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AN EXPERIMENTAL TEST OF GREEN MANAGEMENT INFORMATION SYSTEM EFFECTS ON CARRIER SELECTION: WEIGH STATION AND TOLLBOOTH BYPASS TECHNOLOGY ADOPTION

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ASBSTRACT

In a highly competitive price-driven industry, carriers are continuously searching for opportunities to differentiate their offerings, minimize operational costs, and appeal to shippers. At the same time, environmental sustainability has evolved from being trendy jargon into a requirement for competitive supply chain management. It is at the intersection of these two modern topics that the current study identifies a new carrier selection attribute based on a specialized type of green management information system. We apply social exchange theory to hypothesize carrier price and green technology adoption effects on shipper purchase intent. The hypothesized direct and interaction effects are tested by way of a vignette-based experiment, with a sample of full-time working professionals. The supported hypotheses collectively suggest that the adoption of weigh station and tollbooth bypass technology, as a type of environmentally sustainable information system, positively affects transportation carrier selection and attenuates the negative effect of a carrier's price on shippers' purchase intentions. These research findings offer unique theoretical, practical, and policy implications surrounding the trucking carrier selection decision.

INTRODUCTION

Weigh station and tollbooth bypass technology is a type of environmentally sustainable information system available within the trucking industry. This green system places a transponder within each tractor-trailer to wirelessly communicate load information with tollbooth and weigh station operations (Hansen, 2010). By adopting and implementing this technology, carriers avoid waiting in queues to manually pay tolls and exchange paperwork (Marett et al., 2013). Carriers are automatically identified and compliance with state requirements is verified without stopping for inspections at weigh stations (Gelinas, 2009). Like most green management information systems, bypass technology reduces reliance on unnecessarily manual and time intensive tasks. Carrier idle times, fuel consumption, lead-times, and paper usage are

reduced with this approach resulting in both lower costs and a lower carbon footprint for carrier operations (Crainic et al., 2009).

Although many non-value added activities and carrier related costs are reduced using bypass transponders, little is known about how shippers view carriers who implement this environmentally sustainable technology. Systematic reviews of traditional carrier selection criteria do not identify green management information systems as an important attribute for consideration (Williams, et al, 2013; Meixell and Norbis, 2008). However, given the steadily increasing importance of environmentally sustainable supply chains and recent calls for carrier selection decisions to include green performance (Davis-Sramek et al, 2018; Thomas et al.,2016), this gap in understanding is noticeable and an important question to be answered. Insights from Social Exchange Theory (SET) suggest that carrier selection decisions may indeed be affected by green technology adoption. Specifically, shippers may view bypass technology as an additional type of relational benefit in exchanges with carriers and be more likely to select carriers who utilize this green technology (Thibaut and Kelley, 1959; Emerson, 1976).

To determine if carrier selection decisions are affected by the adoption of bypass technology, a vignette-based behavioral experiment was designed to test *a priori* hypotheses derived from social exchange theory (SET). A vignette experiment is one where various descriptive scenarios are presented to subjects. The vignette approach used various scenarios to describe a carrier selection decision involving high and low conditions for independent variables like price and green management information system adoption. The scenarios also controlled for other known criteria (i.e. service, capability, lead-time, power/ dependence, etc.) that affect carrier selection decisions, but were not a focal interest in this research. Purchase intention, an acceptable proxy

for actual carrier selection decisions, was the dependent variable in the study (Davis-Sramek et al., 2018; Thomas et al., 2016). Participants in the experiment were full-time working professionals. A behavioral experiment was selected as an appropriate method to study the phenomena because it allows researchers to carefully isolate the effects of independent variables while simultaneously controlling for other known factors (Tokar, 2010; Thomas, 2011; Eckerd and Bendoly, 2011). By gaining a greater understanding of bypass technology adoption on trucking carrier selection decisions, results of this research offer theoretical, managerial, and policy implications. Each of these implications will be discussed later in the paper.

THEORY AND HYPOTHESES

Social Exchange Theory

Social Exchange Theory (SET) posits that actors evaluate exchange relationships by comparing alternatives in terms of relational costs and benefits (Thibaut and Kelley, 1978). The theory assumes actors are rational and maximize their own self-interests by seeking awards and avoiding punishments (Homans, 1961). The assessments of costs and benefits are not absolute; they may vary over time or from person to person. This type of subjective cost-benefit analysis may consider a variety of economic, psychological, and sociological factors (Blau, 1964). However, the relational process remains the same. Actors consider the net worth of an existing or potential exchange relationship (i.e. benefits - costs) as a baseline and then compare it to perceived alternatives (Thibaut and Kelley, 1959). This comparison of alternatives drives the formation, evolution, or deterioration of relational exchanges. Ultimately, the behaviors of actors are driven by the basic motivation to obtain profitable outcomes in exchange relationships (Emerson, 1976).

Although SET has been traditionally underrepresented within the supply chain management discipline (Krause and Ellram, 2014), it is gaining wider acceptance as a useful theoretical lens for the broad domain of buyer-supplier exchange phenomena that utilizes behavioral experiments (Defee et al., 2010). For example, Thomas et al. (2010) studied the effects of buyer induced time pressure on suppliers. Kaufmann et al. (2018) examined the resilience of buyer-supplier relationships when faced with a psychological contract breach. Thomas et al. (2013) tested the effects of negotiation strategies on knowledge sharing proclivity in buyer-supplier interactions. Narasimhan et al. (2009) gained better understanding of buyer-supplier relationship dynamics in lock-in situations. As these exemplars show, when supply chain members engage in exchange relationships, SET is an appropriate theoretical foundation to inform behavioral investigations into the complex subtleties surrounding specialized buyer–supplier (i.e. shipper-carrier) interactions.

Carrier Selection Effects

Carrier selection initiates a shipper-carrier exchange relationship. It is a specific type of sourcing decision that has significant cost and service effects on supply chains (Bardi, 1973; Thomas et al.,2016). An extensive body of research has explored determinants of carrier selection from the perspectives of both shippers and carriers (Bardi, 1973; Kent and Parker, 1999; McGinnis, 1990; Meixell and Norbis, 2008; Premeaux, 2002; Voss et al., 2006; Williams, Garver, and Taylor, 2013). Various studies have identified cost and service attributes like pricing, lead-times, reliable delivery, capability, and capacity as key determinants of carrier selection (Baumol and Vinod,, 1970; Milne and Laight, 1963; Heskett et al. 1964; Bardi 1973; Evans and Southard, 1974; Jerman, Anderson and Constatin, 1978; Stock and Lalonde, 1977). However, carrier selection has morphed from a

routine purchase decision into a much more involved evaluation process with important implications for supply chains (Bardi, Bagchi, and Raghunathan, 1989; Murphy and Hall, 1995; Robinson et al., 2013; Garver, 2016; Saleh and Lalonde, 1972). Changing regulatory environments, evolving supply chain strategies, and increasing shipper expectations have influenced carrier selection criteria by expanding the potential attributes that shippers use when choosing a transportation service provider (Wang et al., 2015).

Although recent studies have demonstrated that shippers expect a broader range of carrier attributes and services, transporting goods in a better, cheaper, and faster manner remains a universal constant throughout all types of supply chains (Meixell and Norbis, 2008; Williams et al., 2013; Robinson et al., 2013; Garver, 2016; Joo et al., 2017). In particular, freight rates continue to be a primary selection determinant for transportation services (Dobie, 2005; McGinnis, 1990). As one of the most easily quantifiable and comparable types of relational costs, carrier pricing enables shippers to evaluate potential carrier exchange relationships in an unambiguous manner. If all other attributes are equal, then SET suggests a higher freight rate will reduce the net worth (i.e. relational benefits – relational costs) of a potential shipper-carrier relationship and incentivize a shipper to consider other alternatives. Shippers will be less likely to exchange with carriers that have higher prices. Therefore, based on applicable carrier selection literature and SET insights, we hypothesize the following negative main effect:

Hypothesis 1: As a carrier's price increases, a shipper's purchase intent decreases.

Green Management Information Systems Effects

The role of management information systems (MIS) in transforming supply chain practices to improve performance, enhance innovation, and generate new

economic opportunities has been well documented (Bharadwaj, 2000; Gunasekaran & Ngai, 2004; Rai et al., 2006). However, with growing organizational awareness of environmental concerns and the increasing importance of sustainability, the concept of green MIS is gaining momentum (Melville, 2010; Malhotra et al., 2013). Information systems can play a crucial role in supporting or transforming sustainable organizational practices through MIS-enabled organizational processes that improve environmental performance (Melville, 2010). Increasingly, green technology practices are deemed essential to sustainability movements that seek to meet the demands of the current generation without compromising the ability to meet the needs of future generations (Shrivastava, 1995; Malhotra et al., 2013; Hu et al., 2016).

The concept of "green" has become associated with computing technology in several ways. Green information technology can diminish the carbon footprint of equipment by designing and manufacturing energy efficient chips, reducing energy consumption, and reducing electronic waste generated by obsolete computers, servers or associated subsystems (Watson et al., 2008). Information systems can also enhance sustainability by using teleconferencing, groupware, environmental auditing, and automation to advance environmentally friendly operations through ongoing sustainable process development (Corbett, 2013; Sarkis et al., 2013; Watson et al.,2008). A growing body of research suggests that green MIS is more than simply a cost of doing business; it is an opportunity for firms to increase productivity, reduce costs, enhance profitability, and achieve competitive advantage while also helping organizations deliver environmentally friendly value to stakeholders throughout a supply chain (Nanath and Pillai, 2017; Dao et al., 2011).

MIS can improve efficiency and provide greener solutions for major greenhouse gas emitting supply chain functions like transportation (Dedrick, 2010).

For example, weigh station and tollbooth bypass technology enables carriers to deliver goods in a more efficient and greener manner (Marett et al., 2013). However, by adopting this type of green MIS, carriers may do more than simply reduce their internal costs and environmental footprint. Carrier bypass technology may also be perceived as a relational benefit to shippers as they consider potential exchange relationships with transportation providers. As consumers and governmental entities increasingly demand that processes, products, and services be environmentally friendly, shippers are held more accountable for the waste streams of upstream supply chain members (Green et al., 2012). Selecting carriers with bypass technology helps address these stakeholder concerns and likely makes an exchange relationship more attractive. Therefore, based on applicable green MIS literature and SET predictions, we hypothesize the following positive main effect:

> *Hypothesis 2: As a carrier's green MIS adoption increases, a shipper's purchase intent increases.*

Carrier Selection and Green Management Information Systems Interactions

According to SET, a carrier's pricing and bypass technology adoption influence a shipper's purchase intent. However, beyond these simple main effects, SET logic also suggests a potential interaction may exist between these factors. When carrier prices are low, shipper purchase intentions naturally increase. In this situation, adding bypass technology to the exchange will increase the relational value for a shipper, but since purchase intentions are already high the effects of the green technology benefit will be constrained. However, when carrier prices are high and shipper purchase intentions are low, then the opportunity for green MIS to increase the net worth of the relationship is much greater. As a result, carrier bypass technology adoption has a larger positive effect on shipper purchase intent when carrier pricing is high rather than low.

Therefore, based on the application of SET, we hypothesize the following interaction effect.

Hypothesis 3: A carrier's green MIS adoption and pricing interact in such a way that green MIS has a greater effect on shipper purchase intent in higher price conditions than lower price conditions.

RESEARCH DESIGN AND METHODOLOGY

To test our hypotheses, a vignette-based experiment was conducted using a sample of managers. Vignette-based experiments deploy varying versions of descriptive scenarios to convey scripted information about specific levels of factors of interest that influence judgments, preferences, or decisions (Rungtusanatham et al., 2011). Extant research has illustrated that vignettes are useful for "evaluating the intended reasoning, decision making processes, and/or the intended behaviors of respondents" (Bendoly and Eckerd, 2013; Deck and Smith, 2013; Eckerd and Bendoly, 2011). Further, the use of vignettes works well when asking subjects what they "could" or "would" do in similar situations, rather than what they "did", "have done", or "should do" (Cantor et al., 2014; Thomas et al., 2010). Given the context of environmental sustainability, and the potential for social desirability effects (Fischer, 1993), the use of a vignette is crucial to mitigate the effects of associated norms and it permits explication of how managers actually think and react to the adoption of green MIS (Davis-Sramek et al., 2018; Matthews et al., 2016)

The vignette-based experiment was a 2 x 3 between-subjects factorial design. The independent variables were carrier adoption of green MIS (high, low) and carrier price (high, average, low). Carrier adoption of green MIS was manipulated within the vignettes by describing the extent to which the carrier "utilizes bypass system technologies" or "does not utilize bypass system technologies". Carrier price was manipulated within the vignettes

by including the rate quote per mile - $2.04 (high), $2.00 (average), $1.96 (low) – and how it compared to other carriers under consideration. The dependent variable was the carrier selection decision proxy, which was measured using a three-item scale for purchase intent (Davis-Sramek et al., 2018; Thomas et al., 2016). The vignettes employed in the experiment meet the design guidelines suggested by Rungtusanatham et al. (2011). Additional information on the vignettes, manipulations, and measures can be found in Appendices A and B.

Sample

The sample consisted of 158 full-time working professionals affiliated with a supply chain management executive education program in the United States. The average age of participants was 37.8 years with applicable work experience of 11.3 years. The sample was 62% male. In order to guarantee complete anonymity, encourage authentic responses, and minimize potential social desirability bias effects, no other demographic information was collected from participants. Although individual identifying characteristics are not available for specific analysis, the composition of the executive education program included managers from both shipper and carrier companies.

Procedure

Participants were randomly assigned to one of six treatment conditions that resulted from a 2 x 3 between-subjects factorial design. Vignettes manipulated pricing (high vs. average vs. low) and green MIS adoption (high vs. low). The scenario descriptions (Appendix A) also controlled for other relevant transportation sourcing criteria that could potentially confound results. Data was collected via a paper and pencil format in a common classroom setting over several executive education sessions. All data collection was administered by the same researcher under the same conditions. Participants

were told to read their assigned scenario and simply answer questions openly and honestly. To limit potential social desirability bias effects (Fischer, 1993), participants were specifically instructed that there were no "right" or "wrong" answers.

Measures

All measures used in this study were adopted or adapted from existing scales and used a 7-point scale (Appendix B). All scales had been previously tested and were found to be valid and reliable. Item modifications were limited to small wording changes. The modifications were performed to ensure logical consistency between the vignette descriptions and the individual scale items. Items for the dependent variable of purchase intent were adapted from Grewal et al. (1998) and Hardesty et al. (2002). Manipulation check items for the independent variables of green MIS adoption and pricing were adapted from Choi and Ng (2011). Realism check items were adopted from (Dabholkar, 1994).

RESULTS

Manipulation Checks

Manipulation checks were performed to ensure the vignettes worked as intended (Bachrach and Bendoly, 2011). ANOVA results show a significant manipulation of pricing ($F = 114.878$; $M_{high} = 5.61 > M_{average} = 3.77 > M_{low} = 2.13$; all p's < 0.001) as well as a significant manipulation of green MIS adoption ($F = 486.98$; $M_{high} = 6.10 > M_{low} = 2.14$; $p < 0.001$). Therefore, the experimental treatments effectively manipulated the independent variables.

Attention Checks

Directed query items were imbedded into the post-treatment questionnaire (Abbey and Meloy, 2017). These attention checks were used to determine if participants were sufficiently engaged and attentive to the experimental tasks. Participants effectively responded to these directed queries and thus demonstrated sufficient attention to detail in the research setting. Therefore, results of the experiment can be interpreted without concern for inattentive participant responses.

Confounding Checks

Two types of confounding checks were performed. First, consistent with Perdue and Summers (1986) the discriminant validity of the independent variable manipulations was evaluated. This check showed no significant interactions between the factors and their measures (all p's > 0.05). Therefore, the vignette based manipulations were clean and free from confounding. The second type of confounding check involved post hoc qualitative inquiry that asked participants to describe their decision making processes. These open-ended responses were reviewed to determine if any unknown confounding factors were inadvertently introduced into the experiment. The research team did not find any evidence of confounding conditions in the participant responses. Based on these two types of checks, results of the research can be evaluated without concern for confounding conditions.

Realism Checks

Consistent with Dabholkar (1994), realism checks were performed. Participants were asked if they could imagine themselves in the described situation and if they thought the situation was realistic. Participants responses indicated above average realism ($M_{realism} = 4.99$). Therefore, concerns about the potential adverse effects associated with an artificial or contrived laboratory setting are reduced.

Hypothesis Testing

Hypotheses were tested via ANOVA on the dependent variable of purchase intent with pricing and green MIS adoption as factors. Results show

that an increase in carrier pricing reduces a shipper's purchase intent ($F = 30.567$; $p < 0.001$; effect size = .287) thus supporting H1. Results also show that an increase in a carrier's green MIS adoption increases a shipper's purchase intent ($F = 177.682$; $p < 0.001$; effect size = .539) and offer support for H2. As predicted, the main effect hypotheses were qualified by the predicted interaction between pricing and green MIS ($F = 3.388$; $p < 0.05$; effect size = .043) indicating that green MIS affects the established relationship between pricing and purchase intent. This result supports H3. Table 1 summarizes the hypothesis testing results.

DISCUSSION

The purpose of this research was to test *a priori* hypotheses about the effects of pricing and green MIS in carrier selection decisions. The results of our vignette-based experiment illustrate that the adoption of green MIS positively affects carrier selection and attenuates the negative effect of price on shippers' purchase intentions. These experimental findings are consistent with theoretical predictions of SET and shed light on the subtle relational complexities involved in shipper-carrier

exchange beyond the influence of traditional cost and service factors. Indeed, our study illustrates that the adoption of green MIS presents an opportunity for carriers to increase the relational value of the exchange for prospective shippers and mitigates the negative effect of higher prices. Overall, by providing new insights into the opportunities for differentiation presented by green technologies, our research offers important implications for theory, practice, and public policy.

Theoretical Implications

This research confirmed SET predictions regarding shipper-carrier relationship formation and showed that SET insights can extend beyond traditional psychological or sociological context boundaries into specialized supply chain applications. As anticipated, a price increase was viewed as a relational cost and lowered purchase intent. Although this finding was intuitive, it does support the notion that economic factors still matter in complex exchange relationships often conflated by social/psychological dimensions. However, green MIS was also found to be a statistically significant predictor of shipper purchase intent. This finding is important because it shows that green MIS is indeed viewed as a relational benefit in a shipper-

TABLE 1
SUMMARY OF EXPERIMENT ONE

ANOVA RESULTS

Independent Variables	F-Value	Effect Size
Main Effects		
Pricing	30.567***	0.287
Green MIS	177.682***	0.539
Pricing x Green MIS	3.388*	0.043

*p<0.05 **p<0.01 ***p<0.001

carrier exchange relationship and thereby adds an additional dimension to the evolving carrier selection literature.

Perhaps the most theoretically significant finding of this research addresses the role of green MIS relative to pricing in carrier selection decisions. An effect size comparison shows that adoption of bypass technology has nearly twice the impact of a 4% change in freight rates (i.e. 2% below average to 2% above average). This result questions the decades old assumption that price is the ultimate determinant when selecting transportation providers (Dobie 2005; McGinnis 1990) and it supports the SET premise that relational costs and benefits may change over time. The significant interaction effect of the independent variables on shipper purchase intentions further supports the emerging role of sustainability criteria in carrier selection. Results of this research suggest that green MIS weakens the generally accepted relationship between price and selection. Rather than advocating that actors "should" source sustainably, researchers can now begin to provide evidence that suggests actors "do" consider green factors in carrier selection and propose empirically supported theoretical relationships.

Managerial Implications

Many benefits of bypass technology are well documented and widely accepted (Marett et al.,2013). No one seems to debate that transponders reduce congestion, idle time, or fuel consumption. Everyone seems to agree that instantaneously sharing important carrier information in a wireless digital format can reduce costs, improve service, and shorten lead-times. Multiple transportation stakeholders and the overall environment benefit from these efficiencies. However, results of this research also suggest that green MIS adoption has an additional benefit for carriers. It differentiates them in a way that increases their chances of being selected by shippers. Bypass technology not only reduces

bottom line costs, but it has the potential to increase top line sales. There has always been a case that "going green helps you make more green", but that traditional perspective is cost focused. Our research builds on this foundational premise of environmental sustainability and then suggests that incremental demand can also be generated for carriers. This finding has clear managerial implications for carriers as well as advocates for green MIS adoption.

Policy Implications

Although some suggest that policy mandates may be the only avenue to affect meaningful sustainability progress (Markman and Krause, 2016), results of this research suggest that market mechanisms may be an effective alternative to legislation. In our experiment, the use of bypass technology had a statistically significant effect on carrier selection. Therefore, if the transportation market is permitted to function without intervention, it appears shippers will naturally select carriers with better sustainability performance. Over time, a Darwinian filter could shape the trucking industry by rewarding environmentally sustainable carriers. Carriers with high levels of green MIS adoption could prosper and those with low levels of sustainability would eventually disappear. This type of market driven evolution would take time, but it could avoid potential unintended consequences that may accompany government imposed regulations (Davis-Sramek et al., 2018 cite).

Green MIS also provides a standardized and consistent enforcement function for government agencies. Street-level bureaucrats, such as regulatory agents in weigh stations, exercise significant discretion in the distribution of sanctions and implementation of policies (Lipsky, 1980). However, with bypass technology, trucks are electronically pre-screened for compliance with federal and state regulations, which eliminates the "human" factor in policy implementation. Thus, carrier adoption of bypass technology can help to

decrease variations in the level of compliance and the distribution of sanctions across fleets.

Limitations and Future Research

In shipper-carrier interactions, our results suggest that social benefits of a relationship are beginning to take a more prominent role – perhaps even relative to the economic costs of an exchange. However, future research needs to explore this notion in more detail and determine which psychosocial or economic aspects of green MIS influence relational net worth. Our results show that green MIS has a statistically significant impact and large effect size on carrier selection. SET predicted this relationship based on cost/benefit logic, but our understanding of the perceived benefit of green MIS remains limited. Why do shippers select carriers with bypass technology and what specific rewards are associated with this type of exchange are questions that remain unanswered. Perhaps green carriers are selected because shippers like being associated with environmentally responsible providers or maybe they simply think it is the right thing to do. On the other hand, a more utilitarian decision calculus might be at play. Maybe shippers believe that green technology adoption will eventually drive down economic costs or consumers will purchase more goods from firms that associate with green suppliers. Future research is needed to fully explore the more specific motivations involved in complex shipper-carrier exchanges.

The experimental results of this study show that bypass technology adoption has a much larger effect on shipper purchase intent than a 4% price differential. Although we think this finding is meaningful and suggests that sustainability considerations are beginning to affect traditional price driven sourcing decisions, our vignettes were limited to three treatment conditions for price (i.e. 2% below average, average, and 2% above average). In transportation, many think a 2% to 4% price differential is quite meaningful, but others could

suggest such a cost range is inconsequential and that drawing meaningful conclusions regarding the role of price and sustainability is problematic. Although sustainability appears to be gaining traction as an important selection attribute, there is likely a tipping point where a cost differential becomes large enough that green MIS no longer matters. Therefore, additional research is needed to further refine our understanding of this relationship.

CONCLUSION

While cost and service still have a fundamental influence on carrier selection decisions, the breadth of selection criteria has expanded to include environmentally sustainable technology solutions. For shippers and carriers alike, the adoption of bypass technology is a more efficient form of compliance monitoring and serves as a strong sustainability signal to customers and regulators. By adopting green technologies, carriers can leverage their sustainable approach to supply chain functions and appeal to the sustainable sourcing preferences of shippers. Our findings suggest that adoption of green technologies differentiates transportation service providers and moves carrier evaluation criteria beyond traditional cost focused approaches.

Our study also provides empirical evidence to support managerial and policy discussions focused on the relative efficacy of the private sector versus the public sector in the promulgation of environmental regulations and sustainability standards. Our findings suggest that the shipping market rewards carriers who adopt and implement environmentally sustainable practices, as shippers are more likely to select carriers who have adopted green technologies and weigh adoption more heavily than some price related factors. Accordingly, government interventions may no longer be necessary to motivate environmental friendliness in the trucking industry because the market now provides sufficient incentive for carriers to adopt green technologies. In contrast to government

policies that react to changes in constituent preferences, the self-regulating nature of the market mechanism allows for continual adjustment and fine-tuning over time as demand for environmental sustainability evolves and new green technologies are introduced.

REFERENCES

Abbey, J., and M. Meloy (2017), "Attention By Design: Using Attention Checks to Detect Inattentive Respondents and Improve Data Quality," *Journal of Operations Management,* 53-56(3): 63-70.

Bachrach, D., and E. Bendoly (2011), "Rigor in Behavioral Experiments: A Basic Primer for Supply Chain Management Researchers," *Journal of Supply Chain Management,* 47(3): 5-8.

Bardi, E. (1973), "Carrier Selection From One Mode," *Transportation Journal,* 13(1): 23-29.

Bardi, E., P. Bagchi, and T. Raaghunathan (1989), "Motor Carrier Selection in a Deregulated Environment," *Transportation Journal,* 29(1): 23-29.

Baumol, W.J., and H.D. Vinod (1970), "An Inventory Theoretic Model of Freight Transport Demand," *Management Science,* 16(7): 413-421.

Bendoly, E., and S. Eckerd (2013), "Behavioral OM Experiments: Critical Inquiry Reawakening Practical Issues in Research," In *Behavioral Issues in Operations Management*, edited by I. Giannoccaro, 1-22. Springer, London.

Bharadwaj, A. (2000), "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly,* 24(1): 169-196.

Blau, P. 1964, *Exchange and Power in Social Life,* New York: Wiley.

Cantor, D.E., J.V. Blackhurst, and J.D. Cortes (2014), "The Clock is Ticking: The Role of Uncertainty, Regulatory Focus, and Level of Risk on Supply Chain Disruption Decision Making Behavior," *Transportation Research Part E: Logistics and Transportation Review,* 72(C): 159-172.

Choi, S., and A. Ng. (2011), "Environmental and Economic Dimensions of Sustainability and Price Effects on Consumer Responses," *Journal of Business Ethics,* 104(2): 269-282.

Corbett, J. (2013), "Designing and Using Carbon Management Systems to Promote Ecologically Driven IS-Enabled Transformation," *Journal of the Association of Information Systems,* 14(7): 339-378.

Crainic, T.G., M. Gendreau, and J. Potvin (2009), "Intelligent Freight-Transportation Systems: Assessment and the Contribution of Operations Research," *Transportation Research Part C: Emerging Technologies,* 17(6): 541-557.

Dabholkar, P.A. (1994), "Incorporating Choice Into an Attitudinal Framework: Analyzing Models of Mental Comparison Processes," *Journal of Consumer Research,* 21(1): 100-118.

Dao, V., I. Langella, and J. Carbo (2011), "From Green to Sustainability: Information Technology and an Integrated Sustainability Framework," *The Journal of Strategic Information Systems, 20*(1): 63-79.

Davis-Sramek, B., R. Thomas, and B. Fugate (2018), "Integrating Behavioral Decision Theory and Sustainable Supply Chain Management: Prioritizing Economic, Environmental, and Social Dimensions in Carrier Selection," *Journal of Business Logistics,* 39(2): 87-100.

Deck, C., and V. Smith (2013), "Using Laboratory Experiments in Logistics and Supply Chain Research," *Journal of Business Logistics,* 34(1): 6-14.

Dedrick, J. (2010), "Green IS: Concepts and Issues for Information Systems Research," *Communications of the Association for Information Systems,* 27(1): 173-184.

Defee, C., B. Williams, W. Randall, and R. Thomas (2010), "An Inventory of Theory in Logistics and SCM Research," *International Journal of Logistics Management,* 21(3): 404-489.

Dobie, K. (2005), "The Core Shipper Concept: A Proactive Strategy for Motor Freight Carriers," *Transportation Journal,* 44(2): 37-53.

Eckerd, S., and E. Bendoly (2011), "Introduction to the Discussion Forum on Using Experiments in Supply Chain Management Research," *Journal of Supply Chain Management,* 47(3): 3-4.

Emerson, R.M. (1976), "Social Exchange Theory," *Annual Review of Sociology,* 2(1): 335-362.

Evans, R.E., and W.R. Southard (1974), "Motor Carriers and Shippers Perceptions of the Carrier Choice Decision," *Logistics and Transportation Review,* 10(2): 145-147.

Fischer, R.J. (1993), "Social Desirability Bias and the Validity of Indirect Questioning," *Journal of Consumer Research,* 20(2): 303-315.

Garver, M. (2016), "Examining Carrier Selection with Situational Choice Models," *Transportation Journal,* 55(2): 224-236.

Gelinas, T. (2009), "Save Time and Fuel with PrePass," *Fleet Equipment,* 35(8): 4-5.

Green, K.W., P.J. Zelbst, J. Meacham, and V.S. Bhadauria (2012), "Green Supply Chain Management Practices: Impact on Performance," *Supply Chain Management: An International Journal,* 17(3): 290-305.

Grewal, D., K.B. Monroe, and R. Krishnan (1998), "The Effects of Price-Comparison Advertising on Buyers' Perceptions of Acquisition Value, Transaction Value, and Behavioral Intentions," *Journal of Marketing,* 62(2): 46-59.

Gunasekaran, A., and E.W. Ngai (2004), "Information Systems in Supply Chain Integration and Management," *European Journal of Operational Research,* 159(2): 269-295.

Hansen, S. (2010), "ITS America Smart Solution Spotlight: PrePass," Intelligent Transportation Society of America. Washington, DC.

Hardesty, D.M., J.P. Carlson, and W.O. Bearden (2002), "Brand Familiarity and Invoice Price Effects on Consumer Evaluations: The Moderating Role of Skepticism Toward Advertising," *Journal of Advertising* 21(2): 1-15.

Heskett, J.L., R.M. Ivie, and N.A. Glaskowsky, Jr. (1964), *Business Logistics: Management of Physical Supply and Distribution*. New York: The Ronald Press.

Homans, G. 61), *Social Behavior: Its Elementary Forms*. New York: Harcourt Brace Jovanovich.

Hu, P., H. Hu, C. Wei, and P. Hsu (2016), "Examining Firms' Green Information Technology Practices: A Hierarchical View of Key Drivers and Their Effects," *Journal of Management Information Systems,* 33(4): 1149-1179.

Jenkins, T.A., J. Webster, and L. McShane (2011), "An Agenda for "Green" Information Technology and Systems Research," *Information and Organization,* 21(1): 17-40.

Jerman, R.E., R.D. Anderson, and J.A. Constatin (1978), "Shipper Versus Carrier Perceptions of Carrier Selection Variables," *International Journal of Physical Distribution and Materials Management,* 9(1): 29-38.

Joo, S.J., H. Min, and C. Smith (2017), "Benchmarking Freight Rates and Procuring Cost-Attractive Transportation Services," *International Journal of Logistics Management,* 28(1): 194-205.

Kaufmann, L., J. Esslinger, and C.R. Carter (2018), "Toward Relationship Resilience: Managing Buyer-Induced Breaches of Psychological Contracts During Joint Buyer-Supplier Projects," *Journal of Supply Chain Management,* 54(4): 62-85.

Kelley, H.H., and J. Thibaut, J. (1978), *Interpersonal Telations: A Theory of Interdependence*. New York: Wiley.

Kent, J., and S. Parker (1999), "International Containership Carrier Selection Criteria," *International Journal of Physical Distribution & Logistics Management,* 29(6): 398-408.

Khuntia, J., T.J. Saldanha, S. Mithas, and V. Sambamurthy (2018), "Information Technology and Sustainability: Evidence from an Emerging Economy," *Production and Operations Management,* 27(4): 756-773.

Krause, D., and L. Ellram (2014), "The Effects of the Economic Downturn on Interdependent Buyer-Supplier Relationships," *Journal of Business Logistics*. 35(3): 191-212.

Lipsky, M. (1980), *Street-Level Bureaucracy: Dilemmas of the Individual in Public Services*. New York: Russell Sage Foundation.

Malhotra, A., N.P. Melville, and R.T. Watson, (2013), "Spurring Impactful Research on Information Systems for Environmental Sustainability," *MIS Quarterly,* 37(4): 1265-1274.

Marett, K., R.F. Otondo, and G.S. Taylor (2013), "Assessing the Effects of Benefits and Institutional Influences on the Continued Use of Environmentally Munificent Bypass Systems in Long-Haul Trucking," *MIS Quarterly,* 37(4): 1301-1312.

Markman, G.D., and D. Krause (2016), "Theory Building Surrounding Sustainable Supply Chain Management: Assessing What We Know, Exploring Where To Go," *Journal of Supply Chain Management,* 52(2): 3-10.

Matthews, L., D. Power, A. Touboulic, and L. Marques (2016), "Building Bridges: Toward Alternative Theory of Sustainable Supply Chain Management," *Journal of Supply Chain Management* 52(1): 82-94.

McGinnis, M.A. (1990), "The Relative Importance of Cost and Service in Freight Transportation Choice: Before and After Deregulation," *Transportation Journal,* 30(1): 12-19.

Meixell, M.J., and M. Norbis (2008), "A Review of the Transportation Mode Choice and Carrier Selection Literature," *International Journal of Logistics Management,* 19(2): 183-211.

Melville, N. (2010), "Information Systems Innovation for Environmental Sustainability," *MIS Quarterly,* 34(1): 1-21.

Milne, A.M., and J.C. Laight (1963), *The Economics of Inland Transport* (2nd edition). London: Sir Isaac Pitman & Sons.

Murphy, P.R., and P.K. Hall (1995), "The Relative Importance of Cost and Service in Freight Transportation Choice Before and After Deregulation: An Update," *Transportation Journal,* 35(1): 30-39.

Nanath, K., and R. Pillai (2017), "The Influence of Green IS Practices on Competitive Advantage: Mediation Role of Green Innovation Performance," *Information Systems Management,* 34(1): 3-19.

Narasimhan, R., A. Nair, D.A. Griffith, J.S. Arlbjørn, and E. Bendoly (2009), "Lock-In Situations in Supply Chains: A Social Exchange Theoretic Study of Sourcing Arrangements in Buyer-Supplier Relationships," *Journal of Operations Management,* 27(5): 374-389.

Perdue, B.C., and J. Summers (1986), "Checking the Success of Manipulations in Marketing Experiments," *Journal of Marketing Research,* 23(4): 317-326.

Premeaux, S. (2002), "Motor Carrier Selection Criteria: Perceptual Differences Between Shippers and Motor Carriers," *Transportation Journal,* 42(2): 28-38.

Rai, A., R. Patnayakuni, and N. Seth (2006), "Firm Performance Impacts Of Digitally Enabled Supply Chain Integration Capabilities," *MIS Quarterly,* 30(2): 225-246.

Robinson, J.L., R.W. Thomas, and K.B. Manrodt (2013), "Food for Thought in the Transportation Carrier-Selection Decision" *Transportation Journal,* 52(2): 277-96.

Rungtusanatham, M., C. Wallin, and S. Eckerd (2011), "The Vignette in a Scenario-Based Role-Playing Experiment," *Journal of Supply Chain Management,* 47(3): 9-16.

Saleh, F., and B.J. Lalonde (1972), "Industrial Buying Behavior and the Motor Carrier Selection Decision," *Journal of Purchasing,* 8(1): 18-33.

Sarkis, J., K. Koo, and R.T. Watson (2013), "Green Information Systems & Technologies – This Generation and Beyond: Introduction To The Special Issue," *Information Systems Frontiers,* 15(5): 695-704.

Shrivastava, P. (1995), "Environmental Technologies and Competitive Advantage," *Strategic Management Journal,* 16(S1): 183-200. Stock, J.R., and B.J. Lalonde (1977), "The Transportation Mode Decision Revisited," *Transportation Journal,* 17(2): 51-59.

Thibaut, J.W., and H. Kelley (1959), *The Social Psychology of Groups*, New York: Wiley. Thomas, R.W. (2011), "When Student Samples Make Sense in Logistics Research," *Journal of Business Logistics,* 32(3): 287-290.

Thomas, R.W., T.L. Esper, and T.P. Stank (2010), "Testing the Negative Effects of Time Pressure in Retail Supply Chain Relationships," *Journal of Retailing,* 86(4): 368-382.

Thomas, R.W., B.S. Fugate, J.L. Robinson, and M. Tasçioglu (2016), "The Impact of Environmental and Social Sustainability Practices on Sourcing Behavior," *International Journal of Physical Distribution and Logistics Management,* 46(5): 469-491.

Thomas, S.P., R.W. Thomas, K.B. Manrodt, and S.M. Rutner (2013), "An Experimental Test of Negotiation Strategy Effects on Knowledge Sharing Intentions in Buyer-Supplier Relationships," *Journal of Supply Chain Management,* 49(2): 96-113.

Tokar, T. (2010), "Behavioral Research in Logistics and Supply Chain Management," *International Journal of Logistics Management,* 21(1): 89-103.

Voss, D., T. Page, S. Keller, and J. Ozment (2006), "Determining Important Carrier Attributes: A Fresh Perspective Using the Theory of Reason Action," *Transportation Journal,* 45(3): 7-19.

Wang, J.-J., M.-M. Wang, F. Liu, and H. Chen (2015), "Multi-Stakeholder Strategic Third-Party Logistics Provider Selection: A Real Case in China," *Transportation Journal,* 54(3): 312-338.

Watson, R.T., M.C. Boudreau, A. Chen, and M.H. Huber (2008), Green IS: Building Sustainable Business Practices. *In Information Systems: A Global Text*, edited by R.T. Watson, 1-17, Athens: Global TextProject

Williams, Z., M.S. Garver, and G.S. Taylor (2013), "Carrier Selection: Understanding the Needs of Less-Than-Truckload Shippers," *Transportation Journal,* 52(2): 151-182.

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Directions
In the following scenario, a common transportation sourcing situation is described for a major retailer. Assume all scenario descriptions are accurate and trustworthy. After you read the scenario, please answer each question. As you answer each question, predict how the retailer would act in this type of situation. Please do not base your answers on how you think the retailer should approach the situation, but rather on how they actually would approach the situation.

Basic Scenario
Imagine that a major retailer is conducting its annual review of truckload carriers. Based on this review process, the retailer has decided to add another transportation service provider to its preferred group of core carriers. After evaluating numerous carrier proposals, the retailer has narrowed down their potential options to six remaining truckload carriers. With the exception of rates and bypass technology discussed in the following paragraphs, all six carriers are identical on any relevant selection criteria. For example, all six carriers provide the same level of acceptable coverage, legal compliance, service, safety, and lead-times. All six carriers also have the same basic transportation management information systems capabilities for keeping track of orders, dispatching, shipments, routing, and payments.

Pricing Manipulations:
(HIGH) Superior Transportation Services (STS) is one of the six remaining carriers. STS quoted an average rate of $2.04 per mile. The other carriers under consideration all quoted a rate of $2.00 per mile. Therefore, the STS rate quote is 2% higher than the other carriers.

(AVERAGE) Superior Transportation Services (STS) is one of the six remaining carriers. STS quoted an average rate of $2.00 per mile. The other carriers under consideration also all quoted a rate of $2.00 per mile. Therefore, the STS rate quote is the same as the other carriers.

(LOW) Superior Transportation Services (STS) is one of the six remaining carriers. STS quoted an average rate of $1.96 per mile. The other carriers under consideration all quoted a rate of $2.00 per mile. Therefore, the STS rate quote is 2% lower than the other carriers.

Green MIS Manipulations:
(HIGH) Unlike the other carriers under consideration, STS has also invested in intelligent transportation system capabilities. In addition to basic transportation management systems, STS utilizes bypass system technologies that allow truck drivers to bypass tollbooths and highway weigh stations. STS trucks are equipped with transponders that transmit information about each shipment (i.e. weight, cargo, and driver's hours of service) to receivers located at highway weigh stations along the vehicle's route. This bypass system technology reduces idle time at weigh stations, reduces highway congestion, reduces fuel consumption, reduces greenhouse gas emissions, and reduces paper usage. Therefore, STS has the smallest carbon footprint among the final six carriers. (LOW) Like the other carriers under consideration, STS has not invested in intelligent transportation system capabilities. STS does not utilize bypass system technologies that allow truck drivers to bypass tollbooths and highway weigh stations. STS trucks are not equipped with transponders that transmit information about each shipment (i.e. weight, cargo, and driver's hours of service) to receivers located at highway weigh stations along the vehicle's route. STS does not have the bypass system technology that reduces idle time at weigh stations, reduces highway congestion, reduces fuel consumption, reduces greenhouse gas emissions,

and reduces paper usage. Therefore, STS has the same carbon footprint as the final six carriers.

APPENDIX B
MEASURES FOR DEPENDENT AND INDEPENDENT VARIABLES

Purchase Intent (Grewal et al., 1998; Hardesty et al., 2002):

- The retailer's willingness to select STS as their new carrier is very high.

- The retailer is very likely to purchase transportation services from STS.

- The probability that the retailer would consider selecting STS is very high.

Pricing (Choi and Ng, 2011):

- Compared to the other carriers, STS prices are…(lower, average, higher).

Green MIS (Choi and Ng, 2011):

- STS has "green" management information systems.

Realism (Dabholkar 1994):

- The situation described in the scenario was realistic.

- I can imagine myself in the described situation.