (267), followed by retailers and manufacturers. In general, these results are consistent with the previous study (Gibson and Cook, 2003).

It appears that today's students remain largely interested in staff-oriented responsibilities. Similar to 2003, the most desired position type

is supply chain management (266 top three rankings), purchasing and supply management (181), logistics analysis and planning (153), and international logistics (140) hold the second, third, and fourth positions. Transportation/traffic management was the lone management position to crack the five rankings at number five, with 125 students rating it among their preferred position types.

Interview activity and success among the respondents is much higher in 2007 than in 2003. Figure 1 reveals that 69 percent of the Spring 2007 graduates have participated in campus interviews versus less than 50 percent in 2003. Importantly, more than 54 percent of this group has already received job offers compared to less than 25 percent in 2003.

Also, it should be noted that student participation in on campus interviews varies by university. Fewer than 50 percent of the respondents from six universities had actively engaged in the interview process. On a more positive note, at least 80 percent of the respondents at five universities had participated in interviews. It would be valuable to learn what steps are being taken at these universities to promote student engagement in the interview process.

While the state of the economy may contribute to the increased activity of the current students, it also appears that they are ramping up serious job search campaigns more quickly than their predecessors that are translating into greater employment opportunities. Still, there should be concern that approximately one-third of Spring 2007 graduates had not made much job search progress, despite being less than three months away from graduation!

Job Selection Factors

Regardless of their search and interview activity levels, the student respondents have a strong vision of what they desire in a position. Overall, the respondents rated 14 of the 19 job

selection criteria high (above 5.0 on a 7-point Likert scale where 1 = low importance to 7 = high importance). The 2007 participants are seeking growth opportunities within solid working environments that provide fulfillment, stability, and a challenge. Salary had the fourth highest mean rating. As in 2003, "frequent performance evaluations"—which has implications for advancement opportunities and salary increases—was at the bottom of the students' list.

The employer respondents rated the importance of the same criteria, based on their perceptions of student desires. Their predictions were on target for 13 of the 19 criteria. However, most of the discrepancies in prediction involved criteria rated high by students. In fact, employers differed on 4 of the top 8 criteria.

Both groups were also asked to rank order the top three factors in the job selection process. Table 3 reveals that the same five factors populate each group's list. However, the employers tended to overemphasize salary while failing to recognize the importance of job satisfaction to the students. Employers may need to adjust the focus of their recruiting messages to emphasize the appealing aspects of positions.

Compensation and Benefits

A critical aspect of the job evaluation and selection process is the compensation package offered. Student respondents were asked to provide information regarding anticipated salary offers and the importance of various benefits. Employers were asked to provide information on their range of starting salaries for undergraduate degree candidates.

Figure 2 reveals that the group means are not dramatically different in terms of the lower end of the salary scale. Student expectations tracked fairly well with employer offers. However, the same cannot be said for the high

FIGURE 1
INTERVIEW ACTIVITY LEVELS
PERCENTAGE OF SPRING 2007 GRADUATES

"How many interviews have you participated in for full-time positions?"

TABLE 3
JOB SEARCH AND SELECTION CRITERIA

Criteria	Student Mean Rating ^A	Employer Mean Prediction ^A	Student Rankings ^B	Employer Rankings ^B
Opportunity for advancement	6.52	6.34		
Positive company atmosphere	6.12	5.55		
Anticipated job satisfaction	6.11	5.73	2	5
Salary offered	5.95	6.32	3	1
Job security	5.87	5.14	1	2
Training provided	5.80	5.52		
Personal fit with corporate culture	5.77	5.07		
Challenging and interesting work	5.75	5.73	5	3
Benefits package offered	5.68	5.03		
Key job responsibilities	5.51	5.15		

Table 3
(continued)

Criteria	Student Mean Rating ^A	Employer Mean Prediction ^A	Student Rankings ^B	Employer Rankings ^B
Company reputation and image	5.46	5.37		
Performance based bonuses	5.40	5.04		
Geographic location of the job	5.34	5.60	4	4
Limited night and weekend hours	5.12	5.53		
Job autonomy (independence)	4.84	4.73		
Flexible work schedule	4.84	4.57		
Opportunity to travel	4.84	4.89		
Signing bonus	4.65	4.66		
Frequent performance evaluations	4.25	4.17		

^A Based upon 7 point scale: 1 = Low Importance to 7 = High Importance

^B Based upon weighted rankings of "the three factors that are most important to the job selection process"

FIGURE 2
MINIMUM SALARY EXPECTATIONS VS MINIMUM OFFERS
Percentage of Respondents
In \$xx,000

end of the salary scale. Figure 3 indicates that the students were overly optimistic in these upper level "goals" versus employers' maximum offers.

Although it may appear that students' salary goals may be skewed, nearly 20 percent of the employer participants do have salary ranges that exceed \$50,000. Also, the students' mean "minimum acceptable annual salary" of \$39,347 was well within the mean starting salary range offered by the employers. While their desired compensation levels are higher than what they are willing to settle for, students appear to have a realistic perception of what the market will bear.

Students also pay close attention to the other key component of compensation—benefits. Similar to the 2003 respondents, the 2007 group rated eleven of 13 benefits as important in their job selection and evaluation process. Table 4 reveals that relatively long-range insurance and investment issues topped the list. The employers' ranking predictions were on target for most of the students' important benefits but did not recognize the perceived importance of life insurance. They also overestimated the relative value of training and education support.

Geographic Location Preferences

Another key factor in the job selection process is the locality of the positions offered. Employers and faculty often lament the lack of flexibility on the part of job candidates. Thus, a series of geographic location questions were asked to gain a better understanding of the students' perspectives on this topic. Employers were also asked to predict the students' preferences.

Figure 4 clearly indicates that the students are more geographically flexible than predicted by the employers. Over 43 percent of the students will consider a broad array of locations (either the U.S. or U.S. and international locations)

while less than 25 percent limit themselves to specific cities or states. Additionally, slightly more than half of the students that indicated a regional preference will consider positions in multiple regions.

A main focus of the students' geographic preferences is the desire for solid job opportunities. Today's students are willing to move, especially when prospects are good for advancement. Many also consider lifestyle and financial issues, with "close proximity to family" and "cost of living" receiving high mean scores and high importance ranking. However, other moderately rated issues like the desire to go somewhere new and significant other preferences received relatively high importance rankings. Ultimately, this paints a somewhat confusing picture and employers will need to diligently assess true geographic preferences on a candidate by candidate basis.

Workload Levels

The final job selection question focused on the weekly work hour expectations of the students. Student respondents were asked to provide a range of hours and a maximum level that they were willing to work each week. Employers were asked to predict the students' responses and to provide information on their range of weekly work requirements for new managers.

Figure 5 indicates that students underestimate the number of hours per week on the low end by approximately 4.1 hours. In contrast, they overestimate the number of hours per week required on the high end by 1.5 hours versus employers' mean requirements. While the 2007 students are not quite on target, they are much better informed than their 2003 counterparts who significantly *underestimated* the high end requirements by more than six hours.

The 2007 students' input regarding the maximum number of hours they are willing to work each week (mean = 57.9 hours per week) reveals a stronger willingness to work than

FIGURE 3
MAXIMUM SALARY EXPECTATIONS VS MAXIMUM OFFERS
 In \$xx,000
 Percent of Respondents

TABLE 4
IMPORTANCE OF BENEFITS

Criteria	Student Mean Rating ^A	Employer Mean Prediction ^A	Student Rankings ^B	Employer Rankings ^B
Medical insurance	6.38	5.87	1	1
Retirement plan (401K, pension)	6.26	5.51	2	3
Vacation and personal days	6.00	6.12	4	2
Dental insurance	5.65	4.90		
Training & certification support	5.55	5.25		5
Life insurance	5.45	4.13	3	
Paid sick leave	5.39	4.78		
Tuition support / reimbursement	5.39	5.51	5	4

Table 4
(continued)

Criteria	Student Mean Rating ^A	Employer Mean Prediction ^A	Student Rankings ^B	Employer Rankings ^B
Relocation expense support	5.37	5.06		
Stock options / purchase program	5.35	4.49		
Profit sharing program	5.05	5.07		
Tailored benefits (cafeteria plan)	3.87	3.63		
Company car / car allowance	3.23	2.88		

^A Based on 7 point scale: 1 = Low Importance to 7 = High Importance

^B Based on weighted rankings of "the three factors that are most important to the job selection process"

FIGURE 4
GEOGRAPHIC JOB PREFERENCES

TABLE 5
REASONS FOR GEOGRAPHIC PREFERENCES

Criteria	Student Mean Rating ^A	Student Rankings ^B
Job opportunities in area	5.70	2
Close proximity to family	5.30	1
Cost of living	5.05	4
Social and cultural opportunities	4.94	
Close proximity to friends	4.74	
Desire to go somewhere new	4.46	3
Climate	4.32	5
Educational opportunities in area	4.28	
Familiarity with area	3.92	
Spouse / significant other preferences	3.86	
Opportunity to live at home	3.14	

^A Based on 7 point scale: 1 = Low Importance to 7 = High Importance

^B Based on weighted rankings of "the three geographic preference factors that are most important to you"

FIGURE 5
WEEKLY WORKLOAD EXPECTATIONS AND REQUIREMENTS
AVERAGE OF MINIMUM TO MAXIMUM HOURS ANTICIPATED

found in the 2003 study (mean = 56.8 hours per week). Figure 6 reveals that over 61 percent of the current respondents are willing to work more than 55 hours per week. These individuals will meet the workload needs of all but the most demanding employers represented in the survey.

Employer Preferences and Student Perceptions

Two employer-focused issues were also addressed in the study. Data were collected regarding the importance of various factors: (1) criteria used to review candidates' credentials in the screening process; and, (2) criteria used in candidate evaluation and selection. In the student questionnaire, respondents were asked to predict how employers would rate each criterion.

Screening Criteria and Factors

During the screening process, employers place the greatest emphasis on the ability of candidates to communicate effectively. Skills, leadership, and practical experiences and skills are also important screening criteria. Notably, internships and co-operative education experience jumped four spots in the ratings from eighth most important in 2003 to fourth most important in 2007. A corresponding drop in the importance of general work experience was found, moving from third to eighth position. Table 6 provides additional information regarding the screening evaluation criteria.

Both groups provided rankings of the top five factors in the screening process. Table 6 indicates that students recognize the emphasis that employers place upon communication skills and internship/coop experience. However, the students tended to believe that employers focus more heavily on degree and major than occurs in reality. Overall, the results suggest that students must demonstrate skills, capabilities, and

experiences on resumes and in interviews. Less emphasis should be focused on moderately important employer issues such as objective statements, supervisory experience, and reference lists.

Selection Criteria and Factors

Although the employers stressed one criterion above all others in the screening process, the list of important criteria dramatically expands in the evaluation and selection process. Table 7 reveals that among the 23 employer evaluated criteria, six were rated as very important (mean > 6.0) and 15 others were rated as important (mean > 5.0). Cognitive abilities (e.g., ability to prioritize, plan, and organize, ability to learn quickly, etc.), communication skills, and other interpersonal issues were among the most important factors. Only one criterion dropped out of the top five from the 2003 study, that being the ability to work on teams.

Finally, each group was asked to rank the three most important candidate selection criteria. While the students' predictive rankings were reasonably similar to the employers for three criteria, they overestimated the importance of teamwork, and underestimated employers' perceived value of the ability to learn quickly, and organizational and oral communication skills. Table 7 provides additional details.

Overall, the results reveal important insights into the placement preferences and perceptions of the key stakeholders. Notably, the 2007 students are better aligned with employers on many key issues than the 2003 student participants. Still, opportunities exist to make the search and placement process more productive. Recruiters can use the updated information regarding student preferences and beliefs to develop more tailored hiring practices. Students should use the employer insights to better prepare for interviews and establish reasonable expectations about employment. Finally, educators should use the results to better

FIGURE 6
MAXIMUM ACCEPTABLE WORKLOAD
Percent of Respondents

TABLE 6
CANDIDATE EVALUATION CRITERIA

Criteria	Employer Mean Rating ^A	Student Mean Prediction ^A	Employer Rankings ^B	Student Rankings ^B
Communication skills	6.40	6.40	1	1
Computer/technical skills	5.62	5.52		
Leadership experience	5.56	6.04	2	4
Internship / coop experience	5.56	5.86	3	3
Industry work experience	5.35	5.60	4	5
Education - degree and major	5.31	5.89	5	2
Quantitative skills	5.27	5.34		
General work experience	5.18	5.77		
Classroom performance (GPA)	4.75	4.87		
Customer service experience	4.71	5.11		
Professional organization activity	4.68	5.00		

Table 6
(continued)

Criteria	Employer Mean Rating ^A	Student Mean Prediction ^A	Employer Rankings ^B	Student Rankings ^B
Extracurricular activities	4.37	4.85		
Education - university attended	4.33	5.09		
Date of availability	4.27	4.59		
Supervisory experience	4.23	4.90		
Individual's stated objective	4.04	4.64		
Reference list	3.76	4.38		

^A Based on 7 point scale: 1 = Low Importance to 7 = High Importance

^B Based on weighted rankings of "the three factors that are most important to the job selection process"

TABLE 7
CANDIDATE SELECTION CRITERIA

Criteria	Employer Mean Rating ^A	Student Mean Prediction ^A	Employer Rankings ^B	Student Rankings ^B
Ability to prioritize, plan, & organize	6.27	6.28	3	5
Ability to learn quickly	6.22	6.14	1	2
Oral communication skills	6.21	6.24	5	
Ability to manage relationships	6.19	6.19	4	4
Motivation / enthusiasm	6.15	6.08		
Ability to perform under pressure	6.04	6.25		
Problem solving skills	5.97	6.09		
Decision making skills	5.95	6.18		
Ability to work on teams	5.94	6.53		3
Initiative / resourcefulness	5.90	5.74		
Listening skills	5.88	5.96		
Leadership skills	5.80	6.25	2	1
Time management skills	5.74	5.96		
Self-confidence	5.67	5.82		
Ability to see the "big picture"	5.63	5.96		
Maturity	5.58	5.91		
Critical reasoning skills	5.57	5.78		

Table 7
(continued)

Criteria	Employer Mean Rating ^A	Student Mean Prediction ^A	Employer Rankings ^B	Student Rankings ^B
Ability to think creatively	5.52	5.95		
Assertiveness	5.51	5.58		
Goals / ambitions	5.44	5.73		
Written communication skills	5.39	5.49		
Willingness to relocate	4.88	5.08		
Industry knowledge / awareness	4.81	5.73		

^A Based on 7 point scale: 1 = Low Importance to 7 = High Importance

^B Based on weighted rankings of "the three factors that are most important to the job selection process"

understand and bridge the perceptual gaps between recruiters and students.

IMPLICATIONS AND SUMMARY

Logistics and supply chain employers and students generally have a good understanding of the other group's preferences and requirements as evidenced by the similarities in top five rankings and importance ratings for numerous criteria. Numerical salary and workload estimates of student preferences by logistics employers were also more accurate than those found in the parallel study in 2003.

These more closely aligned results are a testament to the industry orientation of the logistics/supply chain discipline. In recent years, the increased educational-professional interaction in the form of tours, internships, guest lectures, shadow days, and professional meetings has fostered mutual understanding of key placement issues. As a result, students gain a more realistic perspective of the "real world" and employers become better "tuned in" to the desires and expectations of prospective employees.

The results, however, indicate that the situation is not perfect. The level of understanding between the "buyers" of entry-level management talent and the "sellers" of their employment services could be improved in many ways. Hence, a set of research-based recommendations has been developed for the employers, educators and students.

Employer Implications and Recommendations

The active job market will create a challenge for employers seeking entry-level talent. First, talented candidates will be in relatively short supply. As a result, competition for their services will remain keen. Second, although job websites may help employers cast a wider net, they still have to work hard to sift through the larger "catch" quickly to find the candidate with the right "fit" and talents. They must continue to refine their understanding of student perceptions and expectations in order to hire and develop a satisfied, productive, low turnover staff. Key recommendations and implications from the research include:

- Recognize the students' holistic approach to evaluating job opportunities. The student responses regarding job search and selection criteria revealed that they rank opportunity for advancement and job satisfaction ahead of salary offered. Therefore, employers should demonstrate opportunities for advancement within their supply chain organization and show job satisfaction of current employees during recruitment efforts.
- Expand corporate recruiting horizon. As a group, the employer respondents were fairly pessimistic regarding the geographic flexibility of students. In fact, over forty percent of students expressed a strong willingness to relocate anywhere in the U.S. or overseas based upon the job opportunity. In addition, nine percent of students desired to have a base of operation in close proximity to their families. Still, this finding signals an opportunity for employers to recruit on a wider geographic basis rather than limit activities to a single state or specific region.
- Focus on total compensation package. The employer respondents underestimate the importance of benefits to students as part of the overall compensation package. Specifically, employers underestimate the importance that students place on medical, dental and life insurance plus retirement benefits. In fact, three of these four benefits were among the top five benefits in student rankings. Employers perceived that students would be more interested in training and tuition support. It is critical that employers effectively communicate the array of benefits offered and focus on those benefits that student's desire.

Faculty Implications and Recommendations

Faculty can make use of the study results to help bridge the student and employer knowledge gaps. Key recommendations and implications from the research include:

- Promote students' development of key skills and abilities focusing on: ability to prioritize, plan and organize; leadership skills; ability to manage relationships; technical/oral communications skills and problem solving skills. To accomplish this task, the faculty should develop a supply chain curriculum that focuses on team based active learning (cases, team projects, corporate projects) that requires computer technology, quantitative analysis and oral presentations.
- Provide vital logistics, transportation and supply chain related experiences. These experiences should include: tours of facilities, internships, coops. In fact, a business experience should be part of the requirements for completing a supply chain major.
- Mold realistic expectations for students regarding logistics job requirements. Students should be educated regarding the time and techniques required to find a job that fits their needs, issues related to salary levels and other aspects of compensation and interview techniques. Students can be better prepared in these areas through the use of university and college career services, professional service organizations (student memberships) and career development websites.

- Share information with peers regarding student engagement in on campus interviews. Work to identify best practices for boosting career fair and interview participation levels by juniors and rising seniors.

Student Implications and Recommendations

The robust job market in logistics/supply chain management may make students complacent regarding job search. However, the reality is that an increasing number of opportunities and choices will require more not less screening and comparison to identify an opportunity that fits the individual students' requirements. Therefore, students must take a more aggressive role in pursuing logistics/supply chain positions. Key recommendations and implications from the research include:

- Recognize that the job search will require a significant time and effort. Nearly one-third of students had not participated in a single on-campus interview despite being well into their senior year (the survey was conducted in the November to February time frame). Many students indicated a desire to work for logistics or transport service providers and consulting firms. Also, students expressed a great interest in supply chain management, purchasing and supply management, logistics analysis and planning, and international logistics positions. Students must be willing to aggressively search for these "staff" positions among the myriad of service providers. Locating a desirable position is a multi-pronged endeavor—networking, participating in career fairs, using career services resources, conducting internet searches, posting resumes on corporate websites, and coordinating efforts with supply chain faculty—that must begin much sooner than the last few months of the senior year.

- Students must complete an internship or have relevant supply chain experience. Employers indicated that internship/co-op experience and industry work experience were two of the top five entry-level job candidate evaluation criteria. As the supply chain field has matured, more internship opportunities have been created by companies and as a result, most students have had an internship experience. By comparison, students without the necessary experience on their resume will not be competitive.

- Sell your unique capabilities, skills, and attributes. The employer respondents look for specific competencies and experiences that students must be able to communicate and demonstrate during interviews. Clearly, it's not about where you went to school or "who you know" (e.g., your references). In the minds of the employers, it's what you bring to the table in terms of ability to plan and organize, leadership, work experience, interpersonal skills and geographic flexibility that sets you apart from the other candidates.

Summary, Limitations, and Future Directions

The development of effective job placement programs is important for organizations that hire entry-level logistics, transportation and supply chain managers and university logistics/supply chain programs and their students. An important, but not often addressed aspect of the search, evaluation, and selection process in logistics is the student perspective.

This study provides insight into the views of 573 students at 20 U.S. universities regarding logistics job placement. Comparative insights are also provided for the 96 organizations that participated in the study. Analysis of the survey responses revealed many similar

perceptions between the groups and some noteworthy differences.

Employers can use the study findings and recommendations to benchmark their placement processes and to assess their understanding of student views in order to enhance their potential for recruiting success. Faculty can use the results to identify key employment and career issues that warrant additional coverage in the classroom. Finally, students can use the information to develop job search strategies and compensation expectations.

Appropriate methodological steps were taken to ensure that the research results are reliable, valid, and unbiased. However, the authors make no pretense that the results are all-encompassing or present the definitive study on logistics job placement preferences and perceptions. The information contained in the tables and figures are presented with the

caution that students from a few major logistics programs did not participate in the study and logistics services providers were heavily represented in the employer survey. However, the authors believe that the results adequately depict the current issues in logistics job placement.

The topic of logistics job placement is important and deserves additional study. Perhaps the most valuable effort would be to conduct similar studies of logistics students and employers in different countries to analyze variances in perspectives and preferences regarding job placement. Also, it would be beneficial to assess the views of graduate logistics students and the employers who recruit them. Finally, it will be important to repeat this study periodically to assess the trends in student and employer preferences, as well as the impact of economic conditions on placement perspectives and practices.

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SAFETY ATTITUDES AND BEHAVIORAL INTENTIONS OF MUNICIPAL WASTE DISPOSAL DRIVERS

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ABSTRACT

The Theory of Planned Behavior was used to study factors useful for predicting Behavioral Intentions to commit unsafe acts while driving for commercial drivers working for municipal waste management operations centers. The Theory of Planned Behavior was found to be moderately effective in predicting behavioral intentions, particularly through the constructs of Attitude and Perceived Control. Driver perceptions of safety climate, self-assessed personal safety performance, risk aversion, and attitudes toward behavioral factors associated with engaging in risky behaviors while operating motor vehicles were studied. Risk aversion and driver perception of their own safety performance were also useful predictors of intention.

INTRODUCTION

Once a week, employees of the firm responsible for safely and efficiently removing your household waste stop at your house, dump your trash or recycling into their truck, and drive off. The same thing has happened all your life and you've probably thought little of it. Many frustrated drivers race around slow-moving or stopped refuse or recycling trucks every day, unaware that this action is one of the leading causes of death for waste management employees. Despite the common presence of municipal disposal equipment and people on our streets, it seems few have sought to understand the challenging environment in which they work.

Very little research in waste management driving safety exists in the academic literature. Most academic research is focused on the occupational hazards of employees who work in hazardous waste management or waste management facilities (e.g., Akbar-Khanzadeh & Regent, 1999; Betsinger, Brosseau, & Golden, 2000). Perhaps this trend is justified, but waste management drivers face a complex driving environment and more needs to be done to understand driving safety in this context.

Much reading on waste management driving safety is found in the trade magazines. Waste management companies understand the perils of driving a Waste Management Vehicle (WMV) and the grim consequences associated with

unsafe driving. The companies must take driving safety seriously; the consequences for poor safety management practices can be very high. Many companies hold regular safety meetings, require their drivers to view safety videos, and put drivers through rigorous initial and annual driver safety training. Companies even educate the public about how to drive around WMVs. Moreover, the National Solid Waste Management Association (NSWMA) launched a safety video campaign in 2007. The episodes of the "Be Safe, Be Proud" campaign were designed to increase focus on the critical role of supervisors in influencing safety (Kilduff, 2007).

The industry's initiatives to enhance driver safety are laudable. But how much do we really know about how the initiatives influence the safety attitudes and behaviors of waste management drivers? Companies must understand how to tailor their safety programs and practices to influence drivers' safety behaviors. In order to accomplish that task, companies must first understand the attitudes and behavioral intentions of their drivers. Simply put, companies must understand what makes their drivers tick.

Objective, rigorous attitudinal and behavioral research is difficult, particularly in the driver safety context. But research in other fields has provided the tools to assess drivers' personal attitudes and behavioral intentions. Organizational safety climate has been linked to employees' safety attitudes and behaviors (e.g., Zohar, 1980). Furthermore, the Theory of Planned Behavior (TPB) directly assesses attitudes and their influence on behavior. The TPB has even been tested in the professional driving context (Newman, Watson, & Murray, 2004). In addition, a driver's attitude toward risk avoidance in general, and confidence in their own safety skills may affect their decision making (Forward, 2006; Zuckerman, 2007). An investigation of these factors might contribute to an understanding of drivers' safety behaviors and can educate safety professionals on the

next steps they must take to improve safety. The purpose of this study is to assess the influence of drivers' perceptions of safety climate, their propensity to avoid risk, their assessment of their own safety performance, and their attitudes on their intentions to commit unsafe driving actions.

CONCEPTUAL BACKGROUND AND HYPOTHESES

Safety climate is a sub-type of organizational climate that reveals the shared perceptions of organizational members concerning the organization's safety policies, procedures, and practices (Reichers & Schneider, 1990; Zohar, 1980). Studies have identified a direct relationship between safety climate and behavior (e.g., Mearns, Whitaker, & Flin, 2003; Zohar, 2000). In short, employees develop beliefs about the company's actions and communications related to safety and internalize attitudes concerning the consequences of unsafe behaviors. Those attitudes impact behavioral intentions and future behavior.

The Theory of Planned Behavior (TPB; Ajzen 1991) also links individual attitudes and behaviors. It provides a sound framework to study how an individual's personal beliefs, referent beliefs, and control beliefs about unsafe actions influence his or her behavior. While the TPB is cited as a complete theory of human behavior, other factors can influence a person's behavior. Two additional factors were considered in this study: a general aversion to risky behaviors and individual confidence in his or her ability to act safely. First, an individual's tendency to avoid risk in general may encourage that person to shy away from risky driving behavior. Finally, a person's attitudes about their ability to avoid an undesirable outcome (confidence in their ability to act safely) may influence whether or not they actually participate in a risky driving behavior.

The next section introduces the concepts identified above. Particularly, the safety climate-behavior relationship, TPB, risk avoidance, and self-assessed ability concepts are developed and discussed in the context of driving safety. The expected relationships are presented through proposed hypotheses.

Safety Climate and Behavior

Safety climate has been primarily researched in the manufacturing, energy production, and health care industries. Many definitions of safety climate have been proposed. However, most studies define safety climate as the shared perceptions of employees concerning organizational actions and procedures designed to eliminate or reduce injuries and accidents (Naveh, Katz-Navon, & Stern, 2005).

Empirical evidence for the safety climate-behavior relationship exists. High levels of safety climate, such as communication of safety issues to employees and displays of management's commitment to safety, reduce employee error and improve organizational safety (Mearns, Whitaker, & Flin, 2003; Wills, Watson, & Biggs, 2006; Zohar, 1980). Despite disagreement on the number of factors associated with safety climate, researchers generally agree that safety climate is best measured using employees' perceptions of management's attitudes and commitment to safety, the priority of safety within the organization (i.e., safety versus productivity), and the consistency with which safety is encouraged and practiced (Brown & Holmes, 1986; Diaz & Cabrera, 1997; Flin et al., 2000; Griffin & Neal, 2000; Mearns, Whitaker, & Flin, 2003; Naveh, Katz-Navon, & Stern, 2005; Zohar, 1980).

Waste management companies can enact policies and procedures that have a direct and positive impact on drivers' perceptions of safety climate. Safety climate perceptions inform drivers of desired driving behaviors and

the consequences of non-compliance with desired behaviors. Thus, positive perceptions of carrier safety climate are expected to reduce the likelihood that drivers plan to engage in unsafe behaviors.

H₁: Drivers' perceptions of company safety climate are negatively related to behavioral intentions to commit unsafe driving actions.

The Theory of Planned Behavior and Driving Safety

Social scientists have long been interested in why people act the way they do in various situations, and the TPB (Ajzen, 1991) addresses the factors that influence those decisions. The TPB has become generally accepted as a powerful tool for understanding human behavior and is held by some to be a complete theory of human behavior (Conner & Armitage, 1998). The TPB has been used extensively to predict aberrant driving behaviors such as speeding (Elliot, Armitage, & Baughan, 2003; Elliot, Armitage, & Baughan, 2005; Forward, 2006; Newman, Watson, & Murray, 2004; Parker et al., 1992; Warner & Åberg, 2006) and reckless lane changing (Parker, Manstead, & Stradling, 1995). However, few studies have applied the TPB in a professional driving context (see Newman, Watson, & Murray, 2004 for one example).

Predicting behaviors in traffic safety is difficult. Some research applying the TPB to driving behaviors has used drivers' self-reported behavior (Elliot, Armitage, & Baughan, 2003) and actual behavior (Warner & Åberg, 2006). However, given the difficulty in assessing actual behavior, most studies assessed behavioral intentions (Elliot, Armitage, & Baughan, 2005; Forward, 2006; Newman, Watson, & Murray, 2004; Parker et al., 1992). The inherent critical assumption holds that drivers will ultimately perform those behaviors they express intent to perform.

Given this context, the basic TPB model holds that three main factors will determine a person's behavioral intent toward a given behavior: attitude, subjective norm, and perceived behavioral control. Behavioral intentions are indicated by the person's likelihood to perform a behavior (Fishbein & Ajzen, 1975). Attitudes are based on the perceived consequences of a behavior and the likelihood that performing the behavior will lead to those consequences. Subjective Norm refers to a person's generalized belief about whether important referent persons or groups think he or she should (or should not) perform the behavior (Ajzen & Fishbein, 1980). Perceived behavioral control consists of a person's perceptions of factors that facilitate or inhibit their ability to perform a behavior (Ajzen, 1991). In other words, perceived behavioral control refers to whether or not the person feels that he or she can personally control the behavior. The TPB is appropriate for studying traffic safety because some behaviors, even aberrant behaviors, are influenced by factors outside the drivers' direct control (Haglund & Åberg, 2000).

It is expected that as drivers' attitudes and subjective norms reflect acceptance of unsafe driving actions, the more likely it will be that drivers will make an unsafe decision (or commit an unsafe act). Furthermore, the harder it is to avoid the unsafe behavior, the more likely it will be for drivers to perform the behavior. Conversely, if the behavior is unacceptable to both the individual and others, and the person believes they can control the activity, then generally there will be no intent to commit the action.

H₂: Drivers' attitudes, subjective norms, and perceptions of behavioral control towards unsafe driving actions are related (positively, positively, and negatively respectively) to behavioral intentions to commit those actions.

Risk Aversion and Self-Assessed Safety Performance

Two additional factors were considered in this study: a general aversion to risky behaviors and individual confidence in his or her ability to act safely. These were new factors tested for their interaction with the more traditional Climate and TPB model constructs. First, Zuckerman (2007) purported that high sensation seekers are more likely to engage in risky driving behaviors than low sensation seekers. Therefore, an individual's tendency to avoid risk in general may encourage that person to shy away from risky driving behavior. Items related to this factor were included in this study in an attempt to account for individual personal characteristics outside of the effects of the other TPB factors. In other words, it is anticipated that when a personality characteristic like risk aversion is accounted for, the explanatory power of the TPB model would be improved. It is anticipated that for less risk tolerant/more risk averse drivers, the intent to commit unsafe acts would be lower.

Finally, a person's attitudes about their ability to avoid an undesirable outcome (confidence in their ability to act safely) may influence whether or not they actually participate in a risky driving behavior. Forward (2006) found that drivers with confidence in their own driving abilities were able to withstand external pressure to commit risky driving behaviors. Therefore, this factor was added in support of our understanding of the role of safety training programs on the TPB. It is anticipated that increased safety training might improve an individuals' self perceived skill at operating safely, even under adverse conditions. A factor was created using items attempting to measure a drivers' perception of how safely they were able to act, when compared to "typical" drivers. It is proposed that if a driver has a higher level of self-

assessed safety performance, they would be less likely to intend to commit unsafe acts.

H3: Drivers' risk aversion and safety assessment are negatively related to behavioral intentions to commit unsafe acts.

METHOD

The participants in this study were WMV drivers from a small southwestern U.S. waste management company. The company operates out of four locations in the region and participants for the study were employees that operated out of three of the locations. The participants were attending company-mandated safety meetings composed of a general safety awareness discussion. In this context the drivers were given a 15 minute presentation on adverse weather/holiday hazards and then administered the survey immediately afterward. Of 103 potential respondents, 99 drivers volunteered to complete the survey (96% response rate). All data collected was kept strictly anonymous and confidential.

Demographics

Demographic information consists of drivers' personal characteristics and experience. As previously mentioned, 99 drivers completed the survey. Relevant respondent demographics are presented in Table 1. Approximately 63% of the drivers are from Location 1, a large metropolitan pick up and consolidation point. The other 37% are from Locations 2 (slightly smaller metropolitan pickup and consolidation) and 3 (primarily residential pick up). Most of the drivers classify themselves as fleet drivers or owner-operators (65% and 14%, respectively). A number of drivers did not list their classification (15%). All respondents are male (100%) and most are married (71%), with a large proportion of the respondents between the ages of 26-50 (approximately 85%). The majority of the drivers travel between 0-75,000 miles per year (74%). Most drivers are paid by-

the-hour (62%) or as a percentage of revenue (15%). Finally, most drivers have not been involved in a safety event in the last year (60%). The other 40% of drivers have been involved in a "Safety Event" (accident or received some kind of violation) in the last year. This could be characterized as a "high risk" environment.

TABLE 1
SAMPLE PERSONAL
CHARACTERISTICS (N=99)

Age (years)	
21-25	1.0
26-35	29.3
36-50	55.6
51-60	13.1
61 or older	0.0
Unknown	1.0
Marital Status	
Married	70.7
Divorced	10.1
Single	16.2
Widowed	1.0
Unknown	2.0
Safety Event	Percent
None	59.6
Preventable accident	19.2
Non-preventable accident	11.1
Traffic violation	5.1
Out-of-service inspection	2.0
Other	3.0
Experience	
Late career stage (> 10 yrs)	54.5
Mid-career stage (> 2 yrs, ≤ 10yrs)	34.3
Early career stage (≤ 2 yrs)	10.1
Unknown	1.0
Company time	
Extended (> 5 years)	23.2
Average (> 1 year, ≤ 5 years)	38.4
New (≤ 1 year)	35.4
Unknown	3.0

The drivers exhibit a broad range of experience ranging from 0.33 to 40 years with an average experience level of 13.6 years. Company tenure ranges from "just started" to 14 years with an average of 3.6 years with the company. The majority of the drivers are in the mid to late stages of their careers (i.e., > 10 years of experience) and the company seems to employ very few inexperienced drivers (i.e., ≤ 2 years). Additionally, the drivers are relatively new to the company. Approximately 74% of the drivers have worked for the company for five years or less.

Measures

Safety climate and TPB scales were adapted from previous literature (i.e. Zohar and Luria, 2005; Ajzen, 1991, 2002) and developed for the specific needs of this study. Surveys were pilot-tested with both safety professionals and a small group of drivers from a different company before being used in this study. Respondents voluntarily completed the survey and were given token incentives (i.e., pens and notepads) for participating.

Drivers' perceptions of organizational safety climate were measured using a 10-item, 7-point (*disagree* to *agree*) scale adapted from Zohar and Luria (2005). Based on relevance to the occupational context, six items were removed from the original 16 item instrument. The TPB constructs were measured with respect to unsafe driving actions using 5-item, 7-point scales, anchored by *totally unacceptable* to *fairly acceptable* (Drivers' Attitudes and Subjective Norms), *easy to avoid* to *hard to avoid* (Perceived Control), and *very unlikely* to *very likely* (Behavioral Intentions) based on Ajzen (2002).

Unsafe driving actions were identified in the Large Truck Crash Causation (LTCC) Study (USDOT, 2006) and consisted of the most common driver actions or behavioral outcomes that contributed to truck-caused accidents.

Semantic differential scales were adapted to minimize socially desirable responding.

Risk Aversion was measured using a 5-item, 7-point scale based on willingness to get involved in non-specific risky situations. The (safety) Self-Assessment construct asked drivers to compare their personal safety performance to the average commercial driver against a 7-point scale. These were new constructs tested for their interaction with the more traditional Climate and TPB model constructs.

RESULTS

Results are presented in two sections. First, reliability analyses and correlations between constructs are shown. The second section includes the regression analyses used to explore the relationships between the attitudinal or perceptual constructs (as independent variables) and the behavioral intent construct as the dependent variable. These results provide company safety management with some statistical evidence of the influences on drivers' behavioral intentions to commit unsafe driving actions.

Reliability and Correlation Analyses

Construct validity was performed using Factor Analysis and measured with the Cronbach's Alpha. Some items were removed from the proposed constructs after pilot testing and a reassessment of face validity by the researchers (see Appendix A, Survey Instrument). One item was removed from the Climate scale (regularity of safety awareness events). All items remained in the self-assessed safety performance items SA1-SA5, and risk avoidance items RA1-RA5, as these were new constructs to be investigated by the research in an exploratory fashion. One item was dropped from all TPB constructs (use of over the counter medications). This item was originally included due to its presence in the LTCC study. However, as the remaining factors

(speeding, performing a prohibited maneuver, and performing an improper lane change) were all volitional driving actions and the use of medication was not a volitional driving action, it was dropped for relevance. The items related to following too closely were not reliable enough to include in the analysis. It is proposed that for the type of congested metropolitan driving performed by the WMV drivers, this act was not as relevant as it would be for long-haul drivers.

Factor Analysis was used to assess the reliability of the constructs. The Climate variables C1-C9 were found to be reliable measures of safety climate and were included in the climate factor. All five items were found to be reliably related for both Self Assessed safety performance and Risk Avoidance. The TPB factors of Attitude (A1, 3, 4), Subjective Norm (SN1, 3, 4), Perceived Control (PC1, 3, 4),

and Behavioral Intentions (BI1, 3, 4) were all found to be reliable overall measures.

The metrics used to assess reliability are listed on Table 2, with the Cronbach's Alpha in the diagonal where each factor is crossed with itself. Values greater than 0.70 are generally considered reliable (Nunnally, 1978). All of our factors were considered to be reliable, ranging from a low of 0.78 up to a high of 0.92 for the factors. The validity of the exploratory constructs Risk Aversion and Self Assessed safety performance were both found to be internally reliable.

Results of the correlation analysis are also presented in Table 2. Correlations that were significant at the 0.10 level or better are indicated in bold; those better than the 0.01 level are bold and indicated with an asterisk.

TABLE 2
CORRELATIONS FOR KEY CONSTRUCTS

Variables	C	SA	RA	ATT	SN	PC	BI
Climate (C)	(.92)						
Self Assessment (SA)	0.58*	(.89)					
Risk Avoidance (RA)	0.38*	0.71*	(.78)				
Attitude (ATT)	-0.05	-0.11	-0.18	(.84)			
Subjective Norm (SN)	-0.17	-0.16	-0.18	0.58*	(.92)		
Perceived Behavioral Control (PC)	-0.01	-0.06	-0.11	0.43*	0.49*	(.89)	
Behavioral Intentions (BI)	-0.06	-0.24*	-0.29*	0.49*	0.45*	0.53*	(.89)

*Correlation is significant at the .01 level (2-tailed)

Correlation is significant at the .10 level (2-tailed)

Safety climate, self-assessed safety performance, and risk avoidance are highly and significantly related to each other. This finding implies that drivers who rate themselves as safer than other drivers are also likely to rate the company's safety climate higher. Those drivers who tend to avoid risk in general are also more likely to rate the company's safety climate higher. Finally, drivers who rate themselves as safer than others are also more likely to be risk averse.

Strong and significant relationships exist among the TPB variables. Attitude, subjective norm, and perceived behavioral control are all positively related to behavioral intentions. This finding is as expected. That is, drivers who find unsafe actions more acceptable are likely to have higher intentions to perform those actions. Drivers who believe their friends, family, and co-workers find certain unsafe actions more acceptable are likely to have higher intentions to commit those actions. Finally, the less control drivers perceived they have over performing unsafe actions, the higher their intentions to commit those actions. These findings will be discussed again in the regression analysis.

Finally, self-assessed safety performance and risk avoidance have a significant inverse relationship with behavioral intentions. In other words, drivers who assess their safety performance as higher than others have lower intentions to commit unsafe actions. Similarly, drivers who are risk averse have lower intentions to commit unsafe actions. Drivers' perceptions of company safety climate are not related to behavioral intentions.

Regression Analysis

Correlation analysis was followed by regression analysis. The results are presented in Tables 3 and 4. The Stepwise Regression procedure was used first for all of the factors of interest used in the study (C, SA, RA, ATT, SN, and PC; Table 3). The technique was then

applied to the Climate and TPB factors only (C, ATT, SN, and PC; Table 4). In both cases the factors were used to predict Behavioral Intention (BI). The inclusion threshold was set at a significance level of 0.10 or better.

When looking at all the factors, a few findings were noteworthy (Table 3). Overall, the model was very reliable (F Significance) and powerful (adjusted R^2). In contrast with the results of the correlation analysis, self-assessed safety performance and subjective norm were found to provide little additional power in predicting Behavioral Intention. Climate was not found to be significant in either the correlation analysis or the regression analysis.

In contrast, perceived behavioral control, attitude, and risk aversion constructs have a significant influence on behavioral intentions. Drivers who perceived various unsafe driving actions as more acceptable were more likely to commit those actions in the future. Furthermore, the harder it was for drivers to control whether or not they performed unsafe driving actions, the higher their intentions to commit those actions in the future. Those drivers who were generally more risk averse (uncomfortable with risky situations) were also less likely to consider performing the unsafe acts.

When only the climate and TPB factors were looked at, the results were a little different (Table 4). This model was also very reliable (F Significance) and powerful (adjusted R^2 ; slightly less than the "full" model). Contrary to expectations, drivers' subjective norms (how people close to them felt about the drivers performing unsafe actions) did not have a significant effect on behavioral intentions. One plausible explanation is that most drivers are not regularly subject to the perceptions of close friends and family while driving professionally. The results may be different when driving their personal vehicle. Furthermore, professional drivers make numerous split second decisions, and do not have the time to think about the

TABLE 3
HIERARCHICAL REGRESSION ANALYSIS FOR KEY CONSTRUCTS (ALL VARIABLES)

Variable		Behavioral Intent	
		Sig	Std Error
Intercept	3.020	.001	.852
Perceived Control	.418	.000	.098
Attitude	.308	.002	.096
Risk Aversion	-.308	.022	.132
F Significance (reliability)	.000		
Adjusted R ² (strength)	.375		

Entered those factors that were statistically significant at 0.10 or better

TABLE 4
HIERARCHICAL REGRESSION ANALYSIS
FOR KEY CONSTRUCTS (TPB VARIABLES)

Variable	β	Behavioral Intent	
		Sig	Std Error
Intercept	1.223	.001	.368
Perceived Control	.426	.000	.100
Attitude	.341	.001	.097
F Significance (reliability)	.000		
Adjusted R ² (strength)	.346		

Entered those factors that were statistically significant at 0.10 or better

Table 4
(continued)

Please tell us how much you disagree or agree with the following statements:

Top management in this company...	Disagree							Agree						
Reacts quickly to solve the problem when told about a safety issue.	1	2	3	4	5	6	7							
Provides all the equipment needed to do the job safely.	1	2	3	4	5	6	7							
Is strict about driving safely even when deliveries fall behind schedule.	1	2	3	4	5	6	7							
Quickly corrects any safety issue (even if it's costly).	1	2	3	4	5	6	7							
Provides detailed safety reports to employees (e.g., accidents, violations)	1	2	3	4	5	6	7							
Invests a lot of time and money in safety training for drivers.	1	2	3	4	5	6	7							
Listens carefully to employees' ideas about improving safety.	1	2	3	4	5	6	7							
Considers safety when setting delivery windows and schedules.	1	2	3	4	5	6	7							
Provides employees with a lot of information on safety issues.	1	2	3	4	5	6	7							
Regularly holds safety-awareness events (e.g., presentations, ceremonies).	1	2	3	4	5	6	7							

Compared to the average commercial driver on the road, I ...	Disagree							Agree						
Have a much better safety record.	1	2	3	4	5	6	7							
Strictly follow all company safety policies and recommendations.	1	2	3	4	5	6	7							
Set the example for others to follow in terms of safe practices.	1	2	3	4	5	6	7							
Abide by all Federal, State, and Local safety regulations.	1	2	3	4	5	6	7							
Have a much better track record for inspections and enforcement compliance.	1	2	3	4	5	6	7							

Compared to the average commercial driver on the road, I ...	Disagree							Agree						
Am very cautious and approach risks carefully.	1	2	3	4	5	6	7							
Tend to "sit things out" rather than take any chances.	1	2	3	4	5	6	7							
Avoid putting myself in stressful situations.	1	2	3	4	5	6	7							
Generally think things through quite a bit before acting.	1	2	3	4	5	6	7							
Don't like to get involved in new situations.	1	2	3	4	5	6	7							

Please give us your reaction to the following issues:

How acceptable is it to you personally to perform the following actions while driving commercially:	Totally Acceptable							Fairly Acceptable						
Exceed the posted speed limit in "built up" areas	1	2	3	4	5	6	7							
Follow too closely	1	2	3	4	5	6	7							
Perform a prohibited maneuver (U-Turn, rolling stop, etc.)	1	2	3	4	5	6	7							
Perform an improper lane change	1	2	3	4	5	6	7							
Use over the counter medication with a "Do not operate heavy equipment" warning	1	2	3	4	5	6	7							

Table 4
(continued)

How acceptable is it to <i>people close to you</i> (family, friends, coworkers) that you perform the following actions while driving commercially:	Totally Unacceptable				Fairly Acceptable			
Exceed the posted speed limit in "built up" areas	1	2	3	4	5	6	7	
Follow too closely	1	2	3	4	5	6	7	
Perform a prohibited maneuver (U-Turn, rolling stop, etc.)	1	2	3	4	5	6	7	
Perform an improper lane change	1	2	3	4	5	6	7	
Use over the counter medication with a "Do not operate heavy equipment" warning	1	2	3	4	5	6	7	
How easy or hard is it for <i>you</i> to control whether or not you perform the following actions while driving commercially (easy to avoid/hard to avoid):	Very Easy				Very Hard			
Exceed the posted speed limit in "built up" areas	1	2	3	4	5	6	7	
Follow too closely	1	2	3	4	5	6	7	
Perform a prohibited maneuver (U-Turn, rolling stop, etc.)	1	2	3	4	5	6	7	
Perform an improper lane change	1	2	3	4	5	6	7	
Use over the counter medication with a "Do not operate heavy equipment" warning	1	2	3	4	5	6	7	
How likely is it that you will perform any of the following actions, at least once or twice in the next month or so, while driving commercially:	Very Likely				Very Unlikely			
Exceed the posted speed limit in "built up" areas	1	2	3	4	5	6	7	
Follow too closely	1	2	3	4	5	6	7	
Perform a prohibited maneuver (U-Turn, rolling stop, etc.)	1	2	3	4	5	6	7	
Perform an improper lane change	1	2	3	4	5	6	7	
Use over the counter medication with a "Do not operate heavy equipment" warning	1	2	3	4	5	6	7	

perceptions of close friends and family. After the event has happened, this would affect their assessment of the role of those opinions on their own attitudes. Finally, some drivers might think that anything other than people's acceptance of their driving behavior is an indication of people's distrust of the driver to make good decisions. Thus, the driver dismisses others' opinions unless the opinions fit the driver's attitudes (Forward, 2006).

Also surprising was the lack of effect from the climate variable. Apparently, the drivers' perception of the company safety climate did

not correspond closely to their expressed behavioral intention. This was also supported by the correlation analysis discussed earlier. The most common explanation would be that if the climate variable were excessively "noisy" (a wide variation between answers on the climate items for each driver) it would fail to be accepted by the model due to reliability. However, the reliability score of 0.92 (from Table 2) would rule that explanation out. It could be that the drivers had strong (reliably consistent) opinions about the company safety climate, their opinions were not associated with their likelihood to commit an unsafe act.

In other words, their intentions were "indifferent" to how they perceived the safety climate.

MANAGERIAL IMPLICATIONS

This study provides important managerial implications. The findings suggest that, in this context, carrier management should focus on influencing drivers' attitudes towards and perceived control over unsafe driving actions. Also, screening of drivers for risk aversion may be helpful in this regard as well. However, studies have found that it is difficult to change attitudes because they are deeply rooted. Perhaps drivers' perceptions of the value of various safety practices may be used to inform management of potential courses of action to influence attitudes and perceived control.

Training and company support have traditionally been considered important influences of safe driving habits. Results from previous studies have indicated that effective training events may be a key to influencing drivers' attitudes. These events, however, must solicit consistent, active involvement from participants in classroom or interactive computer-based settings (Elliot, Armitage, & Baughn, 2005). Various types and venues of training coupled with a training partnership between drivers and carrier management may be a key to influence drivers' attitudes towards safety (Mejza et al., 2003). This study found no support for a direct link between safety climate perceptions and behavioral intent; however, evidence suggests that climate may have an

indirect effect on behavioral intentions by influencing self-assessed safety skills and risk aversion.

More specifically, training can be used to relay the potential consequences of safe and unsafe actions. It seems that company management does a great job conveying safety information to drivers. However, operational policies may counteract the effect of the information as was indicated in drivers' perceptions of safety climate. In other words, drivers might view the consequences of unsafe actions (i.e., speeding) as related to gains rather than losses. Safety training programs that focus on the positive consequences of safe behavior are likely to influence drivers' attitudes towards safety and, in turn, behavioral intentions (Forward, 2006).

Overall, more research is needed to determine which practices have the most effect on attitudes, perceived control, and behavioral intentions. This study is a good first step to identifying attitudes and perceived behavioral control as important influences of drivers' behavioral intentions to commit unsafe acts. Narrowing down the most important influences will get to the heart of the safety issue and management will ultimately be able to understand focus on the appropriate influencing factors. Also, the contribution of the new attitudinal constructs of risk aversion and self-assessed safety performance merit further investigation. Future research should also consider a broader sample of drivers working in different occupational contexts, as well as a larger number of participants.

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PROFIT CONTRIBUTION INFORMATION'S IMPACT ON INTERNAL INTEGRATION

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ABSTRACT

An exploratory quantitative study on the relationship between profit contribution information and firm-wide internal integration is presented. Specifically, the authors examine how profit contribution information availability impacts firm-wide internal integration and, subsequently, logistics performance. This study provides greater insight into the area; only a few studies have empirically examined the impact of profit contribution information within a firm. The primary implication is that firms should utilize specific types of information, i.e. profit contribution information, for making more informed operational and strategic decisions. The paper also underscores the managerial value of using profit contribution information in decision making and planning.

INTRODUCTION

Information/information exchange is the lifeline of business and has long been considered a potential source of competitive advantage (Closs and Xu, 2000). However, as Kim, Cavusgil, and Calantone (2006) note, information exchange by itself does not offer much benefit. The real value of information exchange is that it can contribute to the development of capabilities. The current

research explores the potential contribution of effective information utilization. Specifically, the research examines the relationship between the availability of profit contribution information (a resource) and firm-wide internal integration (a capability) and, ultimately, logistics performance. The type of information exchanged has important implications. It is argued that availability of one specific type of information—profit contribution information—positively enhances development of firm-wide

integration capabilities. Further, profit contribution information can be extremely useful in decision making and planning.

The next section provides a discussion of relevant background relating to the constructs of interest. This is followed by presentation of our conceptual model of the proposed relationships along with the theoretical grounding and development of hypotheses. Details are then provided covering the methodology and results as well as discussion of managerial implications.

BACKGROUND

Information Exchange

Information exchange—defined as the formal and informal sharing of meaningful and timely information—has been identified as a key component of successful supply chains (Stank, Daugherty, and Ellinger, 1996; Derocher and Kilpatrick, 2000). The exchange can involve transfer of information within a company or extend externally to customers and suppliers (Zailani and Rajagopal, 2005). Sharing information helps to support timely decisions, build strong relationships, and coordinate strategies and has generally been found to reduce total logistics costs and enhance value to customers (Brewer and Speh, 2000).

Information sharing influences both internal operations and interactions with external trading partners. Intra-company, cross-function information exchange helps to coordinate actions and gain efficiencies. External, cross-firm information exchange facilitates planning and can reduce uncertainty. The type of information made available has important implications, too. Simple operational and financial data such as production schedules or cost of goods is most likely commonly available. However, it is less common that vital strategic information such as forecasting, strategic goals, new product designs, and profitability analysis is readily accessible (Kwon and Suh, 2005).

Greater emphasis should be placed on generating and using more strategic information. As Barney, Wright, and Ketchen (2001) note, strategic information (including, but not limited to information on markets and customers) helps to ensure that firms are aware of changes in the environment and can result in a competitive advantage over slower, less informed competitors. The right information can be used to enhance a firm's position with its best customers. For example, customer profitability information can be used to guide strategic initiatives. Consider the example of a Fortune 500 chemical company that determined over 80% of their profit was generated by 50 accounts and more than 99% came from 100 accounts (Bowersox et al., 1995). They had considerably more than 100 accounts "on the books." By identifying the top accounts, they were able to put together programs to better serve those key customers. Eliminating unprofitable accounts freed up resources to better serve those customers with the most potential.

Information has long been suggested as a key element facilitating successful supply chain management; however, the type of information collected and used is critical. Often managers are overwhelmed. They have access to virtually every type of information imaginable, but not enough time to sort through all of it. A prioritization or suggested sequencing of use is needed. Sabath and Whipple (2004) identified profit contribution information of customers and products as critical to decision making and longer term strategic planning. From an economic or accounting perspective, profit contribution is "profit before fixed charges" (Hirschey and Pappas, 1996). However, Sabath and Whipple (2004) used it to mean—literally—the amount each sale contributes to overall profitability. Thus, it would refer to revenue generated minus fixed and variable costs. Profit contribution information can enhance a firm's internal coordination by allowing more informed decisions.

The Pareto principle states that: "Twenty percent of our customers account for 80% of our sales" or "Twenty percent of our SKUs account for 80% of our sales" (Juran, 1951). This phenomenon is a reality for nearly every company. Detailed profit contribution information can identify the top performing customers and products. Companies can then determine appropriate priorities and allocate resources accordingly. The 20% of customers and products that contribute the most to a firm's profit certainly deserve a high level of attention and service level. Of course, requisite service levels must also be maintained for other customers and products, but the top customers/products should always be the priority. Profit contribution information analysis also identifies the bottom (lowest performing) customers and products. This is equally important and can provide justification for dropping customers/products or can signal the need to make adjustments in service offerings and pricing structures.

Integration

Integration is "a process of interdepartmental interaction and interdepartmental collaboration that brings departments together into a cohesive organization" (Kahn and Mentzer, 1998, p. 56). Effective integration requires that "separate parties work together in a cooperative manner" (O'Leary-Kelly and Flores, 2002, p. 226). The "working together" can be within firm (internal integration) or cross firm (external integration). While definitions of integration vary, as Pagell (2004) noted, common themes emerge. Integration is generally believed to encompass cooperation, coordination, interaction, and collaboration with the intention of achieving mutually acceptable outcomes. Integration emphasizes a more coordinated and less functional way of managing.

With respect to the current research, internal integration refers to coordination and collaboration of logistics with other functional

areas within the organization while external integration refers to the integration of a firm's logistics activities with those of customers and suppliers (Stock, Greis, and Kasarda, 1998; Gimenez, 2006). Our focus is on internal integration.

Internal integration can be considered a building block for external integration and, ultimately, supply chain integration. As van Hoek and Mitchell (2006) note, most initiatives are critically dependent upon the active participation of other functions. Functional areas must share priorities and see opportunities similarly. It is a "fundamental concept of supply chain management that you cannot coordinate functions across companies within the supply chain if you cannot do this coordination first within your own company" (Mentzer, 2004, p. 29).

CONCEPTUAL MODEL AND HYPOTHESIS DEVELOPMENT

The Resource Based View of the Firm

The resource based view of the firm (RBV) provides the theoretical foundation for the current research. According to this view, a firm's resources can lead to a sustained competitive advantage, given certain resource attributes (Barney, 1991). Resources include a firm's assets, processes, information, knowledge, etc. that enable the firm to develop and implement strategies to improve efficiency and effectiveness (Barney, 1991). Resources should be viewed as inputs into the production process and are the source of a firm's capabilities (Grant, 1991). Examples of resources include items of capital equipment, employee skills, etc. (Grant, 1991). Capabilities are complex routines that determine the efficiency with which firms physically transform inputs into outputs (Collis, 1994). Capabilities can often be found in typical business activities such as order fulfillment, new product development, and service delivery (Day, 1994).

Building on RBV and the above definitions for resources and capabilities, we propose a model that consists of profit contribution information, firm-wide internal integration, and logistics performance, as depicted in Figure 1. We posit that profit contribution information is a resource that can enhance firm-wide internal integration, which in turn influences logistics performance of the firm. Profit contribution information is a resource that allows firms to develop effective business capabilities more quickly than can be achieved without the information (Teece, 1998; Autry et al., 2005). Information resources are inputs for firm-wide internal integration, a capability of the firm (Stank, Keller, and Daugherty, 2001). Consistent with recent research, firm-wide internal integration is proposed to influence logistics performance (Germain and Iyer, 2006). Logistics performance is a potential source of competitive advantage for firms through delivery speed, reliability, responsiveness, and cost-effective distribution (Morash, Dröge, and Vickery, 1996b).

Hypotheses Development

Bowersox, Closs, and Stank (1999) suggested that customer integration is one of the crucial types of supply chain integration, which involves identifying and satisfying the long-term requirements, expectations, and preferences of customers. However, they also noted that a more realistic approach is to build lasting and distinctive relationships with customers of choice rather than all customers. Their study also cited a manager's comment: "I

manage 24 different supply systems—23 for my best 23 customers and the 24th for everybody else" (p. 32). This is accomplished by tailoring product/service offerings to meet the exact needs and desires of specific customers, not the average needs of the average customer. Similarly, Lambert (2004) suggested that in a supply chain context, it is important to segment customers based on their value over time and work with them closely. Such focused customer relevancy requires the integration of relevant business processes.

While managers and researchers have emphasized the importance of the "best," "important," or "key" customers, how to identify these customers is not clear and warrants careful consideration. Also, supply chain integration requires a significant amount of resource commitment; therefore, the costs related to integration must be carefully examined (Bowersox, Closs, and Stank, 1999). Profit contribution information of different customers appears to be a particularly useful index to identify these important customers. Top customers are crucial to the company's long-term success; their profit contribution can also help to justify the cost related to integration. Although we emphasize the importance of profit contribution information, we do not have the intention to rule out other potentially important indices to evaluate the importance of customers.

The idea of using profit contribution information to guide decision-making is consistent with the concept of customer

FIGURE 1
PROPOSED CONCEPTUAL MODEL

selectivity. As discussed in the 1995 Michigan State University *World Class Logistics* book, "selectivity starts with the notion that firms should aggressively pick customers who have high potential and are best suited as business clients" (Bowersox et al., 1995). The same argument can be made for product selectivity, i.e., focus on products with the greatest potential.

As Sabath (2003) noted, profit contribution information helps to focus service efforts and sense demand changes in the market earlier. The profit contribution information also identifies priorities for integration efforts (Sabath and Whipple, 2004). For example, greater internal integration may be required to support planned expansion by a top customer or efforts may need to be shifted to coordinate manufacturing/distribution support on hot products, to generate better results. Therefore, it is proposed:

- H1: Profit contribution information availability is positively related to firm-wide internal integration.

Research has been conducted examining the relationship between integration and performance (Shapiro, 1977; Stalk and Hout, 1990; Ellinger, Daugherty, and Keller, 2000; Gimenez, 2006; Kim, 2006). Increased integration is generally believed to lead to improved organizational performance (O'Leary-Kelly and Flores, 2002). Gimenez and Ventura (2003) found that when companies achieve a high level of internal integration, this leads to better absolute performance. Higher levels of internal integration are likely to be associated with coordination of more functional areas or processes. For example, increased operational or organizational performance has been documented in companies where two or more processes are integrated (Safizadeh et al., 1996; Narasimhan and Kim, 2001; Pagell, 2004). As Morash, Dröge, and Vickery (1996a) noted, "process integration across functional areas becomes a source of competitive advantage" (p. 58). Further, they proposed that cross-functional excellence can increase "performance synergies."

Thus, the current research looks at broad-based integration—extending across the organization rather than limiting the examination to dyadic-type integration between two functional areas. The broad-based integration provides results in terms of enhanced performance outcomes. It is proposed:

- H2: Firm-wide internal integration is positively related to logistics performance.

METHODOLOGY

Sample and Data Collection

A survey was developed based on an extensive review of the literature and was subjected to the review of six highly qualified professionals. This included three academics, two consultants, and one executive from the electronics industry. They were asked to review the survey regarding domain representativeness, item specificity, clarity, and readability. The survey instrument was modified based on their inputs.

A total of 434 prospective respondents were selected from the logistics/supply chain executives of 2005 Fortune Top 500 companies and members of the Council of Supply Chain Management Professionals (CSCMP) based on job title (targeting Vice President and Director-level executives). After initial telephone contact, 253 executives agreed to look at the survey. Potential respondents had the option of completing the survey either in traditional mail format or in electronic format through a dedicated website. Past studies have shown homogeneity in responses via website and paper-based formats (Griffis, Goldsby, and Cooper, 2003; Deutskens, de Ruyter, and Wetzels, 2006). However, web-based surveys have shown higher response rates when compared with traditional mail surveys (Cobanoglu, Warde, and Moreo, 2001; Griffis, Goldsby, and Cooper, 2003; Deutskens, de Ruyter, and Wetzels, 2006).

A cover letter accompanied the survey explaining the purpose of the study. A drawing for a monetary reward (\$500) was used as an incentive to increase response. Two weeks after the initial wave of mailings and emails, a follow-up post card or email was sent as a reminder. At the end of the designated response time, 125 usable surveys were received, representing a 28.8% response rate (125/434). A response rate of 88.8% was noted for web-based surveys (111/125) and 11.2% for paper-based surveys (14/125). Independent t-tests were used to determine if there were significant differences between the two respondent groups (Field, 2000). No significant differences were noted between the web-based and paper-based respondent groups on any of the 14 variables.

With our survey, eight times as many website responses were returned compared to paper responses. Apparently the convenience of completing an on-line survey was very persuasive. Web-based surveys were definitely the preferred method of response. Other researchers may want to keep this in mind when selecting a delivery method. The response rate, along with additional benefits including cost, ready internet availability and low maintenance costs, and the ability to easily update and change surveys make web-based surveys very attractive. Perhaps of even greater significance is the fact that with web-based responses, data can generally be easily transferred or downloaded into files for further analysis. Respondent demographics are provided in Table 1.

Two approaches were utilized to examine potential non-response bias. First, the last quartile of responses (31), assumed to be most similar to non-respondents, was compared to the first three quartiles of responses (94). Comparisons of group means on individual survey questions revealed no significant differences for the primary variables (Armstrong and Overton, 1977). Second, 15 non-respondents were randomly chosen from the sample and asked to complete an abbreviated

version of the questionnaire online (Lohr, 1999). Follow-up phone calls were made to encourage them to complete the survey. T-tests of the same items in both full and short versions revealed no significant differences between respondents and non-respondents. Non-response bias was thus not considered to be a concern.

Constructs and Measurement

Profit contribution information availability was measured with newly developed scale items. Sabath and Whipple's (2004) study provided the rationale for the four items that measure a firm's profit contribution information availability for all customers, key customers, all products, and top products. A 7-point scale anchored by 1 = Not Available and 7 = Readily Available was utilized. Respondents indicated moderate availability levels of profit contribution information within their firms (mean measures ranged from 4.33 to 4.98).

Items from Rodrigues, Stank, and Lynch (2004) and Zacharia and Mentzer (2004) were used to measure firm-wide internal integration. Respondents were asked to indicate level of agreement with statements concerning the current level of internal integration within their firms (7-point scale with 1 = Strongly Disagree, 4 = Neutral, and 7 = Strongly Agree). Mean measures for the six items ranged from 4.84 to 5.54, indicating moderate to slightly higher levels of integration.

The logistics performance scale was adapted from Stank, Keller, and Closs (2001). Respondents were asked to evaluate their firms' relative logistics performance compared to competitors on a 7-point scale (1 = Much Worse, 4 = About the Same, and 7 = Much Better). Means of the four performance measures were moderately high (4.90 to 5.26). All items used along with their means and standard deviations are shown in Table 2. The correlation matrix of these three constructs is provided in Table 3.

TABLE 1
RESPONDENT DEMOGRAPHIC INFORMATION

	Frequency	Percentage
Respondent Title		
Vice President	36	28.8
Director	39	31.2
Other/Unspecified	50	40.0
Total	125	100
Industry		
Food and grocery	24	19.2
Personal care products	2	1.6
Automotive (suppliers to assemblers)	9	7.2
Office equipment and suppliers	2	1.6
Building and construction products	15	12
Computers/electronics	7	5.6
Other/unspecified	66	52.8
Total	125	100
Firm Size (Number of full-time employees)		
< 5,000	38	30.4
5,000 to < 50,000	31	24.8
>= 50,000	21	16.8
Not reported	35	28.0
Total	125	100

TABLE 2
CONSTRUCTS AND MEASUREMENT ITEMS

Constructs and Measurement Items	Mean	Std. Dev.
<i>Profit Contribution Information Availability</i> (Cronbach's Alpha = 0.904—newly developed based on Sabath and Whipple, 2004) (1 = Not Available, 7 = Readily Available)		
PCIA1. All customers	4.33	1.96
PCIA2. Only key accounts	4.98	1.69
PCIA3. All products	4.66	1.88
PCIA4. Only top (A-level) products	4.94	1.80
<i>Firm-Wide Internal Integration</i> (Cronbach's Alpha = 0.876—Rodrigues <i>et al.</i> , 2004; Zacharia and		

Table 2
(continued)

Constructs and Measurement Items	Mean	Std. Dev.
Mentzer, 2004)		
(1 = Strongly Disagree, 4 = Neutral, 7 = Strongly Agree)		
INTG1. My firm extensively utilizes cross-functional work teams for managing day-to-day operations	4.86	1.42
INTG2. Within my firm, employees from different functional areas are encouraged to work together	5.54	1.21
INTG3. Middle managers in my firm are encouraged to share information and provide input to other functional areas	5.38	1.38
INTG4. Within my firm, employees from different functional areas are encouraged to share resources	4.93	1.36
INTG5. Managers across my firm informally work together in teams	5.21	1.20
INTG6. The orientation of my firm has shifted from managing functions to managing processes	4.84	1.52
<i>Logistics Performance</i>		
(Cronbach's Alpha = 0.861—Stank <i>et al.</i> , 2001)		
Your firm's logistics performance in comparison to competitors. (1 = Much Worse, 4 = About the Same, 7 = Much Better)		
LP1. The ability to reduce the time between order receipt and customer delivery to as close to zero as possible.	4.90	1.19
LP2. The ability to provide desired quantities on a consistent basis.	5.24	1.24
LP3. The ability to modify order size, volume, or composition during logistics operation.	5.00	1.21
LP4. The ability to accommodate delivery times for specific customers.	5.26	1.25

TABLE 3
CONSTRUCT CORRELATION MATRIX

	Mean	Std.	PCIA	INTG	LP
1. PCI Availability (PCIA)	4.73	1.62	1		
2. Firm-wide Internal Integration	5.12	1.06	.298**	1	
3. Logistics Performance (LP)	5.10	1.03	.276**	.343**	1

* $p < .05$, Correlation is significant at the 0.05 level

** $p < .01$, Correlation is significant at the 0.01 level

Scale Assessment

SPSS and AMOS 5.0 (AMOS5) were used for the statistical analysis. A basic analysis of the data, including examination of incorrect coding, item normality (skewness and kurtosis), means, standard deviations, and outliers, yielded acceptable results (Mentzer, Flint, and Kent, 1999).

Confirmatory factor analysis (CFA) using maximum likelihood estimation (MLE) was conducted to assess and validate the operational constructs (Gerbing and Anderson, 1988). All constructs were allowed to correlate with each other. The results of the CFA measurement model are presented in Table 4. Since chi-square fit index has proven to be unrealistic in most structural equation modeling (SEM) research (Byrne, 2001), the major fit indices examined include chi-square/degree of freedom ratio, comparative fit

index (CFI), and root mean square error of approximation (RMSEA). As expected, the test yields an unsatisfactory chi-square value of 144.355 ($df = 74$, $p < 0.001$). However, the relative chi-square value of 1.951 falls into the recommended range of 3 to 1 (Bollen and Long, 1993). Because CFI accounts for sample size, a common bias in index calculations, it has been argued to be the "index of choice" (Byrne, 2001). The current model has a CFI value of 0.928, above the suggested 0.9. However, RMSEA has been recognized as one of the most informative criteria in covariance structure modeling because it takes into account the error of the approximation in the population and is sensitive to the number of estimated parameters in the model (Byrne, 2001). The RMSEA value of 0.078 is within the suggested range (less than 0.08) for good model fit (Browne and Cudeck, 1993). The above critical indices all demonstrate superior fit between the measurement model and the data.

TABLE 4
MEASUREMENT MODEL RESULTS

Path	Standardized Weight	Critical Ratio
PCIA1 β PCI Availability	0.886	(Fixed)
PCIA2 β PCI Availability	0.826	12.207
PCIA3 β PCI Availability	0.863	10.195
PCIA4 β PCI Availability	0.778	8.344
INTG1 β Firm-Wide Internal Integration	0.630	(Fixed)
INTG2 β Firm-Wide Internal Integration	0.841	7.468
INTG3 β Firm-Wide Internal Integration	0.834	7.282
INTG4 β Firm-Wide Internal Integration	0.747	6.786
INTG5 β Firm-Wide Internal Integration	0.713	6.611
INTG6 β Firm-Wide Internal Integration	0.674	6.401
LP1 β Logistics Performance	0.655	(Fixed)
LP2 β Logistics Performance	0.835	7.528
LP3 β Logistics Performance	0.813	7.512
LP4 β Logistics Performance	0.813	7.469

Fit statistics:

Chi-square = 144.355 ($df = 74$, $p < 0.001$), Chi-square/ $df = 1.951$, CFI = 0.928, RMSEA = 0.078

Other AMOS5 outputs on CFA were used to examine the constructs' unidimensionality and validity. Standardized regression weights showed that all items loaded on appropriate factors (constructs) as expected. Critical ratios (CR) of these regression weights are all significant at 0.05 level (> 1.96), supporting the unidimensionality and convergent validity of the constructs (Gerbing and Anderson, 1988). In order to assess discriminant validity, nested models were examined for each pair of constructs, where the inter-factor correlation was fixed to 1. All chi-square differences were significant ($p < 0.001$), indicating the proposed measurement models have better fit with the data. This supports discriminant validity of the constructs.

Finally, a test of internal consistency reliability was performed utilizing Cronbach's coefficient alpha (Cronbach, 1951). The range of Cronbach's coefficient alphas was from 0.861 to 0.904; all are well above the suggested 0.70 (Nunnally, 1978). Therefore, all scales were considered reliable. Together, the above results support the overall reliability and validity of the scale items used to measure the hypothesized constructs.

Hypotheses Testing and Results

Given the overall sound assessment of the measurement model, attention now turns to the structural model and testing of hypothesized relationships. AMOS5 was used

for the SEM analysis. Individual hypotheses were assessed by reviewing the direction and significance in AMOS5 output.

As recommended by Hu and Bentler (1999), multiple fit criteria were considered in order to rule out measurement bias. The most commonly used fit indices were considered (Bagozzi and Yi, 1988). Model statistics are shown in Table 5. Although the chi-square value of 149.038 is significant, the chi-square to degrees of freedom ratio of 1.987 is below the suggested 3.00 (Bollen and Long, 1993). All other indices were within the recommended range, including CFI = 0.925 and RMSEA = 0.079. They meet or exceed suggested values, indicating good model fit (Browne and Cudeck, 1993).

AMOS5 outputs on paths' standardized regression weights with relevant critical ratios and p -values are shown in Table 5. H1 examines the relationship between profit contribution information and firm-wide internal integration. The SEM analysis results supported this hypothesized link (standardized regression weight = 0.324, CR = 3.139, and $p = 0.002$), suggesting that the availability of profit contribution information for customers and products can improve a firm's internal integration. Also, the positive impact of firm-wide internal integration on logistics performance was supported (H2: standardized regression weight = 0.412, CR = 3.623, and $p < 0.001$).

TABLE 5
HYPOTHESIZED PATHS TESTING

Path	Standardized Weight	Critical Ratio	p -value	Note
H1: Firm-Wide Internal Integration β PCI Availability	0.324	3.139	=0.002	Supported
H2: Logistics Performance β Firm-Wide Internal Integration	0.412	3.623	<0.001	Supported

Fit statistics:

Chi-square = 149.038 ($df = 75$, $p < 0.001$), Chi-square/ $df = 1.987$, CFI = 0.925, RMSEA = 0.079

DISCUSSION AND IMPLICATIONS

There is an old joke. One guy is trying to sell something and he's offering it at a loss. The potential buyer asks how he can stay in business. The answer: volume. Well, as we all know, that doesn't work in the real world. Firms must make informed decisions to survive long-term. Accurate profit contribution information has immense managerial value. If products or customers aren't profitable, different approaches must be considered. At the extreme, the customer or product can be dropped. A more realistic approach would be to make adjustments. This typically would involve repricing products or identifying ways to reduce resource consumption, i.e., adjust the cost structure (Cooper and Kaplan, 1991).

If products or customers aren't profitable, a pricing adjustment (increase) may be the answer. Also, investigation is warranted to determine what makes the accounts/products unprofitable. Can something be done to make such accounts/products profitable? If not, it may be necessary to drop them.

Perhaps not as obvious is the value of profit contribution information on products that are showing a profit. For example, is the current profit margin realistic and sustainable? Or is a large profit margin actually inviting competitors to enter the market? What stage of the product life cycle is the product? Examination of products based upon profit contribution and stage in the life cycle can indicate whether the right course is being taken. For example, profit margins typically decrease as the life cycle progresses from introduction to growth as competitors enter the market and drive price down (Levitt, 1965). In the decline stage of the life cycle when there are likely to be many fewer competitors, there is also likely to be a group of core loyal users. It may be possible to adjust prices upward at that time. Another consideration is elasticity of demand. A lower price—lower margin and

lower contribution to profit per item sold—may actually be desirable if a decrease in price will result in a marked increase in demand. Accurate profit contribution information will indicate if a price cut is doable.

The second option is to adjust the cost structure. Efficiencies may be gained through lean manufacturing, improved scheduling to avoid inventory build-up, outsourcing of transportation or warehousing, etc. Activity-based costing (ABC) can be used to view expenses and profitability at the product and customer level and can help to identify improvements that will have the biggest impact on the bottom line (Cooper and Kaplan, 1991). The information can also be used to negotiate with customers to adjust delivery schedules and quantities to gain greater efficiencies. Customers may be willing to consider adjustments in service offerings (fewer deliveries, longer lead times, elimination of customized options, etc. which can directly impact costs) in order to maintain the current pricing structure.

Our research looked at two important areas: 1) the relationship between profit contribution information and firm-wide integration and 2) the relationship between firm-wide internal integration and logistics performance. Not only does availability of profit contribution information have significant pragmatic value for guiding decision making, our research supports an information-integration relationship. Profit contribution information can reduce internal cross-functional arguments and allow management to move forward with speed on critical decisions. For example, if operational level rationing is required (such as which customer's order gets filled when shortages occur or which product gets moved up on the production schedule when they've reached capacity), profit contribution information can be used to determine who should be first in line. At a more strategic level, profit contribution information can provide

undisputed logic for product line extensions, product phase-outs, realignment of costing policies, and a myriad of other areas.

Internal integration is vital to today's complex, fast-paced business environment. Coordinated efforts and close interaction are needed to support decision making and manage complex processes. In spite of this, "internal misalignment" characterized by internal misunderstandings and disagreements rather than cooperation and coordination is often the reality in businesses (van Hoek and Mitchell, 2006). Our research provides empirical evidence that internal integration can positively impact performance—and may serve as justification for managers fighting to get the needed resources to increase coordinative efforts and integration.

CONCLUSION

While using contribution analysis may at first appear to be internally driven and not customer centered, we would argue it offers a sound long-term decision tool. Instead of being viewed as a metric to discriminate against lower volume, lower margin customers,

contribution analysis should be seen as a focused customer centered metric. By identifying the best performing products and best customers, companies can improve their economic health—and potentially be around much longer to serve not only A-level customers, but others as well. Many companies have the data readily available to create profit contribution information, they just haven't made the effort to analyze the data or haven't realized the value in doing so.

Our survey-based research provides important insights into the value of profit contribution analysis and its relationship to internal integration. However, our research findings should only be considered a starting point. For example, while the survey-based research findings can be generalized to broader settings, qualitative research is also recommended. Future research can utilize in-depth interviews to drill-down to gain greater insights and understand how profit contribution information and ABC analysis can be used to greater advantage. Documentation of how companies are actually using the information is needed.

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THE EFFECTS OF INTERDEPARTMENTAL CUSTOMER ORIENTATION ON DISTRIBUTION CENTER PERFORMANCE

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ABSTRACT

Firms have begun to look internally for ways to increase external service quality. ANOVA is used to examine the effect of interdepartmental customer orientation on time, inventory, and customer service-based performance variables in distribution centers. Findings indicate that high interdepartmental customer orientation positively affects distribution center performance in terms of time-based performance measures and customer satisfaction. Interdepartmental customer orientation was found to have only a marginal affect on inventory performance. Implications of the current research for distribution centers and transportation managers are discussed along with limitations and opportunities for future research.

INTRODUCTION

Transportation and distribution center managers must work together to meet their respective value propositions. Distribution center managers depend on transportation service providers to deliver freight undamaged and in accordance with agreed upon schedules. Transportation managers depend upon distribution center personnel to load the

correct, undamaged freight on-time to facilitate this task. However, achieving perfect distribution center performance is difficult due to the many opportunities for late shipments, damaged product, stockouts, and other challenges. In the event of a missed shipping appointment, or loading of incorrect freight, carriers incur losses in the form of increased cost and decreased driver/asset productivity. Driving time is consumed while waiting on

product to be loaded or the correct product to be loaded. Increased asset idle time decreases equipment utilization. Transportation managers' time is consumed dealing with late deliveries, OS&D, or drivers who are upset because their on-duty hours are consumed by non-income generating activity. These are problematic issues for carriers in that cost control and asset utilization have been noted as keys to maintaining motor carrier profitability (Stephenson and Stank, 1994).

In light of this, Dobie (2005) draws a corollary to the core carrier concept and notes that it may behoove carriers to identify core shippers. Core shippers are preferred firms whose characteristics and capabilities most contribute to carrier profitability and performance. Among other shipper selection criteria, Dobie (2005) posits that carriers should examine shippers' timeliness (i.e., extent to which freight is loaded and unloaded in a timely manner, minimizing wait time) and the quality of front-line personnel. One method carriers may utilize to evaluate potential core shippers, and shippers may utilize to improve timeliness and perceived front-line personnel quality, is through assessment and provision of high levels of internal service quality inside distribution centers through interdepartmental customer orientation.

As a way to improve distribution center performance, some firms have begun to examine the integration of their internal functions to discover opportunities for quality improvements yet to be realized (Bowersox, Closs, and Stank, 1999). Conduit and Mavondo (2001) propose that to improve external performance, the quality of service delivered inside an organization must first be improved (see also, Berry, 1983; Grönroos, 1990; Lings, 1999). The importance of internal service quality can also be found in the Total Quality Management (TQM) literature (Finn et al., 1996), and within the Malcolm Baldrige Award criteria (Stauss, 1995).

Distribution center personnel in contact with products and services just prior to delivery to external customers directly affect customer perceptions. To achieve corporate value propositions, front-line personnel receive information from other departments within the organization (Lings, 1999). Departments serve as internal suppliers to other functions of the firm that consume the output of supplying departments (Berry, 1981; George, 1990; Grönroos, 1990). To deliver the greatest value, each department must perform its duties in a customer-oriented manner to other departments (Mohr-Jackson, 1992; Conduit and Mavondo, 2001). Ultimately, the service delivered internally culminates in the service level delivered by front-line employees to the external customer.

This work explores the effect of interdepartmental customer orientation on distribution center performance. Specifically, the research delineates the effects of interdepartmental customer orientation on distribution center efficiency (e.g., inventory turns) and effectiveness (e.g., external customer satisfaction) as well as the net effect of this performance for transportation service providers. Next, a discussion of internal service quality and interdepartmental customer orientation is presented. The method used to assess the relationship of interdepartmental customer orientation to distribution center performance is explained. Results, implications, and limitations conclude the discussion.

LITERATURE REVIEW

Hammer (2001, p. 52) defines a process as "an organized group of related activities that together create a result of value to customers." Internal service processes include simplified standard operations, procedures, and activities that support front-line business employees that interact with customers.

The concept of designing internal service systems was introduced in the 1960's (Davis, 1993) and has led to a concept called service blueprinting (Shostack, 1987). Service blueprinting graphically details internal service processes in flow charts depicting interrelated activities as those that are, and are not, visible to the external customer (Lings, 1999).

Service blueprinting implies that internal service systems are organized into a type of work-flow service (Davis, 1993) where each department is a sequential stage in the production of a product or service that is ultimately delivered to the end customer. In the absence of exceptional internal customer service between departments, the service delivered to external customers is likely to be less than optimal. However, departments are often encouraged, by the way they are evaluated within the firm, to view their function as merely a single activity in a process (Stauss, 1995). This results in a myopic view of the department's role in the service delivery process, leading to departments that focus solely on their *intra*-departmental activities and measures and giving little regard to how the output affects others downstream.

The existence of an interdepartmental customer orientation may help alleviate this problem through the delivery of exceptional service to each internal customer during each internal transaction (Conduit and Mavondo, 2001). Interdepartmental customer orientation is the organizational orientation that encourages departments to view their internal role as part of an entire process and to make the necessary efforts to increase service levels they provide to other departments downstream toward the external customer.

Interdepartmental customer orientation potentially improves distribution center efficiency and effectiveness by facilitating internal integration (Bowersox, Closs, and Stank, 1999; Conduit and Mavondo, 2001).

Bowersox, Closs, and Stank (1999, p. 59) define internal integration as "the competency of linking internally performed work into a seamless process to support customer requirements" and find that internal integration is a significant indicator of supply chain performance as measured by supply chain efficiency and effectiveness metrics. Interdepartmental customer orientation is not only useful to support front-line employees but is applicable throughout the firm (Hartline and Ferrell, 1996). It is particularly effective in process-type operations, such as distribution center service operations, that are highly service- and process-based (Lings, 1999). Front-line distribution center employees are often the last touch-point of product inspect and verification just before customer delivery. Service is critical at this stage because it greatly influences external customer perception of the distribution center.

In light of this, the effect on carriers of improved distribution center interdepartmental customer orientation is likely to be pronounced. The presence of an interdepartmental customer orientation could be characterized as: 1) increasing the value one department provides to another, 2) improved collaboration to understand the requirements of a downstream department, and 3) ongoing interdepartmental performance appraisals, among other factors. Therefore, an interdepartmental customer orientation is likely to result in increased timeliness and accuracy of distribution center interdepartmental information exchange. This improvement in the speed and accuracy of information exchange would logically reduce the number of missed shipping dates while simultaneously reducing shipping errors. A reduction in late shipments lessens driver and asset wait time at distribution locations, therefore increasing driver and asset productivity. Further, receivers often contact carriers first upon discovery of OS&D and a reduction in distribution center shipping errors would reduce the amount of time

carriers' administrative personnel allocate to resolving these issues.

Seibert and Lingle (2007) support the notion that superior levels of internal service quality are associated with superior levels of business performance. Rodrigues, Stank, and Lynch (2004) utilize a structural equations method and find that integrated operations, conceptualized as a combination of external and internal integration, positively affect logistics performance. While Voss, Calantone, and Keller (2005) find that interdepartmental customer orientation positively influences supply chain efficiency and firm service performance, they did not examine its effects on firm efficiency. The present investigation seeks to fill this gap in the literature and investigate the effect of interdepartmental customer orientation on distribution center time-based, inventory, and customer service performance measures while illustrating the importance of these outcomes to transportation managers.

METHOD

A survey methodology was utilized to explore the specific effects of interdepartmental customer orientation on logistics performance. E-mails sent to distribution managers inviting them to complete an on-line questionnaire. Respondents accessed the survey via an established website provided by researchers. A random selection of managers from the leading association of warehousing and distribution, Warehousing Education and Research Council (WERC), constituted the sample.

A total of 365 useable questionnaires were received from 1,486 potential respondents (24.86% response rate). Data analysis began by formulating a multi-item summated scale consisting of 4 items used to measure the emphasis respondents placed on providing interdepartmental customer orientation. The utilization of summated scales is common in social science research to provide more reliable

measurement of an underlying construct of interest (Yuan, Bentler, and Kano, 1997). Summated scales hold several advantages over the use of a single item concept measurement. Specifically, summated scales average out item specificity, allow researchers to make more granular distinctions among respondents, and increase reliability while simultaneously decreasing measurement error (Churchill, 1979). By utilizing summated scales, the researcher obtains a more 'well-rounded' perspective of the concept at hand (Hair et al., 1998).

Items were drawn and modified from previous works investigating interdepartmental customer orientation (Voss et al., 2004) with acceptable psychographic properties. Responses to the multi-item scale were gathered by asking respondents to indicate the frequency with which managers have performed the action in question (7 point scale with anchors of 1 = infrequently; 7 = frequently). Items were factor analyzed and fell into a single factor with factor loadings exceeding the required .70 cutoff (Nunnally and Bernstein 1994). A test for internal consistency yielded a Chronbach's alpha of .74, exceeding the .70 cutoff recommended by Churchill (1979). Items and scale properties are presented in Table 1.

Respondents were divided into high (HICO: High Interdepartmental Customer Orientation), medium, and low (LICO: Low Interdepartmental Customer Orientation) interdepartmental customer orientation groups. These three groups were formed by splitting the sample into groups of approximately equal size (~123) and adjusting the groups such that the same summated scale average was not divided into two separate groups (i.e., such that a summated scale average of 6.25 was not present in two different groups). This resulted in a sample of 126 respondents in the HICO Group and 97 in the LICO Group. In order to illuminate the effects of interdepartmental customer orientation,

TABLE 1
INTERDEPARTMENTAL CUSTOMER ORIENTATION MEASURES

	"Over the past month, how frequently have you done the following?" [†]	λ	Mean	s.d.	α /Deleted	Item/Total Correlation
ICO	Ensured that my department treated other departments as internal customers.	0.75	5.98	1.16	0.67	0.52
ICO	Consistently tried to increase the value of the output my department provided to other departments.	0.75	5.95	1.06	0.67	0.53
ICO	Collaborated with other departments to ensure that my department understood their on-going requirements.	0.80	5.53	1.25	0.62	0.60
ICO	Inquired on how my department's performance was appraised by other departments.	0.70	5.09	1.57	0.71	0.48

[†] $\alpha = 0.741$

KMO Sampling Adequacy = 0.882

Bartlett's Test of Sphericity: $\chi^2_{10} = 486.218$, $p < 0.01$

Scale Variance Extracted = 56.387%

subsequent discussion focuses on the differences between the HICO Group and LICO Group.

Demographic characteristics of the entire sample, HICO, and LICO groups are provided in Table 2. Statistical comparisons of demographic differences in the HICO and LICO groups are provided in Table 3. The only significant demographic difference between the HICO and LICO groups was in the number of years employed in the distribution industry with HICO respondents having spent an average of 17.76 years and LICO and average of 14.18 years ($t = 2.72$; $p < 0.05$).

ANOVA was utilized to determine significant performance differences between the HICO

and LICO groups. Performance variables were recoded such that a higher response indicates better performance. Three general groups of performance variables were examined. First, time-based performance measures were conceptualized to be represented by 1) on-time delivery, 2) orders shipped on-time, and 3) order cycle time. Second, inventory performance measures were measured by 1) inventory turns, 2) inventory accuracy, and 3) inventory levels/number of days supply. Finally, customer service performance measures were measured by 1) customer satisfaction, 2) order fill rates, 3) shipping errors, and 4) customer complaints. These performance metrics were drawn from past works as indicated in Table 4.

TABLE 2
DEMOGRAPHICS

	Mean Responses		
	Entire Sample	HICO [†]	LICO [†]
Years in Industry	15.95	17.76	14.18
Years with Employer	9.25	8.90	9.66
Years in Current Job	5.59	5.74	5.45
Employees in Facility	246	276	233
Age	42.84	43.59	41.38
Position			
Warehouse/DC Operations	271	90	75
Inventory Control	17	8	3
Administration	13	3	3
Transportation	13	2	4
Customer Service	5	1	3
Other	46	22	11
Gender			
Male	315	105	88
Female	50	21	11
Education			
Some high school	5	1	4
Graduated from high school/G.E.D.	63	28	15
Some college/technical training	148	54	42
Graduated from college	94	28	25
Some graduate school	22	4	5
Graduate degree	33	11	8

†HICO = High Interdepartmental Customer Orientation
LICO = Low Interdepartmental Customer Orientation

TABLE 3
DEMOGRAPHIC COMPARISONS: HICO AND LICO GROUPS

t-test	HICO [†]	LICO [†]	t	p-value
Years in Industry	17.76	14.18	2.72	0.01*
Years with Employer	8.90	9.66	-0.71	0.48
Years in Current Job	5.74	5.45	0.39	0.70
Employees in Facility	276	233	0.672	0.50
Age	43.59	41.38	1.561	0.12
Crosstab	HICO [†]	LICO [†]	χ^2	p-value
Position			5.81	0.33
Warehouse/DC Operations	90	75		
Inventory Control	8	3		
Administration	3	3		
Transportation	2	4		
Customer Service	1	3		
Other	22	11		
Gender			1.40	0.24
Male	105	88		
Female	21	11		
Education			4.81	0.44
Some high school	1	4		
Graduated from high school/G.E.D.	28	15		
Some college/technical training	54	42		
Graduated from college	28	25		
Some graduate school	4	5		
Graduate degree	11	8		

[†]HICO = High Interdepartmental Customer Orientation

LICO = Low Interdepartmental Customer Orientation

*Indicates significant mean difference between HICO and LICO groups at $p < .05$

TABLE 4
PERFORMANCE MEASURES

Performance Measure	Authors	Title/Outlet
Time-Based		
On-time delivery	Griffis et al., (2004)	"Performance Measurement: Measure Selection Based Upon Firm Goals and Information Reporting Needs," <i>Journal of Business Logistics</i>
Orders shipped on-time	Byrne and Markham (1991)	Improving Quality and Productivity in the Logistics Process, <i>Council of Supply Chain Management Professionals</i>
Order cycle time	Nyaga et al. (2007)	"The Impact of Demand Uncertainty and Configuration Capacity on Customer Service Performance in a Configure to Order Environment," <i>Journal of Business Logistics</i>
Inventory		
Inventory turns	Griffis et al., (2004)	"Performance Measurement: Measure Selection Based Upon Firm Goals and Information Reporting Needs," <i>Journal of Business Logistics</i>
Inventory accuracy	Byrne and Markham (1991)	Improving Quality and Productivity in the Logistics Process, <i>Council of Supply Chain Management Professionals</i>
Inventory levels (number of days supply)	Zinn et al. (2002)	"Customer-based Measures of Inventory Availability," <i>Journal of Business Logistics</i>
Customer Service		
Customer satisfaction	Tracey (1998)	"Importance of Logistics Efficiency to Customer Service and Firm Performance," <i>International Journal of Logistics Management</i>
Order fill rates	Zinn et al. (2002)	"Customer-based Measures of Inventory Availability," <i>Journal of Business Logistics</i>
Shipping errors	Byrne and Markham (1991)	Improving Quality and Productivity in the Logistics Process, <i>Council of Supply Chain Management Professionals</i>
Customer complaints	Bartlett et al. (2007)	"Improving Supply Chain Performance Through Improved Visibility," <i>International Journal of Logistics Management</i>

RESULTS AND DISCUSSION

ANOVA results presented in Table 5 indicate several differences between the performance means for HICO and LICO. Examination of the *time-based performance* measures indicate managers whose departments frequently perform the interdepartmental customer orientation items examined (HICO) report significantly higher performance in terms of on-time delivery ($F = 3.581$; $p < .05$) and orders shipped on-time ($F = 3.828$; $p < .10$). No significant difference was found between the groups in terms of order cycle time length ($F = 0.640$; $p = 0.424$).

The results for *inventory performance* are less slanted toward the HICO Group. HICO managers reported significantly higher inventory turns ($F = 2.865$; $p < .10$) but the difference was only marginally significant at the $p < 0.10$ level. No significant difference was found between the HICO and LICO groups in terms of inventory accuracy ($F = 0.447$; $p = 0.504$) or inventory days of supply ($F = 0.515$; $p = 0.474$).

In terms of *customer service performance* measures, HICO managers indicate their firms achieve significantly better performance in terms of customer satisfaction ($F = 13.204$; $p < .05$), order fill rates ($F = 7.240$; $p < .05$), and shipping errors ($F = 4.320$; $p < .05$). No significant difference was found between the groups in terms of customer complaints ($F = 2.520$; $p = 0.114$).

Clearly, not all elements of logistical performance were impacted by interdepartmental customer orientation, although some meaningful differences were found. Firms exhibiting higher levels of interdepartmental customer orientation are able to ship and deliver orders on-time more reliably than their counterparts in the LICO Group. This increase in reliability likely results from efforts to understand the needs of other departments and meet these needs

through provision of accurate information. Distribution environments are characterized by the need to process orders in an effective manner in order to allow shipments to depart on-time. This requires error free information exchange to prevent undue and unpredictable shipping delays. The HICO Group also achieved significantly higher performance in terms of on-time delivery. This result implies the natural relationship between on-time shipping and on-time delivery.

Interestingly, no difference was found between the groups in terms of order cycle time. It would be logical to assume that interdepartmental customer orientation would speed up information exchange and therefore lower order cycle time. Results do not support this assumption and indicate that interdepartmental customer orientation primarily affects time-based performance in terms of shipment and delivery reliability but does not affect the total time it takes to perform logistical activities.

The difference between reliability and speed is well-known to transportation managers. Given the choice, receivers would rather have their product delivered reliably as opposed to faster but less reliably. The same could be said for transportation managers preference for shipping date reliability versus speed characterized by order cycle time. Given the choice, transportation managers would rather an order be processed slower but shipped on-time in a reliable manner. This prevents drivers and transportation assets from waiting for product to be loaded.

The relationship between distribution center reliability (e.g., on-time shipping) and speed (e.g., order cycle time) is illustrated in figures 1 and 2. Figures 1 and 2 depict a normal distribution illustrating the difference in speed and reliability. LICO firms are represented by Figure 1 and HICO firms are represented by Figure 2. By definition, shipment occurs at the completion of an order cycle. The mean order

TABLE 5
GROUP PERFORMANCE DIFFERENCES

Time-Based Performance Measures				
Performance Item	Group [†]	Mean	F-ratio	p-value
On-time delivery	HICO	5.09	3.58	0.06**
	LICO	4.73		
Orders shipped on-time	HICO	5.20	3.83	0.05**
	LICO	4.83		
Order cycle time	HICO	3.83	0.64	0.42
	LICO	3.99		
Inventory Performance Measures				
Performance Item	Group [†]	Mean	F-ratio	p-value
Inventory turns	HICO	4.35	2.87	0.09**
	LICO	4.05		
Inventory accuracy	HICO	4.84	0.45	0.50
	LICO	4.70		
Inventory levels (number of days supply)	HICO	3.90	0.52	0.47
	LICO	3.76		
Customer Service Performance Measures				
Performance Item	Group [†]	Mean	F-ratio	p-value
Customer Satisfaction	HICO	5.33	13.20	0.00*
	LICO	4.72		
Order fill rates	HICO	4.98	7.24	0.01**
	LICO	4.46		
Shipping errors	HICO	4.80	4.32	0.04*
	LICO	4.38		
Customer complaints	HICO	4.82	2.52	0.11
	LICO	4.53		

[†]HICO = High Interdepartmental Customer Orientation

LICO= Low Interdepartmental Customer Orientation

*Indicates significant mean difference between HICO and LICO groups at p<.05

**Indicates significant mean difference between HICO and LICO groups at p<.10

FIGURE 1
LICO ORDER CYCLE

FIGURE 2
HICO ORDER CYCLE

cycle time is 5 days for both LICO and HICO firms. However, there is greater variance in the order cycle time for LICO firms ($1\sigma = 8$ hours) than for HICO firms ($1\sigma = 2$ hours), implying that HICO distribution centers are more likely to ship product on-time than LICO distribution centers. Consequently, carriers serving HICO distribution centers will incur fewer hours of driver and asset downtime as a result of late shipments.

Among the three performance measure groups, interdepartmental customer orientation has the most profound effect on customer service. The HICO Group achieved significantly fewer shipping errors and higher order fill rates, which results in improved customer satisfaction. Higher customer satisfaction is likely to also be derived from improvements in on-time delivery as discussed previously. Kent, Parker, and Luke (2001) find that delivery reliability is among the most important attributes determining shippers' preference for carriers. Delivery reliability is also ranked among the most important attributes determining firms' supplier preference (Braglia and Petroni, 2000). Therefore, HICO firms are likely to improve customer satisfaction as it is indirectly affected by a decrease in shipping errors and an increase in delivery reliability.

Despite increased performance in certain time-based logistical measures and an increase in customer satisfaction, it is surprising that there was not a difference in customer complaints. Logically, one would expect an inverse relationship between the number of customer complaints and customer satisfaction but this was not the case. This may be attributed to a possible tendency of LICO Group customers to switch logistics service providers without voicing their concerns. For the HICO Group, this finding may be attributed to high levels of overall satisfaction, which may override customers' tendency to voice problems they encounter.

Interdepartmental customer orientation has the least effect on inventory-based performance measures. While the HICO Group achieved marginally superior performance in terms of inventory turns, no significant difference was found with respect to inventory accuracy. These results may be a function of the primary role played by the materials handling department in determining inventory accuracy. In distribution centers, the materials handling department is responsible for product put-away and handling. Therefore, materials handling plays a primary role in determining inventory accuracy. Interactions between departments are less valuable when a single department is the primary driver of a given performance measure. Further, employing adequate information technology (e.g., WMS or RFID) stands to improve inventory accuracy. It is beyond the scope of this work to assess information technology adoption but interdepartmental customer orientation would have little effect on whether the firm employs said technology or whether the technology is sufficient to improve inventory accuracy of the materials handling function.

The HICO Group also failed to outperform the LICO Group in terms of inventory reduction. This result indicates that management inventory decisions primarily determine inventory levels and increased interdepartmental customer orientation plays little role in determining stock keeping policies.

CONCLUSIONS AND LIMITATIONS

These findings detail the relationships between the perceived level of interdepartmental customer orientation and logistics performance within a distribution center setting. Results contribute to the existing literature and further emphasize the importance of cooperation, collaboration, and inter-departmental service levels in increasing firm performance and customer satisfaction levels.

While not all performance measures were impacted by interdepartmental customer orientation, results substantiate the impact of interdepartmental customer orientation on distribution center performance.

Managers should endeavor to support a firm culture that engenders interdepartmental cooperation, collaboration, and communication in order to achieve customer oriented internal transactions to subsequently improve external service quality. Supporting a more integrative environment, compared to the typical "silo" culture, can help increase the quality of output both between departments and to the external customer.

From a supply chain perspective, results indicate that it is not only the interaction between departments that affect distribution performance, but also the interaction between firms. Distribution center managers must take care to employ carriers that deliver loads in a timely manner or lose some of the benefits derived through an interdepartmental customer orientation. Had respondents' firms employed carriers that fail to deliver loads reliably, any efforts to improve on-time shipping and delivery through interdepartmental customer orientation would be nullified. Therefore, an integrated supply chain should stress both intra- and inter-firm customer orientations.

Results have further implications for transportation managers. The current transportation business environment is characterized by increased pressure to reduce costs, increase asset utilization, and decrease customer turnover. As mentioned previously, one method of accomplishing these goals may be to select core shippers whose characteristics and capabilities most contribute to carrier profitability and performance. As Dobie (2005) implies, one challenge to implementing a core shipper strategy is determining the characteristics that make a shipper worthy of being part of this core group. One implication

of this research is that carriers should assess potential core shippers' level of interdepartmental customer orientation. Results indicate that HICO firms are significantly more likely to ship orders on-time and reduce shipping errors. This increased performance is likely to pay positive dividends to carriers on several fronts. First, increased on-time shipping performance increases asset utilization by decreasing the amount of time transportation assets sit idle at distribution centers. Second, reliable shipping performance reduces the amount of time drivers spend waiting for loads thereby increasing driving time, subsequent job satisfaction, and decreasing driver turnover. Decreasing on-duty hours spent waiting on loads is especially critical in today's environment of fluctuating hours of service regulations. Third, reduced shipping errors curtail the number of OS&D claims handled by carriers, thereby allowing managers to reallocate their time to revenue generating activities.

As part of a broader effort to determine appropriate core shippers and their characteristics, carriers are encouraged to utilize the interdepartmental customer orientation questions presented in Table 1. Carriers may utilize these questions as part of a formal survey or ask shippers in a more casual manner the extent to which their firm is characterized by these items.

This study focused on distribution centers, and it is possible that the effects of interdepartmental customer orientation could be more or less prominent in other settings. To improve upon the current study, research should be performed outside of a distribution center environment. This would add further generalizability to the current findings.

Another limitation found in this work is the reliance upon respondent perceptions. Responses could have been influenced by perceptual and attributional biases. Further research should utilize a simulation

methodology to further substantiate the effect of interdepartmental customer orientation on distribution performance.

Interdepartmental customer orientation has come to the forefront in recent years as a means of increasing service and performance levels. Results indicate interdepartmental customer orientation affects distribution center

efficiency and effectiveness. Firms should view the internal customer on equal footing with the external customer and endeavor to create a culture that emphasizes interdepartmental customer orientation as a necessary strategy to increase internal service quality, external service quality, customer satisfaction, and logistical performance.

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APPENDIX DESCRIPTION OF ANOVA

ANOVA (Analysis of Variance) is a dependence technique used to assess the difference of one metric dependent variable (e.g., inventory turns) based on a set of non-metric independent variables (e.g., HICO and LICO interdepartmental customer orientation groups). ANOVA can be stated in the following general form:

$$Y_i = X_1 + X_2 + X_3 + \dots + X_n$$

(metric) (non-metric)

In essence, ANOVA assesses significant and non-significant differences between mean responses provided by groups of respondents. ANOVA is analogous to performing simultaneous t-tests, but is preferable because it allows for greater control of Type 1 errors. Type 1 errors are defined as the probability of finding a significant difference between mean responses when none actually exists (Hair et al. 1998). Presently, a Type 1 error would occur if a significant difference was found between mean responses of the HICO and LICO groups when, in fact, none actually existed.

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MOVING TOWARDS A RESILIENT SUPPLY CHAIN

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INTRODUCTION

The nature of supply chain management—global in scope, the existence of interdependent activities in the various processes, the need for collaborative relationships between members, and the uncertainty that is inherent in both supply and demand – makes it vulnerable to unexpected events that have the potential to disrupt operations as planned. Disruptions to the supply chain can have a profound effect on the firm ranging from loss of revenue to increased costs when operations don't proceed as planned. Firms realized that it was critical to their business interests to proactively manage, and even mitigate, the risks that are inherent in global supply chains.

In today's changing and challenging markets, it becomes paramount for supply chain managers to identify vulnerabilities and associated risks that may cause disruptions of the flows in the supply chain. Supply chains today are more complex in design and in service offerings due to global sourcing, cost reduction and lean manufacturing initiatives that have often led to fewer resources to absorb unexpected "shocks." Demand for higher standards of continuous service, both at the business-to-business and business-to-consumer level, has further challenged firms to manage and mitigate

supply chain risks through a more resilient supply chain.

Just as important as individual firm interests is the fact that supply chain and logistics management is the foundation of supply and demand. Should the process be disrupted either due to a natural disaster or an act of terrorism, the global economic foundation is impacted. Therefore it is critical to develop and build supply chains that have the capability to respond to disruptive events in such a manner that they are able to recover to their original state.

The first step in building a resilient supply chain is to define the concept itself. It is necessary to identify the components and elements that comprise resiliency. For this task it is possible to examine other disciplines where the concept has been well researched. After presenting a review of selected resilience research, this paper offers a discussion of various areas that introduce risk in global supply chains. In addition to identifying the areas of risk, the paper provides recommendations for building resiliency in each area. Finally a framework is offered to assist firms in developing a formal process for building resilient supply chains.

Defining Resilience

While firms have always been aware of the need to be prepared for a large scale crisis or disaster, most plan for events that are primarily internal to the organization. Data from Booz, Allen and Hamilton (2008) indicate that companies have spent the most effort in being prepared for an IT breakdown or information security breach (Figure 1). This can be contrasted to 68 percent of the respondents that stated that interruption in supplies from key suppliers is the most critical potential disruption that the firm faces. The difference between importance of occurrence and the level of preparedness is quite striking. What is clear is that firms have spent more effort on planning for events that are "within"

the firm's control versus events that are "between" firms or boundary spanning.

It wasn't until September 11, 2001 that businesses realized the absolute necessity of understanding something much more fundamental to their corporate wellbeing - supply chain risk and vulnerability. The interrelated and interdependent nature of business on a global scale caused many firms to recognize that critical parts of their operations were external to the organization, and in many cases outside their control. This is due in part to the nature of supply chains. They are not linear systems; instead they resemble a web in which multiple nodes and arcs exist for efficient and effective flow.

FIGURE 1
IMPORTANCE AND PREPAREDNESS FOR SUPPLY CHAIN RISKS*

* Top bar = level of preparedness; bottom bar = importance of event for SC resilience planning

Source: Lewis, Martha, Shorten and Salmon, 2008

Just as physical distribution and transportation moved to the broader scope of logistics and then to supply chain management, contingency planning and preparedness has evolved to risk management. Norman and Lindroth (2004) suggest that supply chain risk management is the application of these process tools in a collaborative manner with supply chain members to handle risks and uncertainties that are intrinsic to logistics and supply chain activities. This definition was expanded by Manuj and Mentzer (2007) to include the identification of potential sources of risk and the implementation of strategies that would reduce supply chain exposure to risk. Reduction, avoidance, sharing and transferring of risk are considered to be core elements of the risk management process. They are also important components in supply chain resilience in that it deals with multiple types of risks at multiple stages of the risk management process (Ponomarev and Holcomb, 2008). While identification of the components and elements of resilience is a critical part of defining the concept, it does not totally answer the question as to what is resilience and why is it important to supply chain management.

While resilience is a relatively new word and concept in supply chain management, it has an extensive background in other disciplines such as ecology, psychology, and emergency management. The Canadian ecologist C. S. Holling (1973) has been noted as one of the first researchers to classify two characteristics of ecosystems – resilience and stability. Holling defined resilience as the ecosystems ability to absorb changes, and stability as being the ecosystems capacity to return to a state of equilibrium after a disturbance. Since this seminal research, the concept in resilience in ecology has expanded to include other dimensions such as the magnitude of disturbance that a system can tolerate before it changes significantly (Carpenter et al., 2001). This suggests that systems have an adaptive capacity that enables them to evolve, thereby adjusting to new conditions.

Resilience has been widely researched in the field of psychology. Most commonly, resilience is defined to be the positive capacity of people to cope with stress and catastrophe (Reich, 2006). It is used to indicate a characteristic of resistance to future negative results. Furthermore, Reich surmised that the incorporation of key principles of resilience - control, coherence, and connectedness – into disaster planning would result in improved effectiveness in dealing with the event. Another important dimension of resilience was noted by Stewart, Reid, and Mangham (1997). Their research suggests that resilience is a complex interplay between certain characteristics of individuals and their broader environments. As such, resilience must have the capacity to extend across multiple levels from individuals to communities. This aspect is particularly relevant to supply chain resilience that must span from an individual company to a network of companies that comprise a supply chain.

The interdisciplinary field of emergency management offers additional insight into the concept of resilience through research on disaster recovery. It deals with issues of risks, disruptions, and recovery at a macro level rather than the individual. Resilience is referred to as one of the prerequisites for sustainable economic development (Folke et al., 2003). Lindell, Prater and Perry (2007) stated that a disaster resilient community has the capacity to learn from its experience. The learning aspect is a key part of the four stages of emergency management which includes: hazard mitigation, disaster preparedness, emergency response, and disaster recovery. These stages are directly related to building resilience consciousness discussed later.

More recently the field of computer technology has also recognized the importance of resilience. Computer networking defines resilience as the ability to provide and maintain an acceptable level of service in the face of faults and challenges to normal

operations (Xie et al., 2005). The research by Xie et al. suggests that resilience is the most important property of a networked system, and that it is one of three quality service characteristics along with security and performance.

In terms of logistics and supply chain management, Christopher and Peck (2004) adopted a dictionary-based definition of resilience that has an eco-systems foundation. This definition simply states that resilience is "the ability of a system to return to its original state or move to a new, more desirable state after being disturbed." Perhaps the most important aspect of this definition is the acknowledgement that after a disruption a system can be different – even better – than it was before the event occurred. The idea that a system possesses learning capabilities is one that has been researched by Esper et al. (2007). They suggest that the dynamic nature of logistics capabilities enable the system to convert learning outcomes to new logistics management strategies, tactics and operations that in turn lead to the development of other logistics capabilities. Sheffi (2006) uses materials sciences as the basis for defining supply chain resilience. The ability and speed with which a company can return to their "normal" level of performance following a disruption is a measure of that entity's resilience. This perspective does not incorporate the viewpoint of Christopher and Peck (2004) which suggests that the original state may not be achieved post disruption, but rather a new and better state than pre-disruption.

The selected review of research on the concept of resilience from the perspective of various disciplines, including supply chain management, establishes a good understanding of the properties and characteristics of this phenomenon. With this knowledge comes the question of what are the sources of disruptions for which resilience is needed? The following section enumerates some of the events that

have the potential to pose serious disruptions to supply chain operations. By identifying those things that can create interruptions to the planned flow of goods in the supply chain, managers will be able to build resiliency in their supply chains such that they can withstand and respond more efficiently and effectively to disruptive events.

Identifying Potential Supply Chain Disruptions

Managing a supply chain is a complex and challenging task. Throughout the years the number of challenges has increased as supply chains have increased the scope of markets, production locations, and sources of supply to span the world. The global reach, however, is only one of many challenges that have had a profound impact on the supply chain process. The challenges shown in the list below have the ability to significantly affect planned operations in that they are potential sources for supply chain disruptions.

- Globalization
- Carrier mergers and acquisitions
- Focus on financial discipline
- Other disruptions
 - Weather
 - Strikes
 - Global sports events
 - Pandemics
 - Geopolitical issues/pressures
 - Terrorism

Each of the challenges is addressed in detail in the following sections. Following the discussion of each challenge, a set of recommendations or a course of action is presented to assist managers in developing a more robust approach to that potential source of disruption.

Globalization

It is widely accepted that globalization is the current and future state of the marketplace. That is to say that there are no efforts and

initiatives to restrict neither the economic growth of countries nor the profitability of businesses by limiting their geographic reach. The empowered consumer is the driving force behind globalization. The consumer's demand for quality products at lower prices has driven multi-national companies to seek partners in various countries to help offset the costs of doing business. Manufacturing and sourcing from low cost regions has strengthened many companies' bottom line as well as placing increased demands and importance on the supply chain process.

The multi-national customer has and continues to demand the same levels of service and products no matter where the destination happens to be. Having consistent service and product accessibility for the multi-national customer in a global market is just as important as it is in a domestic market. Success in meeting this level of expectation falls heavily on the supply chain process.

Think globally and act locally has been the prevailing philosophy for several years. A strategic focus on supply chain principles and methodologies is being stressed to maintain efficiency, consistency, and cost containment while meeting or exceeding customer requirements. This focus generates a number of challenges for the firm, and increases the potential for a supply chain disruption due to a number of conflicting objectives. Firms can reduce their risk of not meeting customer requirements by holding higher levels finished goods' safety stock or by building redundancy into the supply chain through underutilized capacity. While this would impact service effectiveness, it would have a negative effect on efficiency measures.

The challenge of "thinking globally and acting locally" is also an opportunity for companies to build resilience into their supply chain by implementing the following:

- Allocating production in a manner that allows the firm to rapidly shift manufacturing to locations that can better meet changes in demand;
- Developing strategic relationships with critical suppliers that will support flexible sourcing;
- Using operational strategies that promote standardization through modular products and processes.

Carrier Mergers and Acquisitions

One view on carrier mergers and acquisitions is that "as long as my carrier is the one surviving the merger or initiating the acquisition, then it is a good thing and service will improve." This will only be the case if your firm is working with financially strong carriers that will not be stressed even if they are involved in a merger or acquisition. An important resiliency measure for a merger or acquisition would be whether or not it reduces (or conversely increases) the risk of service failure in your supply chain.

There are activities that can be implemented within your infrastructure to strengthen developing a resilient supply chain. These are

- Identify transportation partners that have the capability to perform the needed and specific functions for your supply chain.
- Move functions that need to be done to the supply chain member that can perform the functions effectively and efficiently—include the carrier in this equation.
- Recognize that the lowest cost carrier does not necessarily guarantee lowest landed cost.

- Keep the “big picture” in mind when selecting a carrier. A carrier that increases your resiliency is one that can expand or contract to best meet the needs of the entire supply chain and not just a portion of the flows.

Today, mergers in the transportation industry seem to happen more frequently than in the past. While much of the research suggests that many mergers do not fulfill the promises of greater efficiency and higher profitability, for the most part transportation industry mergers seem to be more successful. For example, the Yellow and Roadway (YRC) merger broadened the global scope of the carrier in making it more advantageous for the multi-national company to expand into newer markets.

Focus on Financial Discipline

A primary goal for today's CEO's is to increase the firm's profitability. In many cases the key to increasing profitability begins with reducing costs. Wall Street has greatly influenced the single-minded focus on profitability by driving corporations into short-term returns for the sake of the stockholder. The concentration on short term returns has forced many long term initiatives to lose priority, and caused quick initiatives to be more on cost cutting rather than on improving core processes that would have sustainable positive impact on profitability.

An example is lean manufacturing. While lean manufacturing looks at cutting cost associated with the manufactured product, it can also raise transportation costs by changing product density factors which in turn changes rate structures of the carriers to the shipper. Lean manufacturing and lean inventory strategies can also bring in more low cost region sourcing methodologies, thus bringing more risk to the supply chain infrastructure. The answer to this issue is not the abandonment of lean principles. Rather the solution is to select and partner with transportation and logistics providers

whose operational strategies support the firm's lean initiatives. Lean has been demonstrated to improve a firm's and the supply chain's flexibility. Increasing supply chain flexibility assists the firm in being able to be better to respond to disruptions. In some cases flexibility may enable the firm to avoid or mitigate the disruption to operations.

Other Disruptions

Weather. Floods, hurricanes, earthquakes, tsunamis, typhoons are weather challenges that happen throughout the world. Supply chain managers are expected to maintain operations in the best manner possible in the event of a significant weather occurrence.

Natural disasters and other weather issues are hard but not totally impossible to mitigate. The first thing that should be done is to identify the specific weather seasons, and then second, develop plans for alternative routes or modes of transport depending on the type of weather event. It seems so simple, yet many firms neglect to reduce this potential for supply chain disruption. Resilience can be built and developed in the supply chain by configuring a network that operates without the affected parts for a short or extended time period. The strength of that resiliency will be measured by how well the operations continue during the event, and by how quickly things return to a “normal” state after the event.

Industry strikes. Industry strikes are not new in today's marketplace, but they have more of an impact on the now than in the past. Strikes happen for various reasons and they can create ripples throughout the global supply chain. The impact of a strike's ripple effect on today's supply chain is realized much sooner because the capacity of the logistics infrastructure is leaner and more dependent on efficiency and consistency in the operational processes. The Los Angeles longshoremen strike in the fall of 2005 proved just how fragile and dependent the infrastructure has become. Within a week's

time of the first day of the strike, ocean container vessels were not making their return voyages back to the Asian origin ports. This caused a container back-up at the origin ports waiting for vessels to reload. As freight was shifted to air, the demand for this transportation mode in the last quarter of 2005 grew dramatically as many shippers sought to circumvent ocean shipping. Due to the high demand for freight capacity and the extremely limited capacity of the air cargo planes, on the spot buying of space was the norm and all freight rate contracts were not being honored.

What can firms do to mitigate this risk?

- Anticipate potential stoppages and develop a formal plan for shifting freight to other transportation modes. Collaborate with a freight forwarder(s) to determine how the reserve transportation capacity with alternate carriers.
- Identify critical stoppages and plan alternative actions
 - Split key shipments into smaller size shipments so modal shifting is possible and more cost effective. Conversely, develop a plan for shipment consolidation for shifting freight to modes that have greater capacity such as intermodal or rail.
 - For ocean shipments, developing flexibility in port of import and/or port of export is critical to prevent stoppages.
 - For truck strikes, review your strategy on the use of union versus non-union carriers.

Global sports. Most people would not consider a global sports event to be a potential disruption to the supply chain. Yet, this was the case when the World Cup caused a major

disruption in the import process in Brazil. In 2006, Brazil was doing so well in the World Cup series that fan enthusiasm was reaching heights of major excitement. This caused the Brazilian customs to close for five days in anticipation of Brazil's game. Timing could not have been worse. This closure happened in September—a quarter ending month. Everything came to a screeching halt pending the outcome of the soccer game. Strong and well connected freight forwarders had personnel that were able to work with the customs agents to free up the required orders and allow importation and exportation.

While all world sporting events may not lead to closure of key supply chain intermediaries, they may lead to delayed flows. Just like other supply chain challenges, this one necessitates action on the part of the firm to ensure that the flow of goods continues in the manner planned. What can you do to build resiliency in the supply chain to handle global sports events?

- The first step is simple. Follow the key sport and know specific schedules that could cause disruption to your supply chain process.
- Understand what countries your key suppliers and customers are based in and know the history of that country's position/activity in global sports.

Pandemics. Globalization has created a new awareness of how pandemic illnesses can spread quickly through the logistics and supply chain network. The Avian influenza strain like SARS, Asian flu, and most recently, bird flu has made everyone more aware of the potential outbreaks throughout the world. It is believed that an airborne influenza strain can be spread by an infected person loading an ocean container breathes the strain into the air that will be closed into a sealed container. This infected air will incubate during transit and will infect the consignee personnel when

unloading the container. This possible scenario is one that infectious disease professionals are researching.

Recommendations for building supply chain resilience for handling a possible pandemic include

- Survey your supplier and carrier base to understand what their processes and procedures are for pandemic situations. If they do not have any, work with them in getting a program started.
- Educate personnel so they know how to safeguard themselves and others against pandemic situations through a company wide initiative.
- Test out preventive actions/procedures throughout your supply chain to ensure that procedures are effective.

Geopolitical issues. Geopolitical issues should be one of the top concerns of the supply chain manager. He/she must be attuned to the political issues in the world and understand the implications to the supply chain process. More than a few U.S. firms are operating among and within countries that are not totally friendly towards them. Some of these countries have unstable political structures, and are hedging politically as to whom they should align themselves. Unfortunately, these same countries are major sources for raw materials and manufacturing activity. Civil war and military coups have become commonplace. Yet in the midst of all this turmoil, the supply chain process must continue.

What can you do to help mitigate these types of disruptions?

- Try to source product and manufacturing services from politically stable or less politically troubled countries.

- Stay up-to-date on current events. Develop contingency plans that use neighboring countries that could play a key role in assisting in the event of a geopolitical disruption.
- Maintain a very strong global network of carriers and other intermediaries.
- Make sure in-country personnel are aware of what they have to do in support of their safety and the supply chain process.

Other geopolitical challenges involve regulations and restrictions on products or shipping that can hamper the import/export process. What may be an embargoed country for your company may not be the same condition for your supplier. It is the supply chain manager's responsibility to make sure that exports from a supplier's country to other countries do not conflict with the home countries embargoes list. These types of disruptions are not pleasant and are extremely painful to overcome if caught.

Regulations on imports can change whenever it is deemed necessary by the importing country. If the paperwork does not cover the change, the import process will come to a complete stop. Something as simple as using wood pallets that have not been treated against wood boring beetles can stop a shipment and even cause it to be confiscated or destroyed by country customs for non-compliance of treated wood regulation.

Suggestions for building supply chain resilience include

- Keep current and well informed on any changes in customs that could have an effect on your product flow. If this is not possible, use a customs broker and/or a freight forwarder as a conduit for this knowledge.

- Build strong relationships with in-country import brokers. The in-country personnel should have established relationships with key contacts to work out problems incurred with customs.
- Establish a process to ensure that necessary import documents are correct and in perfect order. Surprisingly enough, a high percentage of import delays can be attributed to poor preparation of paperwork.
- Validate your export supplier's supply chain. The validation process should go as deep as possible to ensure that you know who your supplier uses within their supply chain process.
- Mandate that all carriers be C-TPAT certified at the highest status level.
- Become a partner in the U.S. Customs Trade Partner Against Terrorism (C-TPAT).

Risk mitigation for borders crossings to avoid closing issues and delays should cover:

- Mandating that all carriers be C-TPAT certified; the higher the status level, the better.
- Achieving the highest C-TPAT certification level possible. It is recommended that you achieve Level 3 status which gives your company primary privilege of being cleared first once a border reopens.
- Validating your export supplier's supply chain. The deeper you go in researching your supplier's supply chain process, the greater the potential to increase your firm's supply chain resiliency.

Terrorism. Immediately following the terrorists attacks on 9-11, air traffic was shut down. All U.S. borders were closed and remained so for a week and a half. Only passengers were allowed on airplanes, and even the smallest of cargo boxes remained motionless, eventually routed to a ground transportation carrier. Even the U.S. Postal System diverted mail and packages away from airplanes. After more then 70 years of being the first thing loaded on an airplane, mail and packages had to take the same ground route as general cargo. From this experience, logistics and supply chain managers have learned what can happen should another attack take place. Since 9-11 security regulations and initiatives have focused on ocean ports and borders, and have lead to increased control by the U.S. government. The regulations have had a global impact on supply chains as product flows are being monitored and controlled from end-to-end.

Building resilience for ocean port infrastructure involves the following:

- Know the rules of the ports. Understand what they are planning and doing in security assistance and needs on imports and exports.
- Develop and implement a flexible port plan that spreads out shipping volume to more ports for both import and export.

MOVING TOWARDS A RESILIENT SUPPLY CHAIN

A review of the relevant research and the identification of the possible sources of disruptions that supply chain managers may face, leads one to conclude that several key goals can be gained by developing and building supply chain resilience. These include being able to:

- Anticipate, mitigate, and avoid any disruption in meeting delivery commitments while maintaining consistency in processes and cost effectiveness in solutions.

- Preserve the functionality of the global supply chain from sourcing to delivery in a robust and competitive manner.

Resilience does not just happen, it has to be planned for, tested, and implemented throughout the entire supply chain infrastructure. Building and developing supply chain resilience can be assisted through the use of a closed-loop planning process. As shown in Figure 2, this process is comprised of four basic steps ranging from an assessment and identification of environmental threats to the development of operational plans for execution. The planning framework presented in Figure 2 is detailed in the following steps.

1) Anticipate the problem by conducting an environmental assessment. The fundamental justification for building and developing supply chain resilience is the assumption that the worst can happen at any given time. It is imperative that managers determine potential sources of disruption to the supply chain. This entails understanding the supply chain process from the very beginning to its ultimate end.

Areas that should be assessed for potential sources of disruption include the firm's global supply chain strategy, mergers and acquisitions of transportation providers, the firm's financial focus, and nature and man-made events such as earthquakes, hurricanes and acts of terrorism. The goal of the environmental assessment is to identify as many potential sources of disruption to the supply chain as possible.

An example of anticipating problems occurred during the 1996 Atlanta-based Olympics when a key committee was tasked with all the logistical planning to ensure that service for the Olympic Games was not disrupted. Every venue had its own level of needs and services. It was the responsibility of the logistics group to make sure that everything was done efficiently and at the lowest cost possible. Every plan was developed with the anticipation that something will go wrong and when it does, there will be a plan of action. The importance of the Games and the service demands that it generated led to the development of some 20 different solutions. There was no room for service failure.

FIGURE 2
THE SUPPLY CHAIN RESILIENCE PROCESS

2) Conduct a strategic evaluation of potential disruptions. After the identification of potential sources of disruption, the next step is to determine the likely impact of the event on operations. In conjunction with this evaluation it should be established what is the likelihood that this event will occur. These two questions—"What is the likelihood that the event will even occur?" and "What will the magnitude of the disturbance be?"—are key to prioritizing the firm's efforts in building and developing the needed resilience.

Determining the impact of a disruption to the supply chain can often be done by conducting "what if scenarios." This level of analysis will help the firm and supply chain members quantify the possible operational and financial impact of the disruption. It will also help pinpoint critical weaknesses in the supply chain process.

3) Create resilience support. After potential disruptions with the highest risk score in terms of impact and occurrence have been determined, the next step is to develop structural and functional plans that will mitigate the risk. As discussed earlier, some initiatives such as lean manufacturing might increase supply chain risk unless an integrated functional approach is taken. In some cases structural changes to the network or system may be necessary. An example of this would be the allocation of production across manufacturing facilities to reduce risk and increase the firm's resiliency. Always develop plans and solutions that maintain a holistic view of the supply chain. A local (or firm) solution is generally not a global optimum.

4) Implement the operational plan, measure and evaluate performance. Once you select the most effective and efficient solution to mitigate a supply chain disruption, it is time to implement the plans. Develop processes and procedures for everyone to follow. Identify roles and responsibilities, and communicate these throughout your supply

chain infrastructure. You, your carriers, your suppliers, and your customers should know what to expect and how they must function in the event of a disruption. Key people should be selected and trained to perform tasks so that when/if a disturbance occurs, everyone will know immediately what they have to do to mitigate the disruption. This is especially important for multi-national companies that operate in different time zones. Action should be taken with delaying valuable time waiting for directions from personnel in other regions.

CONCLUSION AND FUTURE DIRECTION

For a number of firms, risk management planning is often an afterthought. The approach of "we'll deal with it when it happens" leaves the firm vulnerable to supply chain disruptions that have the potential to negatively impact revenues and increase costs—at a minimum—and at the other end of the spectrum shut down operations for an extended period of time. It is important that supply chain managers identify the most critical risks to their supply chain process, and begin the development of functional and structural of process and practices that mitigate and possibly eliminate the potential risk. This is a cornerstone of supply chain resilience. In a global business environment companies must begin moving towards resilience consciousness. To do otherwise is to ignore the opportunity to build robustness into everyday operations.

This paper has discussed several key sources of supply chain risk along with recommendations or courses of action to assist companies in their attempt to become more resilient. The framework that was presented for building a supply chain resilience process can be used by firms to guide their efforts as they move forward. As the review of the relevant literature revealed, resilience in supply chain management is a relatively new concept. While other disciplines have a much longer and

deeper knowledge base in this area, supply chain management has just begun to understand its importance.

Although key elements of supply chain resilience have been identified, the links between them and the implications for supply chain management are poorly understood. There are abundant opportunities for future research on the topic of supply chain resilience.

The methods and approaches that are best for managing key resiliency issues are not well understood. They must be researched and analyzed in order to justify the need for resilient supply chains. The increased risks that result from complex and disperse global supply chains necessitates that companies gain a better understanding of this emerging critical area in order to effectively manage in this business environment.

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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 interfirm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate interfirm 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*, 2001). 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.

$$y = a^2 - 2ax + x^2 \quad (1)$$

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