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EXAMINING SUSTAINABILITY ATTITUDES AND PRACTICES AMONG OVERTHE- ROAD LOGISTICS COMPANIES OPERATING IN INDIANA

Robert Louis Crull III
Purdue University

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LOGISTICS COMPANIES OPERATING IN INDIANA

For the degree of Master of Science

Is approved by the final examining committee:

Dr. Edie Schmidt

Dr. Maria-Ribera Sancho

Dr. Chad Laux

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Dr. Edie Schmidt

Approved by Major Professor(s): _____

Approved by: Dr. Kathryn A. Newton

05/1/2014

Head of the Department Graduate Program

Date

EXAMINING SUSTAINABILITY ATTITUDES AND PRACTICES AMONG OVER-
THE-ROAD LOGISTICS COMPANIES OPERATING IN INDIANA

A Thesis

Submitted to the Faculty

of

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by

Robert L. Crull III

In Partial Fulfillment of the
Requirements for the Degree

of

Master of Science

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West Lafayette, Indiana

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ABSTRACT

Crull III, Robert Louis. Master of Science, Purdue University, May 2014. Examining Sustainability Attitudes and Practices Among Over-The-Road Logistics Companies Operating in Indiana. Major Professors: Edie Schmidt and Maria-Ribera Sancho.

This research study takes a look at the sustainable attitude/awareness level and practices of over-the-road logistics companies operating in Indiana. It has a descriptive study design, providing information in an area that has not been previously analyzed. As the world adopts a “greener” mindset with the purpose of reducing the carbon footprint, this study helps lead the way towards this goal. It allows for the performance of further research into the reasons certain companies focus on sustainable practices more than others. Eventually, the hope is to increase the amount of companies operating sustainably.

The research study included an in-depth literature review of the current transportation business in Indiana and of studies assessing companies’ sustainable attitudes, awareness, and practices. A web-based survey was used to gather information from 42 respondents. At least 25 different companies were represented in the study.

The results from the survey displayed the respondents’ demographic information as well as their responses to 18 sustainability practice and awareness questions incorporating a 5-point Likert scale. The sample consisted

of participants with varying levels of sustainable logistics knowledge and awareness. Companies' respondents showed a high priority in economic sustainability practices and a low priority in societal sustainability practices. Larger companies, which employed 10,000 or more people, appeared to have better overall sustainability awareness and practices than smaller companies. As a whole, the sample's sustainability commitment was low. Government policies need to be implemented to instigate change in a positive direction. Companies must adopt a sustainable mindset for significant changes to take effect.

CHAPTER 1. INTRODUCTION

This chapter introduces the research study performed. It sets the stage for the significance of the study by providing the statement of purpose and a background in the area of research conducted. Boundaries and assumptions are outlined in order to specify the authenticity of the results.

1.1 Background

In today's global world, obtaining a product is difficult without having it travel through a series of complex channels prior to reaching the consumer. Within the United States, many products are transported via truck and trailer. In 2007, trucks accounted for 28.6% of the freight volume transported domestically in the United States (National Transportation Statistics, 2010). The 2009 Department of Transportation records show that in 2006, road-based transportation consisted of 8.8 million trucks traveling 263 billion miles (Montreuil, 2011). Unfortunately, the current way physical objects are being transported is considered to be lacking sustainability in three aspects: economy, environment, and society. Montreuil (2011) created a visual representation highlighting symptoms that an unsustainable supply chain and logistics structure exists around the world, shown in Table 1.1.1. The symptoms

are placed within categories based on their description. The three categories are: economical, environmental, and societal (Montreuil, 2011).

Table 1.1.1 *The Unsustainability Symptoms* (Montreuil, 2011)

| Unsustainability symptoms | | Economical | Environmental | Societal |
|---------------------------|---|------------|---------------|----------|
| 1 | We are shipping air and packaging | ● | ● | |
| 2 | Empty travel is the norm rather than the exception | ● | ● | |
| 3 | Truckers have become the modern cowboys | ● | | ● |
| 4 | Products mostly sit idle, stored where unneeded, yet so often unavailable fast where needed | ● | | ● |
| 5 | Production and storage facilities are poorly used | ● | ● | |
| 6 | So many products are never sold, never used | ● | ● | ● |
| 7 | Products do not reach those who need them the most | ● | | ● |
| 8 | Products unnecessarily move, crisscrossing the world | ● | ● | |
| 9 | Fast & reliable intermodal transport is still a dream or a joke | ● | ● | ● |
| 10 | Getting products in and out of cities is a nightmare | ● | ● | ● |
| 11 | Networks are neither secure nor robust | ● | | ● |
| 12 | Smart automation & technology are hard to justify | ● | | ● |
| 13 | Innovation is strangled | ● | ● | ● |

Economically speaking, there are more efficient ways and practices for the transport of products throughout the United States. For example, companies can optimize production quantities and distribution channels as well as cut down on packaging and waste (Hoffman, 2008). Overproduction is a problem because it causes an increase in inventory storage costs and unnecessary human work hours. Distribution channels can be optimized to ensure lower amounts of miles are being driven when transporting products. Finally, trailer space should be fully utilized to reduce the amount of trips needed to transfer products. Empty or half empty containers during shipment are a likely occasion rather than an exception.

Official statistics report that trailers in the United States are roughly 60% full when they are travelling loaded (Montreuil, 2011).

With the widespread use of trucks for transportation, the environmental impact of trucking products is a significant area of concern. Since 1999, the transportation sector has been the leading source of carbon emissions among end-use sectors (Emissions of Greenhouse, 2009). In 2003, transport generated nearly 25% of CO₂ emissions in the world and this number continues to drastically increase (Raux, 2009). These vehicle emissions are a major concern because they directly affect the stabilization of CO₂ that, in turn, facilitates global warming (Hiramatsu, Mimura, & Sumi, 2008).

While there are many initiatives trying to address the environmental issues related to logistics, simple practices like incorporating radio frequency identification (RFID) are not widely being used (Hoffman, 2008). RFID allows for the transfer of real-time information throughout a supply chain. This kind of visibility can counteract the bullwhip effect, cut down on labor, and reduce inventory costs. The bullwhip effect is “a phenomenon in which the fluctuations in the order sequence grow larger for suppliers farther away from the customers” (Ouyang & Li, 2010). By minimizing this problem, unnecessary transportation and pollution will occur throughout the supply chain. Successful supply chain information coordination allows for maximum profitability (Jones & Chung, 2008). RFID essentially allows for supply chain efficiency, the reduction of environmental issues, and the reduction of human work hours.

From a societal or social aspect of sustainability, truck drivers from all over the United States have started to experience higher levels of stress in the twenty-first century. Demands to provide products rapidly to a finicky population allow for very small transportation windows or delays. Truck drivers are constantly being overworked each week due to the enormous amount of hours they are needed for operating a truck. This adds to their stress levels and decreases the time they spend at home. The truck driving profession is one of the fastest-growing occupations in the United States, where the total number of drivers is inadequate (Hagenbaugh & Blass, 2004). Locating a pool of qualified replacement employees has become such a challenge, that over-the-road (OTR) companies constantly advertise in an effort to gain new recruits.

Another societal aspect of OTR logistics includes its impact on traffic congestion within a city and its contribution to the number of accidents within an area (Anderson, Allen, & Browne, 2005). The necessity for OTR drivers to maneuver throughout congested urban communities requires strong transportation training and skills. The need to combine punctuality with expert maneuverability results in a stressful lifestyle.

1.2 Significance

Information about supply chain sustainability attitudes and practices among logistics companies operating in Indiana is scarce. Older research studies have shown companies' sustainability commitment levels. One study, in particular, observed the use of sustainable practices from 39 third-party logistics

(3PL) companies. This information came from 3PLs operating all over the United States but it is not nearly enough. Some findings showed that during the 2008-2009 global recession, many large 3PL companies continued to increase their commitments to building sustainability programs (Lieb & Lieb, 2010). Hoffman (2008) reinforces this evidence by asserting that numerous shippers are currently embracing environmental initiatives. However, very little current information exists about the sustainable practices used by logistic companies operating throughout the state of Indiana.

From an economical perspective, OTR logistics could greatly improve. In many developed countries, the conduit through which products flow is an ever-growing cost that could be reduced through efficiency. Various European countries currently use sustainable practices to transport products all over Europe. The United States is behind these European countries and their sustainable logistics practices. In 2009, transportation costs represented 10% of the United States' Gross Domestic Product. This was approximately \$1.4 trillion (Montreuil, 2011). Considerable expenses come from the way products are moved. Trucks are preferred over trains in order to decrease transfer time. Fuel costs have started to rise sharply because of increases in the demand for diesel. Other types of cleaner and cheaper fuel alternatives are starting to become more popular in the United States. Due to increases in technology, compressed natural gas (CNG) is an alternative type of fuel that is being used more frequently to power trucks. Alternative Fuels Data Center (2013) provided the data in Figure 1.2.1 depicting the price differences of various fuel types.

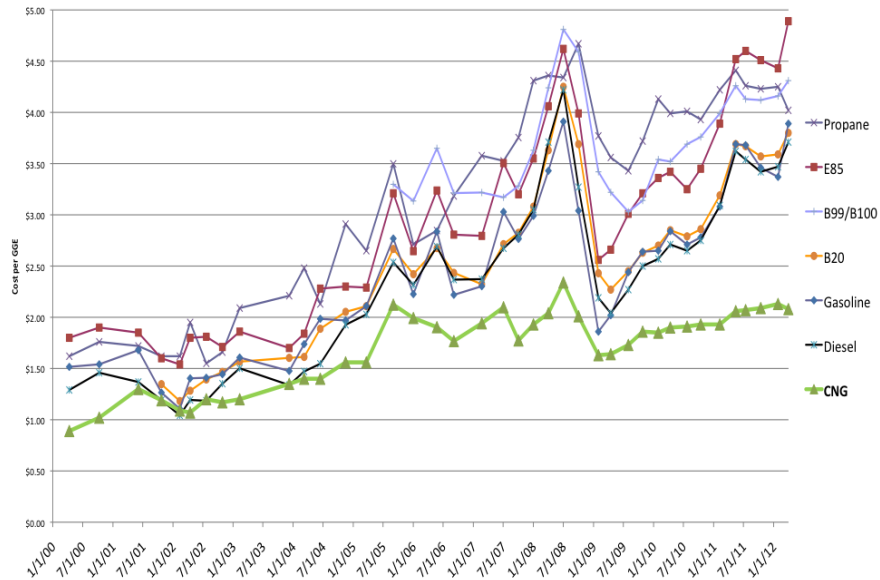


Figure 1.2.1 United States' Average Fuel Prices

(Alternative Fuels Data Center, 2013)

As of 2012, the average price difference between diesel and CNG was approximately \$1.68 per gasoline gallon equivalent (GGE). Using this kind of fuel, in conjunction with vehicles meant for transporting goods, makes the most sense economically.

CNG offers lower carbon dioxide, carbon monoxide, lead, and nitrogen oxide emissions than fuel oil when burned. The overall lifetime maintenance and purchase price of vehicles utilizing this fuel type is also cheaper than its alternatives. Finally, transport and distribution of natural gas is comparatively cheaper if a pipeline infrastructure exists (Pascoli, Femia, & Luzzati, 2001). In the United States, a pipeline infrastructure is already in use across the country to supply homes and industrial businesses with natural gas. When making

comparisons between this type of natural gas energy and diesel, natural gas is currently more economically and environmentally sustainable for the reasons previously stated.

By operating OTR logistics in a sustainable fashion, cost savings are accrued and fewer emissions are released into the atmosphere. “Transportation, distribution and logistics are the biggest contributors in the supply chain to carbon and other greenhouse gas emissions” (Hoffman, 2008). Transport, in 2003, accounted for nearly 25-30% of the global CO₂ emissions. These emission contributions continue to grow (Raux, 2009). Greenhouse gases repeatedly create climate changes and fuel global warming. Figure 1.2.2 illustrates the seven phases of global warming and many of the contributing factors to this problem. “There is an urgent need to develop an international initiative to increase efforts to reduce greenhouse gas (GHG) emissions at the local and global levels” (Hiramatsu, Mimura, & Sumi, 2008). Companies are willing to pay a little extra for alternatives that reduce GHG emissions. Massachusetts Institute of Technology professor David Simchi-Levi claimed “a portion of the market is willing to pay a higher price for a greener product” (Hoffman, 2008).

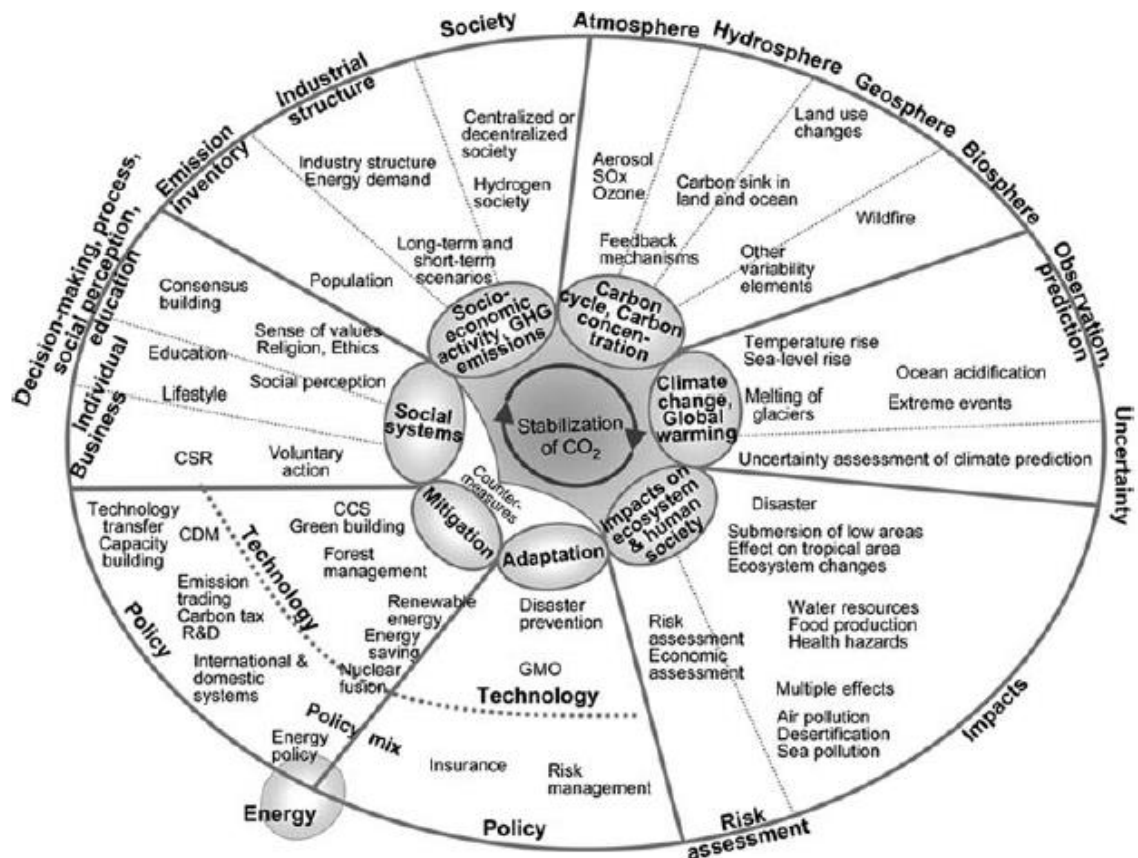


Figure 1.2.2 Map of Global Warming with Seven Phases

(Hiramatsu, Mimura, & Sumi, 2008)

A major concern, when looking at an unsustainable logistics structure in the United States, is the effect it has on social or human sustainability. The United States Government estimated, in 2008, the number of truck drivers would rise by 19% from 2002 to 2012. This would make truck driving one of the fastest-growing professions within this time period (Hagenbaugh & Blass, 2004). In, 2008, trucking companies employed 1.4 million people. This accounted for around 1% of the United States' employment (The Value of Freight: Overview of the U.S. Freight Transportation System, 2011). There were over 1.7 million truck

drivers employed within the United States by 2012, which is over the expected 19% increase (Occupational Outlook Handbook: Heavy and Tractor-trailer Truck Drivers, 2014). Even with this rapid growth in drivers, the demand for this profession remains much higher than the supply of truck driving professionals.

Figure 1.2.3 depicts the shares of United States ton-miles by mode of transportation. The trucking mode greatly increased from 18.5% in 1980 to 28.6% in 2007 causing the need for more truck drivers (National Transportation Statistics, 2010).

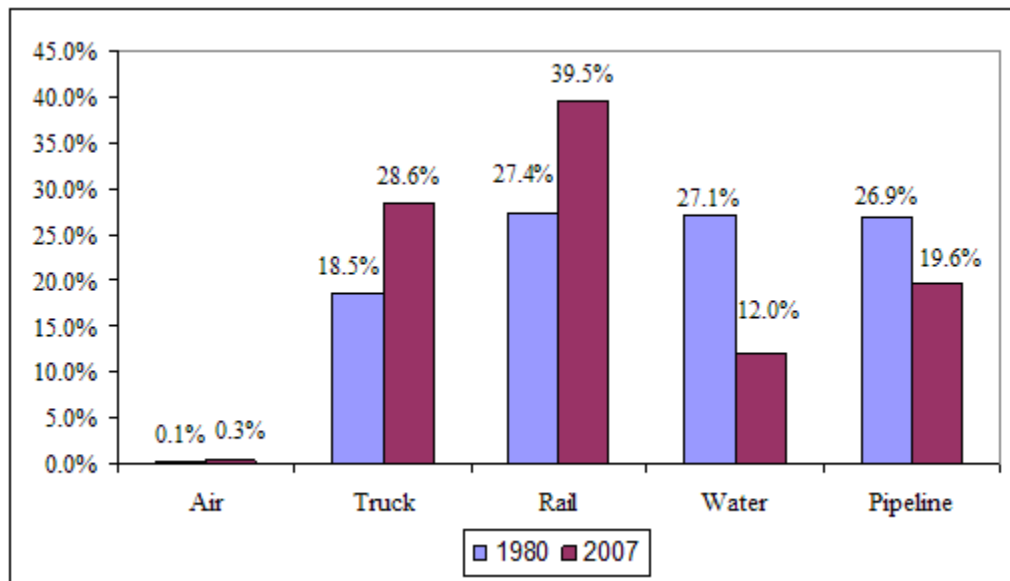


Figure 1.2.3 Shares of Ton-Miles by Mode in the United States
(National Transportation Statistics, 2010)

In 2008, the American Trucking Association estimated that the truck driver shortage would grow to 111,000 drivers by 2014 (Montreuil, 2011). With this

shortage of personnel and the high demand of moving products over-the-road, drivers have been overworked to the maximum legal driving time limit and bodily strain has resulted. Consequently, their health has become a concern. Drivers are constantly on long trips away from home, which reduces their family life, social life and overall health (Montreuil, 2011). In addition to these various factors, a 1995 United States National Transportation Safety Board study found that 58% of accidents reported by truck drivers were caused by fatigue and sleep deprivation (Johnston III, 2005). The effects are not only being seen within the truck driver community, unfortunate fatalities have occurred due to these accidents. The human sustainability factor needs to be addressed by making OTR logistics more efficient and sustainable.

1.3 Statement of Purpose

This project examined the levels at which over-the-road logistics companies in Indiana were aware of the need for sustainable practices and how often the companies implemented these practices in their operations. The research focused on the economic, environmental, and societal areas of sustainability. Previously developed surveys on sustainable practices were used as references. Questions from the surveys were then changed, validated, and administered to OTR logistics companies operating in Indiana. Employees of these companies were asked to evaluate their company's awareness levels and current practices within the three sustainability areas. This project analyzed present over-the-road logistics departments' practices in Indiana. It also

identified the extent to which companies followed the global practices of a more sustainable transportation system.

1.4 Research Questions

The study focused on gaining insight into current Indiana OTR industry practices, attitudes, and awareness related to logistical sustainability. It answered two questions:

1. What is the awareness of sustainable OTR practices among logistics companies operating in Indiana?
2. What are the prevailing attitudes and practices adopted by OTR logistics companies operating in Indiana with respect to sustainability?

1.5 Assumptions

The research study required data collection through the use of a survey conducted by companies operating logistics in Indiana. The following assumptions were made:

1. The questions answered on the survey were being answered honestly.
2. The responder understood sustainable logistics practices.
3. The responder was aware of the sustainable practices used by the company he or she represented.
4. The survey questions adequately assessed the sustainability practices of the company in question.

5. Logistics companies knew that diesel trucks produced more harmful emissions than trucks running on alternative fuels such as compressed natural gas.

1.6 Limitations

The limitations associated with the research study included:

1. The subjects consisted of logistics companies or departments operating in Indiana of which the researcher could contact and receive responses.
2. Subjects may have obscured true information in an effort to create a positive image about his or her company.
3. Some information may not have been conveyed accurately due to influence or misconception.

1.7 Delimitations

The delimitations of the research study included:

1. The study was based on the economic, environmental, and societal sustainability aspects of logistics practices.
2. The project included only subjects whose logistics companies operated in Indiana.

1.8 Definition of Key Terms

- Compressed Natural Gas (CNG)-Natural gas which is compressed to around 3,000 pounds per square inch (psi) and is used in vehicles such as

trucks, compacts, vans, and buses (Clean Alternative Fuels: Compressed Natural Gas, 2002).

- Global Warming-Climate changes causing the earth's atmosphere to gradually increase in temperature (Laurance et al., 2011).
- Greener-Acting green involves addressing and reducing the effects humans and other entities of the supply chain have on the natural environment (Srivastava, 2007).
- Logistics-The part of the supply chain process which plans and implements the flow and storage of goods efficiently (Rutner & Langley, 2000).
- Over-The-Road (OTR)-Carriers or trucks that travel via highways or roads moving freight or products (Taylor, DuCote, & Whicker, 2006).
- Radio Frequency Identification (RFID)-Radio frequency technology uses radio frequency to identify and track items containing an embedded coded electronic chip (Sari, 2010).
- Sustainability-Ability to meet the needs of the present without compromising the capability of future generations to meet their own needs (Rosner, 1995).
- Third-Party Logistics (3PL)-A firm that provides a variety of services including transportation and warehousing (Jayaram & Tan, 2010).

1.9 Chapter Summary

This chapter explained the statement of purpose and the research questions of the study. It also clarified the global contribution and significance of delving into the research topic. Assumptions were identified, allowing for a more precise understanding of the results that follow. Finally, limitations and delimitations were clarified and definitions to key terms were provided.

CHAPTER 2. LITERATURE REVIEW

The task of identifying sustainable practices within logistics has been researched in the past. However, as new forms of energy, technology, and sustainable practices become available, this topic should be reinvestigated. This is especially true within the area of over-the-road (OTR) logistics departments operating in Indiana. Much of the previously written literature focused on three main aspects within the entire logistics field. These three main areas concentrated on economical, environmental, and societal factors.

This chapter shows the importance of the study by first providing information about the current transportation business in Indiana and OTR companies that operate there. Then, multiple studies, similar to the one being performed, are assessed in this section. The literature review was completed in stages lasting over a year to conduct and came from various sources of information including: journals, books, articles, websites, and other types of media. Information was accessed through Purdue University databases and Google Scholar. Keywords used for finding information about this study included: logistics, sustainable logistics, Indiana transportation, logistics companies operating in Indiana, third-party logistics, surveys in sustainable logistics, and many others. Much of the information came from journal articles such as “The

International Journal of Logistics Management” and “Supply Chain Management Review.” The “Indiana Department of Transportation” website was accessed for much of the current information about logistics in Indiana.

This research study explored the current industry practices in implementing logistical sustainability with the scope restricted to companies in Indiana that employed over-the-road logistical operations. Specifically, it explored the prevailing attitudes, awareness, and current industry practices. The adoption of current sustainable industry practices fell into one of three categories: economical, environmental, or societal. The literature reviewed in this chapter analyzed research studies that either surveyed the attitudes about sustainability among various industry personnel, or examined the adoption of sustainable practices by companies.

2.1 The Transportation Business and OTR Companies in Indiana

Indiana is nicknamed the “Crossroads of America” because many interstates intersect at the center of this state. These crossroads include: Interstate 65, Interstate 69, Interstate 70, Interstate 74, Interstate 465, and Interstate 865. This highway infrastructure plays an important role to the OTR logistics aspect of national cargo. Transportation companies operate and reside throughout Indiana because of its transportation infrastructure. For example, Celadon Group Incorporated is headquartered in Indianapolis. It is one of the largest OTR logistics companies in North America.

OTR companies run millions of miles across Indiana every year moving products outbound, inbound and intrastate. Figure 2.1.1 shows the annual tons of goods and materials moved throughout Indiana in 2002 and by which mode of transportation these products were transferred. 2035 projections are also shown in this figure (Indiana Multimodal Freight and Mobility Plan, 2009).

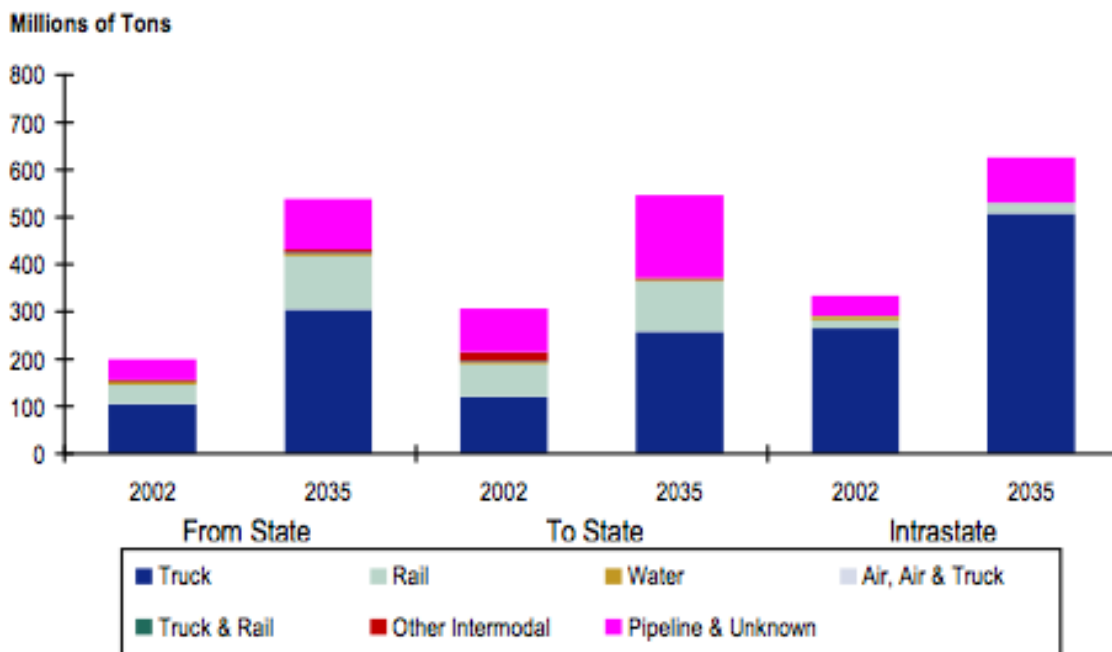


Figure 2.1.1 Total Commodity Flows from, to, and within Indiana by Tonnage (Indiana Multimodal Freight and Mobility Plan, 2009)

In 2002 around 106 million tons of goods left Indiana by truck. Base metals led the way at almost 25 million tons. Figure 2.1.2 shows Indiana’s top 10 truck-outbound commodities by tonnage (Indiana Multimodal Freight and Mobility Plan, 2009).

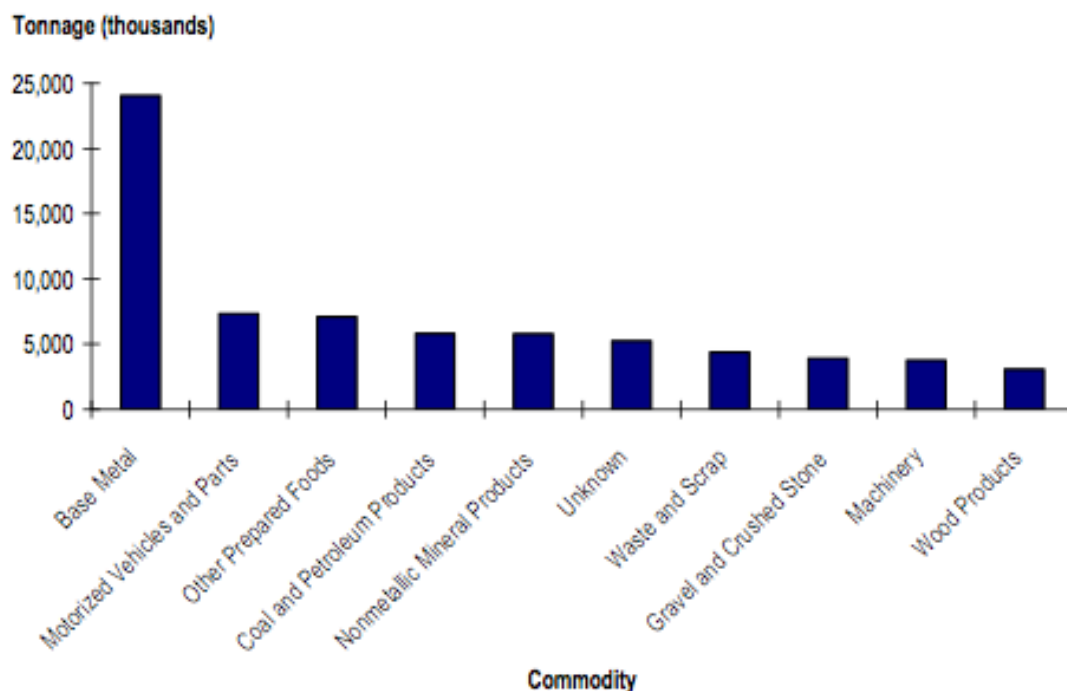


Figure 2.1.2 Indiana's Top 10 Truck-Outbound Commodities by Tonnage

(Indiana Multimodal Freight and Mobility Plan, 2009)

Truck-outbound commodities are projected to nearly triple by 2035 to 306 million tons. Figure 2.1.3 shows the counties in Indiana with the truck commodity flow origins in 2002 and what is projected for 2035 (Indiana Multimodal Freight and Mobility Plan, 2009).

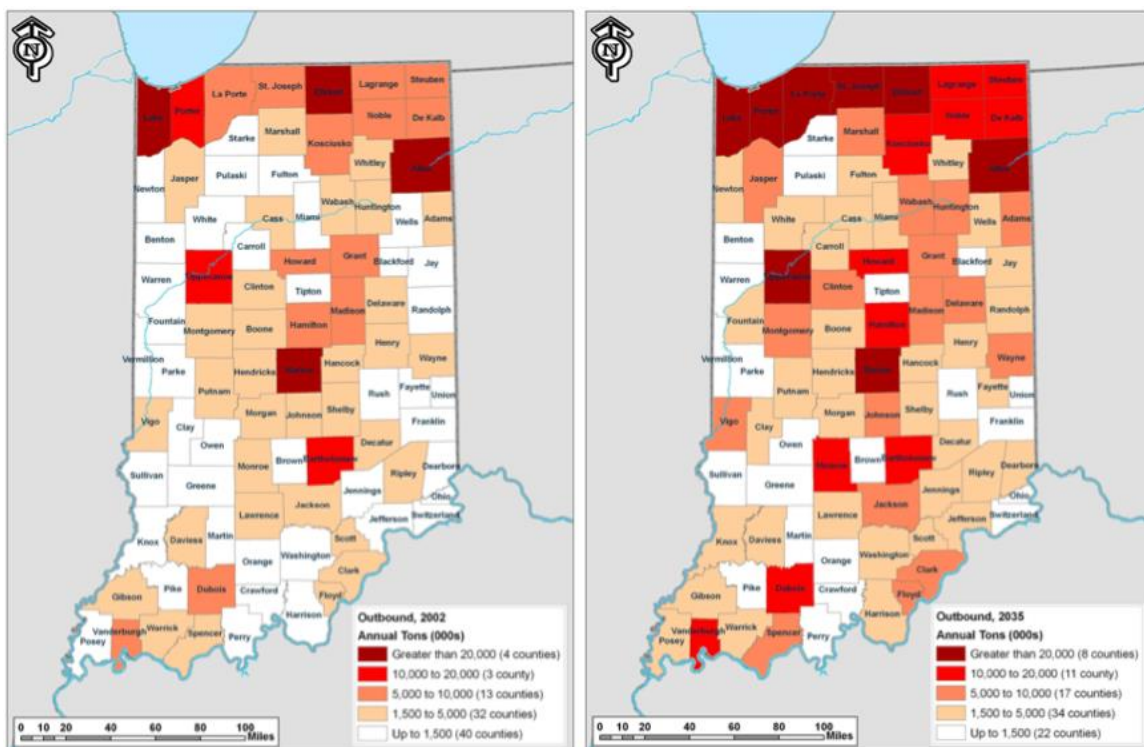


Figure 2.1.3 Indiana Truck Commodity Flow Origins
(Indiana Multimodal Freight and Mobility Plan, 2009)

In 2002 around 119 million tons of goods entered Indiana by truck. Waste and scrap led the way at almost 17 million tons. Figure 2.1.4 shows Indiana's top 10 truck-inbound commodities by tonnage (Indiana Multimodal Freight and Mobility Plan, 2009).

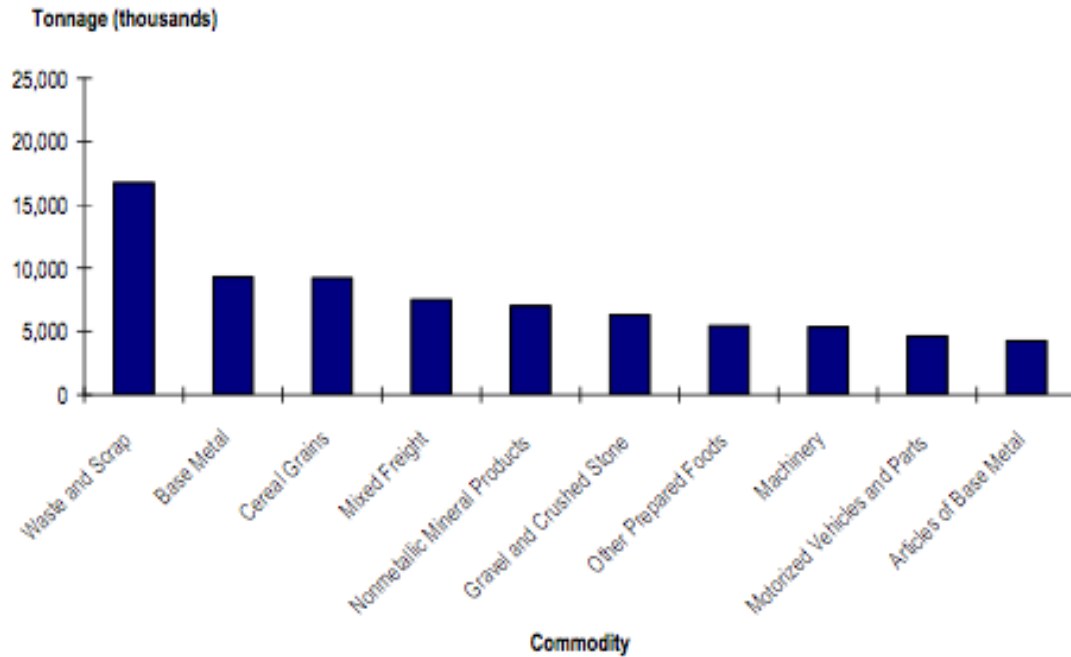


Figure 2.1.4 Indiana's Top 10 Truck-Inbound Commodities by Tonnage

(Indiana Multimodal Freight and Mobility Plan, 2009)

Truck-inbound commodities are also projected to nearly triple by 2035 to around 250 million tons. Figure 2.1.5 shows the counties in Indiana with the truck commodity flow destinations in 2002 and what is projected for 2035 (Indiana Multimodal Freight and Mobility Plan, 2009).

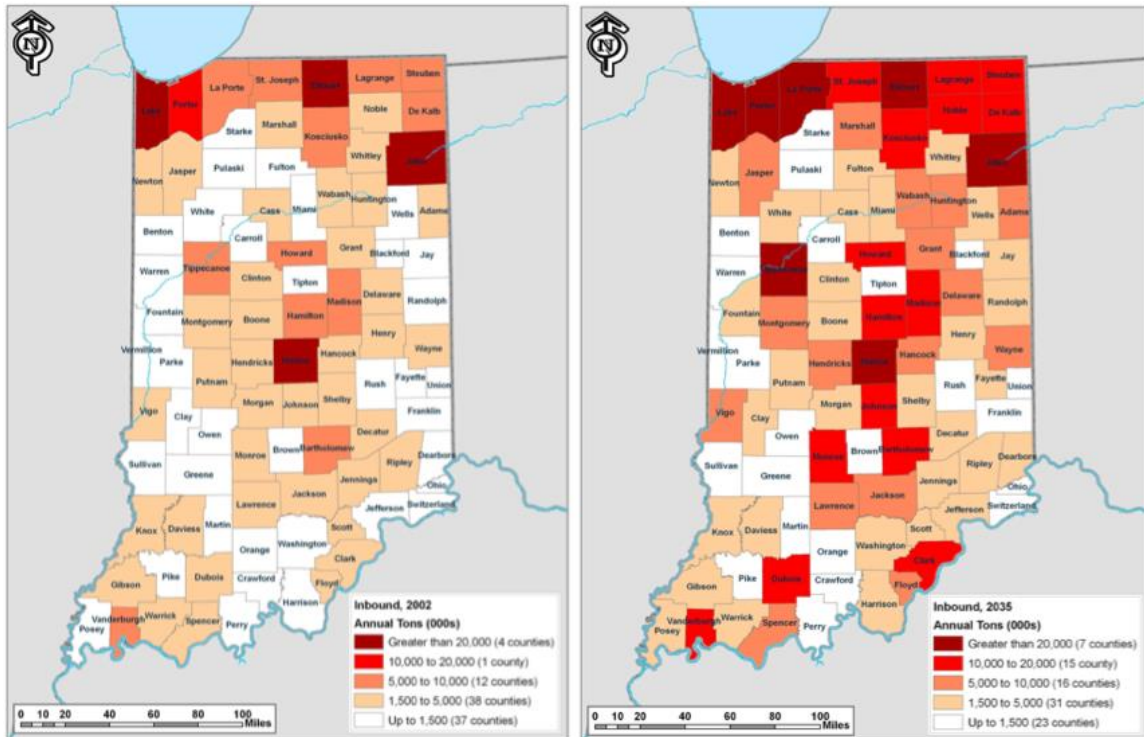


Figure 2.1.5 Indiana Truck Commodity Flow Destinations

(Indiana Multimodal Freight and Mobility Plan, 2009)

The forecast for inbound and outbound tonnages by truck is projected to drastically increase within the next 20 years. With this increase, more large trucks will be on the road. Conceivably, this may cause an increase in the number of large truck-related fatalities. Figure 2.1.6 shows the large truck-involved crash fatality rate by county in Indiana compared to the national average in 2006 (Indiana Multimodal Freight and Mobility Plan, 2009). At this time, Indiana had over 10 counties in the upper third portion of the national average for large truck-involved fatalities.

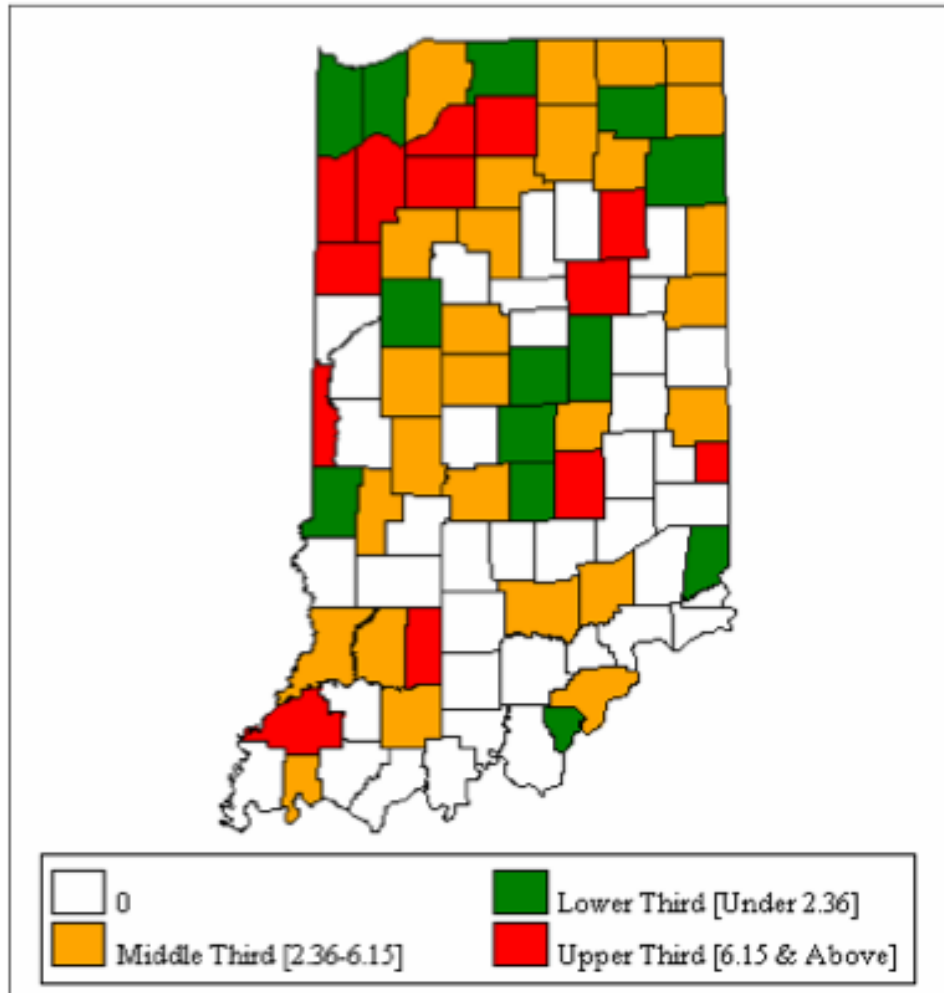


Figure 2.1.6 Indiana Counties' Large Truck-Involved Crash Fatality Rate 2006
(Indiana Multimodal Freight and Mobility Plan, 2009)

2.2 Studies Assessing Attitudes or Awareness Related to Sustainability

Illge & Schwarze (2008) studied attitudes towards sustainability within a very specific group of people. The researchers assessed ecological and neoclassical economists on the norms related to sustainability and economics. They used a literature survey to generate 40 statements related to sustainability economics and asked 196 researchers, in the field, to indicate their degree of

agreement with the statements. Then, Illge & Schwarze (2008) used cluster analysis to extract the opinions both groups shared and also to separate the different schools of thought on the statements about which the groups did not agree.

Hanks, Odom, Roedl, and Blevis (2008) evaluated the attitudes of the millennial population towards sustainability and especially towards interactive technologies like: cell phones, computers, and music players. This research attempted to establish a connection between sustainable interaction design and sustainable behaviors. They interviewed 435 undergraduate students, using a 29-question survey, about his or her opinion towards sustainable use of interactive technologies. The questions asked the participants about cell phone usage, replacement cycle, and disposal strategies. Next, the examiners divided the users into profiles based on his or her behavior and suggested different research strategies on the basis of his or her profile (Hanks et al., 2008). While the researchers took it a step further by proposing design changes based on consumer attitudes, their study was similar in the way that they also assessed the levels of awareness about sustainable practices.

The Sustainable Green Printing Partnership (SGP) directed a survey in 2012 identifying the printing community's awareness on sustainable printing practices. The report consisted of 179 respondents from all over the printing community. "The survey sample was obtained by leveraging contacts through various social media outlets" (2012 SGP Sustainability Awareness Survey, 2012). The SGP asked its board of directors to distribute the survey using their social

networking websites including LinkedIn Corporation. Some of the results highlighted reasons as to why specific printing companies did not have a sustainability program in place. Nearly 60% of the companies responded that the primary reason they did not have a sustainability program was because they did not have a significant amount of customers inquiring about a sustainability program. Therefore, it was never made a high priority. Other companies felt that a sustainability program was not essential to the future of their business.

2.3 Studies Assessing Sustainability Practices

Romaniw and Bras (2012) administered a survey to major aerospace manufacturing companies in an effort to understand the environmental stewardship and sustainable practices of these companies. The researchers proposed that after these practices were recognized, future research would be conducted to answer the question: Why are companies not implementing these sustainable methods within their aerospace manufacturing business? Most of the information was ascertained through company environmental reports. Further investigation was not pursued because the companies solicited were unable to divulge that kind of information. The businesses that were surveyed included: Airbus, Boeing Company, Bombardier Aerospace, General Dynamics Corporation (Gulfstream), Lockheed Martin Corporation, Northrop Grumman Corporation, Textron (Bell and Cessna), and United Technologies Group.

Vinodh and Joy (2011) examined how sustainability was engaged in the manufacturing practices and organizational performance of industries located in

Tamil Nadu, India. The purpose of this study was to observe the sustainable manufacturing practices across industrial sectors, and then identify the critical factors for successfully implementing them (Vinodh & Joy, 2011). Many current sustainable businesses in Tamil Nadu had been forced to adopt methods that promoted energy reduction as well as environmental safety. A fully sustainable business is defined as one that reduces production costs and prevents its environmental impact, therefore, maintaining a green and clean atmosphere (Kumaran, Ong, Tan, & Nee, 2001).

The authors created hypotheses and tested them via an email questionnaire sent to 50 small and medium enterprises operating in Tamil Nadu. This study primarily focused on two aspects of sustainability within manufacturing practices. The two aspects examined were economical and environmental sustainability practices. They were then evaluated for any correlations to the social aspect of sustainability. In this research study, economic sustainability consisted of four constructs: financial health, economic performance, potential financial benefits, and trading opportunities. Environmental sustainability consisted of three constructs: air resources, water resources, and mineral/energy resources. Social sustainability consisted of four constructs: internal human resources, external population, stakeholder participation, and macro social performance (Vinodh & Joy, 2011).

The results showed a strong correlation between all three aspects of sustainability. Conclusions drawn from this research showed that environmental, economic, and social sustainability were all very important facets to maintain

within sustainable manufacturing. They are also important indicators for positively and significantly impacting waste and emissions. The study claimed that their approach filled the literature gap about the suitability of sustainable manufacturing practices with regards to the environment.

A.T. Kearney and the Institute for Supply Management (ISM) used surveys to examine corporate sustainability practices among various Fortune 100 firms throughout a multitude of industries. This research focused on discovering how these companies promoted sustainable practices within three primary areas: economic development, environmental stewardship, and social well-being. Mahler (2007) found, through his study, that nearly 60% of the companies surveyed used sustainable practices in order to strengthen brand names or to distinguish their products. The author claimed that genuine sustainability was only achieved through making every aspect of the supply chain more sustainable (Mahler, 2007). This included having suppliers that also incorporated the same three core values of sustainable practices.

In 2010, *Chemical Week* and consulting company Computer Sciences Corporation (CSC) examined the sustainability and regulatory challenges companies were facing around the world. Diese (2010) used surveys and received over 200 responses from business executives. Fifteen top executives were also interviewed during the research process. Results found that sustainability management programs were being implemented at both the corporate and plant levels. These programs were used to monitor greenhouse gas emissions and water utilization (Diese, 2010). A key finding from this study

showed that just over half of the companies surveyed indicated they were abiding by their global product stewardship goals. For the companies not following their stewardship goals, two-thirds said it was due to a lack of importance and investment in these ambitions.

In Malaysia, Zailani et al. (2012) researched sustainable supply chain management (SSCM) and the extent of practice implementation. Two main supply chain practices were examined: environmental purchasing and sustainable packaging. This research study analyzed whether these two practices positively affected environmental, economic, social, and operational outcomes. A stratified random sample was used to conduct the research. Therefore, it focused on firms implementing SSCM only in Malaysia. Data collection took place by sending a questionnaire survey through the mail. It was sent to 400 manufacturing firms that only operated in Malaysia. Out of the 400 surveys, only 105 were rendered usable and complete. The questionnaire consisted of 76 items divided into five sections. A 5-point Likert scale was used in order to measure the extent of sustainable development-related practices within each firm. Results showed that both environmental purchasing and sustainable packaging had a direct impact on a firm's performance, economic, and social outcomes. The authors claimed that, by utilizing more SSCM practices, a reduction of resources, materials, and waste could occur. This would assist in achieving social, environmental, and economic performance, causing a more sustainable and developed environment.

2.4 Studies Assessing Both

In 2011, 2,031 United States adults and 302 Fortune 1000 executives took part in a “Gibbs & Soell Survey” in an effort to see if companies were adopting sustainable practices (Fortune 1000 Executives Confidential, 2011). According to the survey, 88% of business leaders reported that their company was headed toward a “green” initiative. However, 29% of those executives and 17% of consumers actually believed that these businesses were really committed to “going green.” This skepticism, about becoming more sustainable, could cause a lag in the progress of achieving these efforts. Most companies do not get past the envisioning phase of implementing environmentally friendly products or services. The survey stated that sales, social responsibility, and shareholders were the main drivers for companies to adopt “green” initiatives. This study analyzed both attitudes and adoption practices related to sustainability, similar to the research study in this paper.

A researcher from Purdue University, Palisi (2012), investigated sustainable purchasing practices (SPP) and the current level of awareness and implementation. The study focused on firms’ SPP with regards to evaluating, selecting, and retaining suppliers. Its population consisted of firms located in the United States’ plumbing, heating, cooling and piping manufacturing and distribution industries. The study also incorporated the extent to which these practices were being implemented. He captured his data by surveying members within the American Supply Association (ASA) on the green purchasing practices occurring in his or her organization. The 25-question survey was quantitative

and administered through email with the help of Qualtrics. Qualtrics is a web-based survey tool used by many universities to conduct professional research. Palisi (2012) received a contact list from the ASA containing information about all of their members and how to contact them.

The results of this study proved to be very interesting. Of all the sustainable purchasing practice experts surveyed, only 17% believed they had a good understanding of SPP. Others felt they had a very bad to zero understanding of SPP. At this point, Palisi (2012) listed 14 practices in order to confirm that companies were using sustainable practices without realizing it. The implementation results were “all over the board” depending on the practice being inspected. Some companies showed a widespread use in certain practices and a total lack of use in others.

The survey questionnaire format and methodology used to conduct this paper’s research was quite similar to the Palisi (2012) method. The Qualtrics survey tool was utilized and subjects were contacted by email to complete a questionnaire. Contact information was ascertained through a logistics contact list, logistics companies’ websites, and LinkedIn Corporation.

2.5 Chapter Summary

This section outlined previous research performed using surveys to measure sustainability within various fields. The chapter was subdivided into four main areas for conclusive measures. First, literature was reviewed on the current logistics industry in Indiana. Then, studies assessing attitudes or

awareness related to sustainability, studies assessing practices, and studies capturing both were reviewed. This research study used some of the surveys in the literature review as guides for generating a unique questionnaire aimed at measuring sustainability attitudes and practices among OTR companies operating in Indiana.

CHAPTER 3. FRAMEWORK AND METHODOLOGY

This chapter shows the framework for how the researcher conducted the research study. The intended survey population is determined in this section as well as the survey structure and content. A data collection flowchart graphically displays the process used for gathering information in this study.

3.1 Sample Set

The research study population consisted of participants working for logistics organizations operating in Indiana. Email and contact information was obtained through a third-party logistics contact list from the Internet. Much of this information came from logistics companies' websites, LinkedIn Corporation, and other various networks. The final contact list consisted of a wide variety of companies in terms of employees and geographical operation. By using a diverse sample set, the results more accurately resembled the sustainable actions and knowledge of companies throughout the OTR logistics industry.

Managers and employees, demonstrating seniority and knowledge of his or her company, were targeted. This targeting occurred by analyzing each

employee's job title. The sample size depended solely on the response rate of the survey. Based on research adequacy and time feasibility, 30 responses from a wide variety of companies was the goal.

This study also collected demographic data such as whether the company was publicly or privately owned, the number of employees working at each company, and the geographical region at which it operated. This included: statewide, regional, national, and international. Each subject had the option to identify the company name for which he or she worked. Gathering this information provided insight into sustainable practices/awareness and distinguishability.

3.2 Methodology

The section below outlines the steps completed for the methodology:

- Step 1: Identify participants, sampling technique, and population sample
- Step 2: Develop survey questions
- Step 3: Validate new survey with experts
- Step 4: Conduct survey
- Step 5: Statistical analysis of data, document findings, and generate discussion

Step 1: Identify Participants, Sampling Technique, and Population Sample

The population sample consisted of companies with OTR logistics operations going through Indiana. Many of these companies had operations

running outside of Indiana as well. Different sizes of companies were incorporated in this study to increase the accuracy of the results. Emails, containing a link to a Qualtrics' survey, were sent out and targeted for operations' managers to complete. This population was chosen due to their increase in company knowledge and simplicity of communication. No personally identifiable information was asked in the survey in order to ensure participant anonymity. The final version of the survey email can be seen in Appendix A.

The study used a systematic type of sampling technique. Email and contact information were readily available through a 3PL contact list, logistics companies' websites, and LinkedIn Corporation. After sending emails to people on the initial contact list and company websites, only three responses were received. To reach the goal of at least 30 responses, another additional survey delivery method was used. A stratified random selection of logistics professionals had the survey sent to them through LinkedIn Corporation messages. Most of these professionals graduated from Purdue University. At the end of the survey two-month timeframe, a final sample size of 42 participants, from at least 25 different companies, was collected.

Step 2: Develop Survey Questions

The survey questions in the questionnaire were refined and designed from previous studies. Both the 2012 SGP Sustainability Awareness Survey (2012) and Palisi (2012) provided the desired structure and content for the survey questions. Eighteen questions, incorporating a 5-point Likert scale, were used to

capture information about the employees' attitudes or awareness as well as the sustainable practices of their organization. Two questions looked at an employee's attitude or awareness level related to sustainability. Sixteen current practice questions were designed to fit into one of three sustainability categories: economical, environmental, and societal. All questions were close-ended to allow for easier quantitative interpretation of the answers. Several questions contained similar content in order to provide reliable results. Key terms were thoroughly defined before the survey questions began.

Distinguishable questions were used for the purpose of drawing better conclusions and correlations between varying companies. These types of questions answered: the age of the responder, his or her education, and the geographical area at which his or her company operated. Each respondent also had the choice to write down the name of his or her company. However, this information was not required for the completion of the survey. The geographical area, at which a company operated, and the total number of employees later proved to be contributing factors as to what practices a responder's company incorporated.

The final version of the survey questionnaire can be seen in Appendix B. These questions were screened, edited, and verified by the Purdue Institutional Review Board (IRB). The IRB is a part of the Human Research Protection Program at Purdue University and they are responsible for safeguarding research protocols. This study's IRB approval form can be seen in Appendix C.

Step 3: Validate New Survey with Experts

Before the survey was administered, the questions were validated. Content validation was completed using the face validity method. According to Sekaran (2000), face validity ensures that items intended to measure a concept do appear to measure that concept. Two graduate students performed face validation and provided feedback as to how the survey could be written and structured to better answer the research questions within this study. In order to increase the validity of the survey, an expert panel review also took place by three university professors specializing in research, statistics, and sustainability. The professor specializing in statistics previously created and administered many surveys throughout his career and is an expert at structuring questions. The professors in research and sustainability know how to ensure that content validity is accurate.

Sekaran (2000) states that using an expert panel of judges to validate a survey can be considered as an acceptable way of ensuring content validity. The ability of measuring the intended concept and collecting accurate and measurable data were realized through this process. The face validity method was chosen due to time constraints and because it allows for more accurate results.

Step 4: Conduct Survey

The survey was administered using the Purdue Qualtrics web-based survey tool. A link to access this tool and questionnaire was distributed to the

population via email and LinkedIn. Incorporated in the email was a short description about the researcher and how the information would be put to use. Participants were made aware that his or her responses were going to be anonymous. Data collection, from the survey, lasted for a period of two months. Figure 3.2.1 shows the flow of activities needed in order to conduct the survey and to ensure a sufficient amount of data was collected. This process helped yield more accurate results.

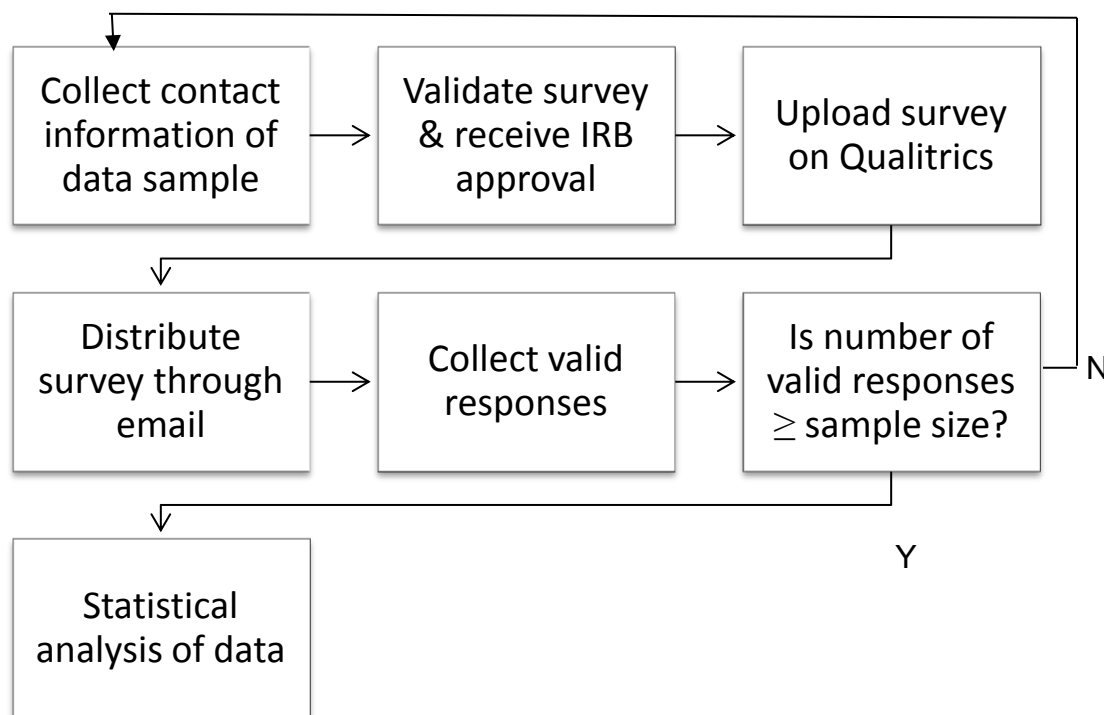


Figure 3.2.1 Data Collection Process

Step 5: Statistical Analysis of Data, Document Findings, and Generate Discussion

Data collection, statistical analysis, and documentation of findings occurred through the use of Microsoft Excel and Purdue Qualtrics. Purdue Qualtrics has the ability to analyze data through statistical testing. Using this tool also improved the accuracy/validity of the data and results because there was no need to transcribe data. Many human errors can occur when a researcher has to transcribe data. Microsoft Excel assisted in the documentation of findings and the creation of graphs and tables. These graphs and tables also helped in better understanding the results. Detailed descriptions were used to display the results of the study. Finally, discussion and conclusions were generated after the data were analyzed and the findings documented.

3.3 Chapter Summary

This chapter described the procedures employed to conduct the research. It then outlined the steps taken in the survey process and the nature of the sample population. A data collection flow chart was provided in order to better understand the process used for gathering information. Also, a brief description of the study's statistical techniques, used to analyze the data, was provided.

CHAPTER 4. FINDINGS

This chapter provides the results and statistical analysis of the study performed. Graphs and figures are provided to visually understand the information provided. The final sample size of the survey questionnaire was 42 participants from at least 25 different companies. This sample was randomly selected through logistics professionals' email addresses and LinkedIn Corporation profiles. The demographic data captured from this study is shown first, followed by the responses recorded on the questionnaire. The findings given in this section are from a descriptive study. The results could slightly vary if the study was repeated due to different respondents or demographic response categories. For this reason, survey tolerances are taken into account and only distinctive statistics, making an impact on the overall conclusion, are highlighted in this section. Appendix D shows a breakdown of all results collected during the survey questionnaire. This information can be used to draw one's own conclusions of the data received.

The survey questions were designed to capture information about the attitudes or awareness as well as the practices related to sustainability within an organization. Questions about a company's practices focus on three primary aspects of sustainability within this study. These aspects are economic,

environment, and society. Therefore, this chapter is broken down into these four sections: awareness, economical, environmental, and societal. Results were additionally separated into groups based on the respondent's company size. Companies employing below 10,000 people and companies employing 10,000 or more people were the two groups formed. This allowed for comparative analysis between businesses with differing resources and purchasing power. The differences between these two groups' responses are further analyzed in the next chapter.

4.1 Demographic Data

The survey contained six demographic questions. These questions addressed the respondents':

- Ages
- Education levels
- Company names
- Company ownership types
- Company employee sizes
- Company geographical area of operations

4.1.1: Respondents' Ages

Figure 4.1.1 shows the respondents' ages.

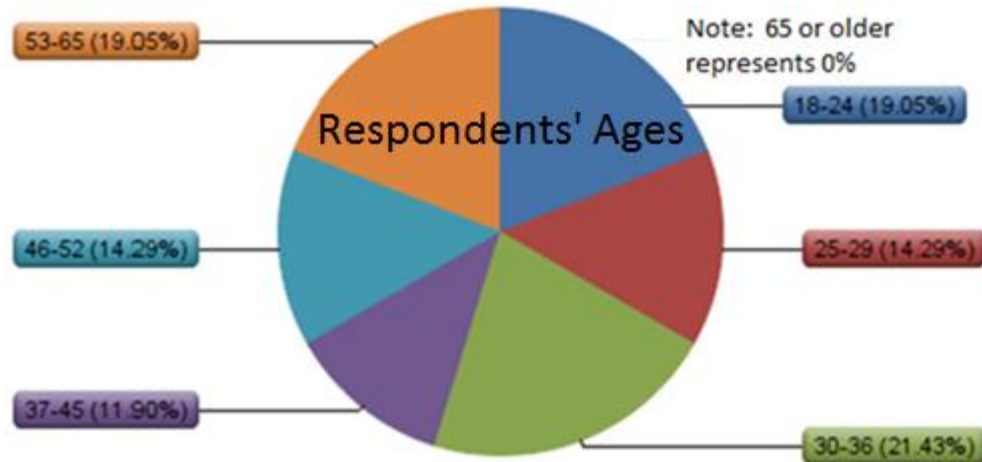


Figure 4.1.1 Respondents' Ages

There is nearly an even distribution among the selected age group brackets with no participants over the age of 65. Approximately 19% were between 18-24 years of age, 14% were between 25-29 years, 21% were between 30-36 years, 12% were between 37-45 years, 14% were between 46-52 years, and 19% were between 53-65 years.

4.1.2: Respondents' Education Levels

Figure 4.1.2 displays the highest education levels achieved amongst the respondents.

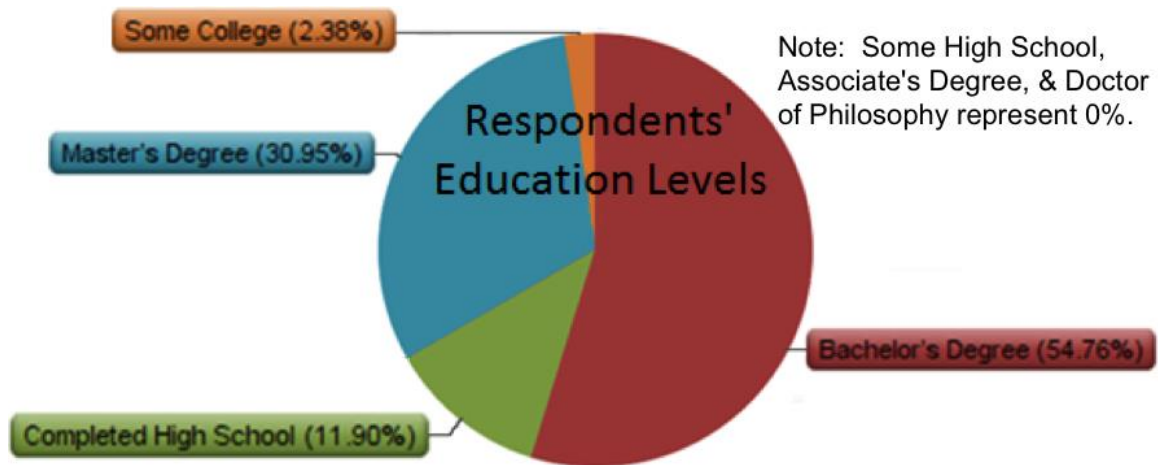


Figure 4.1.2 Respondents' Education Levels

The majority of the respondents obtained some type of college degree. None of the participants were high school dropouts. Roughly 31% had a master's degree, 55% had a bachelor's degree, 2% had some college education, and 12% had a high school degree.

4.1.3: Respondents' Company Names

There were 25 different company names listed on the survey out of 42 responses. One company was listed five times from different respondents. Another company was listed twice from separate respondents. Only 12 respondents did not provide any company name on his or her survey.

4.1.4: Respondents' Company Ownership Types

When asked about the type of ownership the respondents' companies currently had, 64% stated that they were publicly owned and only 36% said they

were privately owned. This was a good mixture of responses. Figure 4.1.4 depicts the respondents' company ownership types graphically.

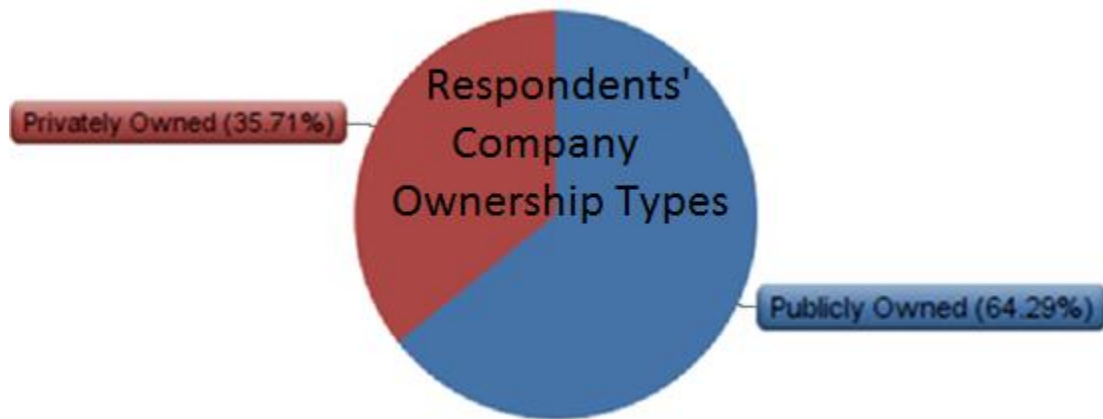


Figure 4.1.4 Respondents' Company Ownership Types

4.1.5: Respondents' Company Employee Sizes

Figure 4.1.5 shows the breakdown of the number of employees within the companies who responded.

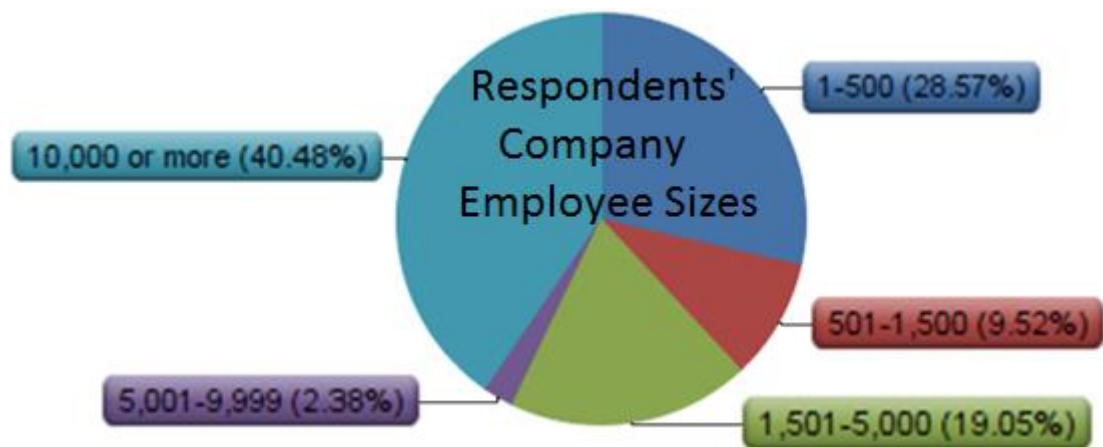


Figure 4.1.5 Respondents' Company Employee Sizes

Nearly 41% of the companies employed over 10,000 people. Also, approximately 2% employed 5,001-9,999 employees, 19% employed 1,501-5,000 employees, 10% employed 501-1,500 employees, and 29% employed 1-500 employees.

4.1.6: Respondents' Company Geographical Area of Operations

Figure 4.1.6 shows a very interesting breakdown of the companies' operational area. Nearly the entire sample operated nationally or internationally. Roughly 71% of the companies operated internationally. Also, approximately 21% operated nationally, 5% operated regionally, and 2% operated statewide.

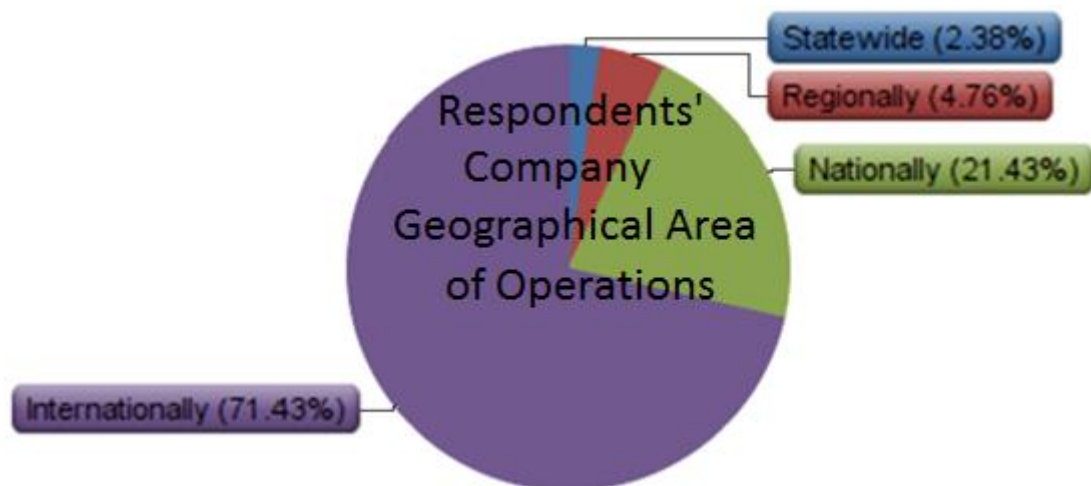


Figure 4.1.6 Respondents' Company Geographical Area of Operations

4.2 Attitude or Awareness

This survey contained two questions designed to generate a better understanding of the participants' current attitudes or awareness level for sustainable practices in OTR logistics among companies operating logistics in Indiana. The first question, asking whether all employees have a clear understanding of sustainable transportation practices, yielded fairly equal numbers of responses across the Likert scale. Each point on the scale contains about 20% of the all responses. Figure 4.2.1 shows this graphically through a horizontal diverging stacked bar chart.

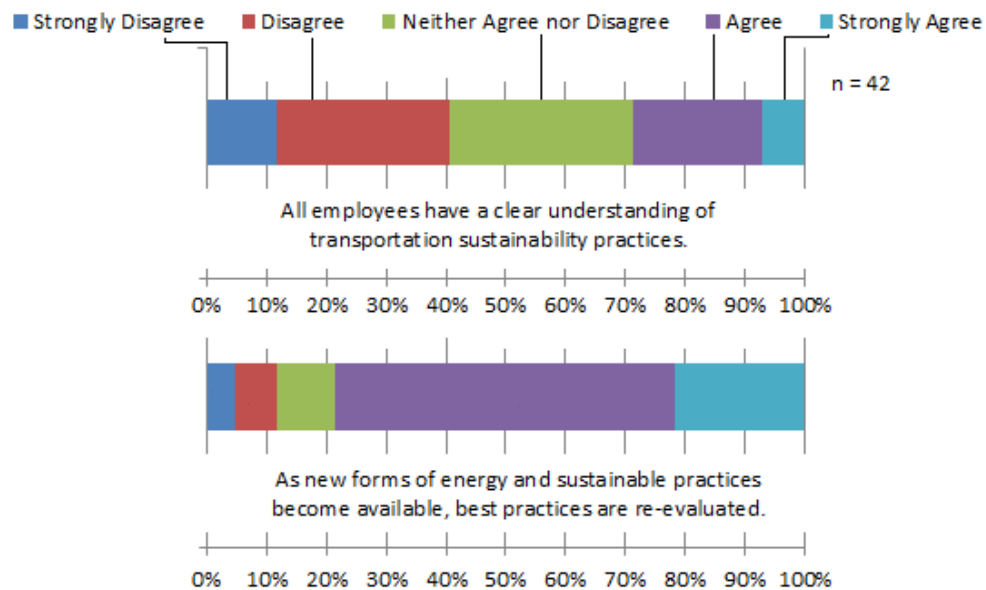


Figure 4.2.1 Sustainability Attitude/Awareness Questions & Responses

The second question, however, shows nearly a 60% response rate of subjects who “agree” that as new forms of sustainable practices became available, the

company's best practices were re-evaluated. Figure 4.2.1.1 takes the responses from the sustainability attitude or awareness level questions and splits them up based on the respondent's company employee size.

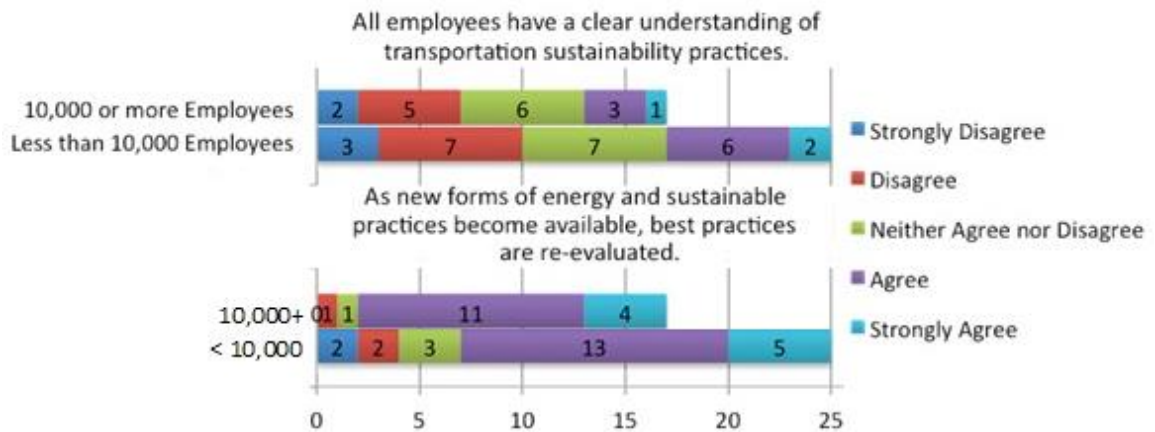


Figure 4.2.1.1 Sustainability Attitude/Awareness Questions & Responses by Company Size

Large companies consisted of 10,000 or more employees and small companies consisted of less than 10,000 employees. There were a total of 17 large companies and 25 small companies. The large companies comparatively had a greater percentage of responses stating that best practices were re-evaluated as new forms of energy and sustainable practices became available.

4.3 Economical

The subsequent questions were categorized as a company's economical practices in logistics. These survey questions and responses can be seen in Figure 4.3.1 below.

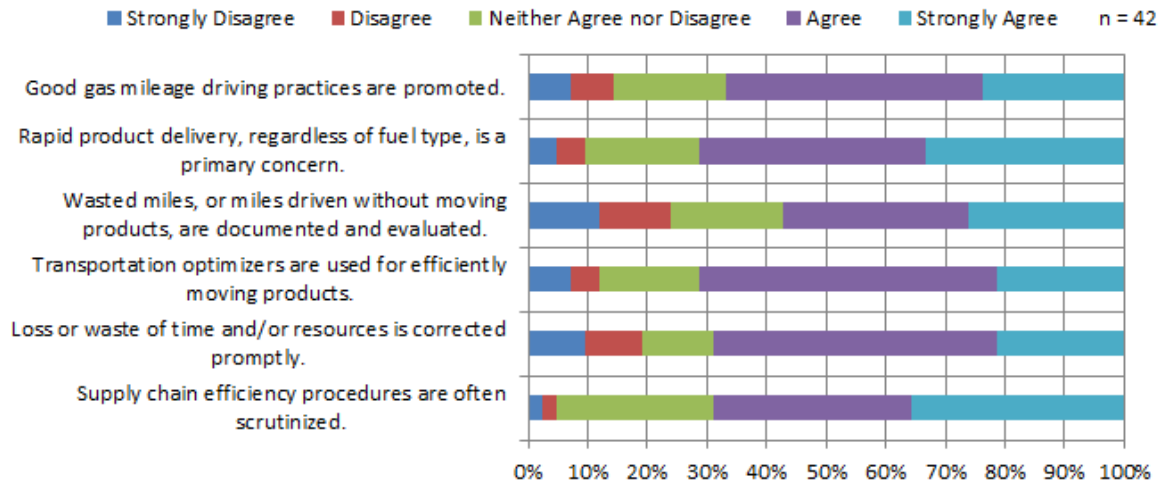


Figure 4.3.1 Economically Sustainable Questions & Responses

Each question approximated, had a 60%-70% total response of “agree” and “strongly agree.” The survey evaluated when good gas mileage driving practices were promoted at the respondent’s company, 43% agreed and 7% strongly disagreed. Overall, 38% agreed that rapid product delivery regardless of the fuel type was a primary concern. Nearly 33% strongly agreed with this concept. Almost 25% of the sample claimed that their company did not document or evaluate wasted miles. Over 70% of the respondents agreed or strongly agreed that their companies used transportation optimizers for efficiently moving products. Five respondents claimed that their company did not use any

kind of optimizer for moving products. If there were wasted miles resulting in a loss of time and/or resources, this problem was corrected promptly by nearly 70% of the companies surveyed. The same amount of companies, who agreed or strongly agreed with the fifth economically sustainable question, agreed or strongly agreed that supply chain efficiency procedures were often scrutinized at his or her company. Approximately 26% neither agreed nor disagreed with this question. Figure 4.3.1.1 shows the breakdown of large and small companies and their responses to economically sustainable questions.

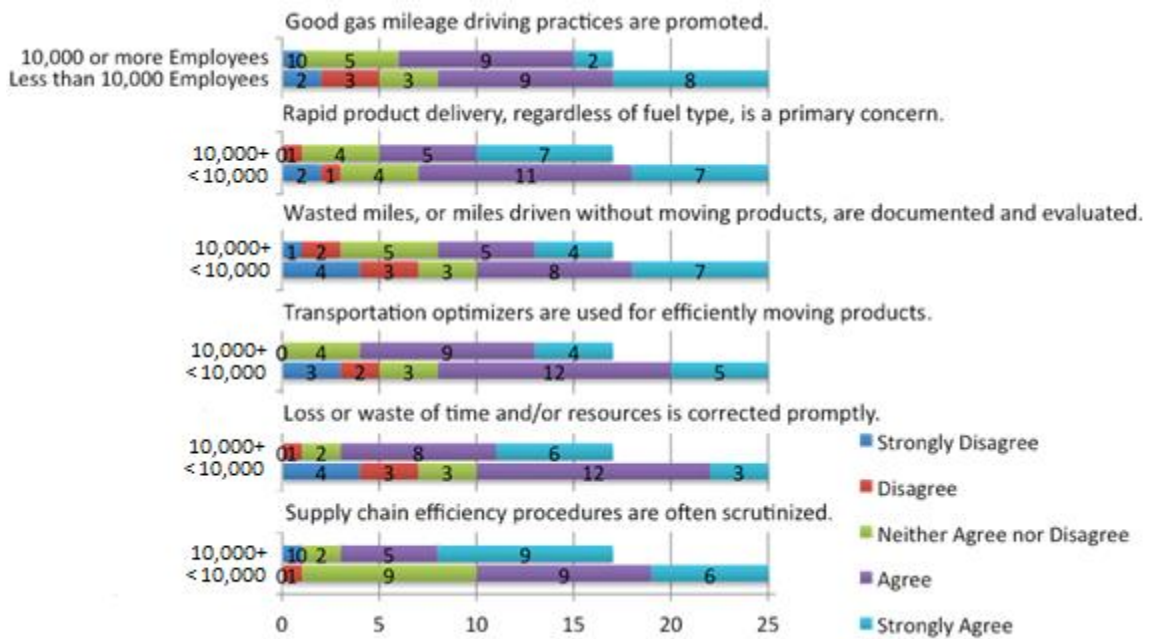


Figure 4.3.1.1 Economically Sustainable Questions & Responses by Company Size

Smaller companies fell behind larger companies on multiple economically sustainable questions. They generally did not promote good gas mileage as

much as larger companies. Smaller companies also had lower responses stating that they often scrutinized supply chain efficiency procedures.

4.4 Environmental

Other survey questions asked were categorized as a company's environmental practices in logistics. These questions and responses are shown below in Figure 4.4.1.

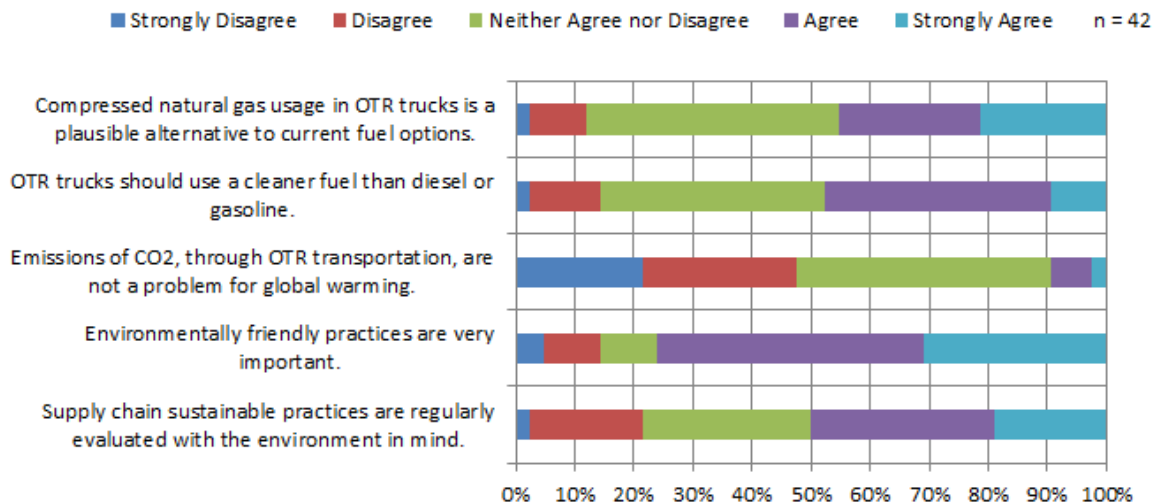


Figure 4.4.1 Environmentally Sustainable Questions & Responses

The environmentally sustainable results showed much less of a definitive pattern than the economically sustainable responses in the previous section. Most of these questions contained large responses of “neither agree nor disagree.”

Nearly 50% of the respondents believed that OTR trucks should use a cleaner fuel type and approximately 45% of them thought that natural gas was a

plausible alternative to current fuel options. Close to half of the survey sample considered CO₂ emissions from OTR transportation as a major problem and contributor to global warming. Roughly 76% of the companies' employees agreed or strongly agreed that environmentally friendly practices were very important. Finally, when asked if their company regularly evaluated supply chain practices with the environment in mind, only 50% agreed or strongly agreed that this occurred. Figure 4.4.1.1 shows the breakdown of large and small companies and their responses to environmentally sustainable questions.

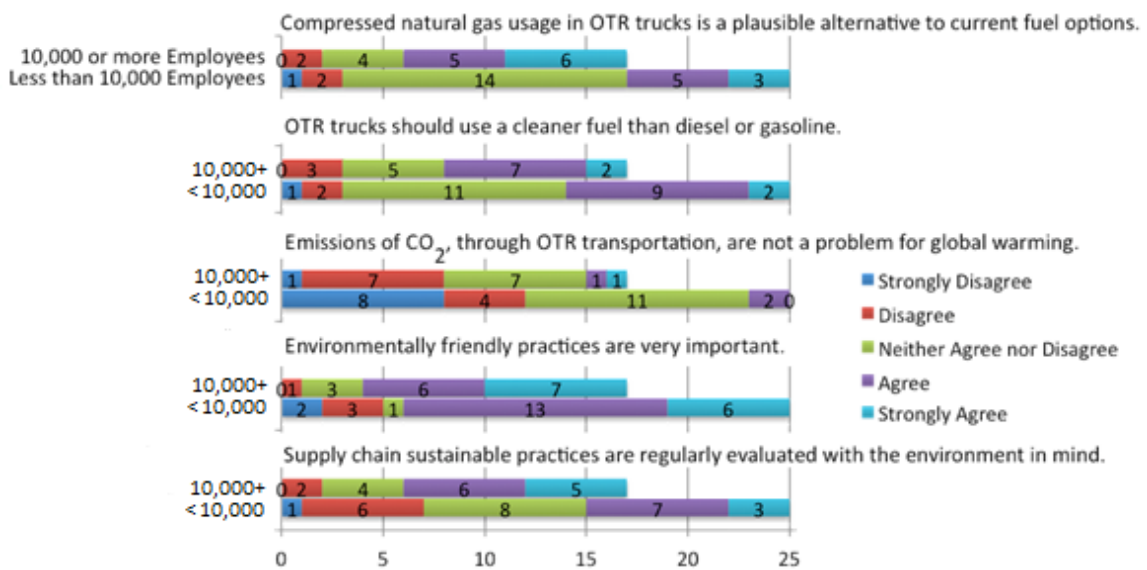


Figure 4.4.1.1 Environmentally Sustainable Questions & Responses by Company Size

The larger companies comparatively had more respondents who strongly agreed with the questions. This occurred because many of the larger companies had already started to implement cleaner fuel types in their OTR trucks. They have

the funding available to begin this transition whereas smaller companies do not. Therefore, they place more importance on the environmental impacts than smaller companies.

4.5 Societal

The last questions asked were categorized as a company's societal sustainability practices in logistics. The societal sustainability questions and responses can be seen in Figure 4.5.1 below.

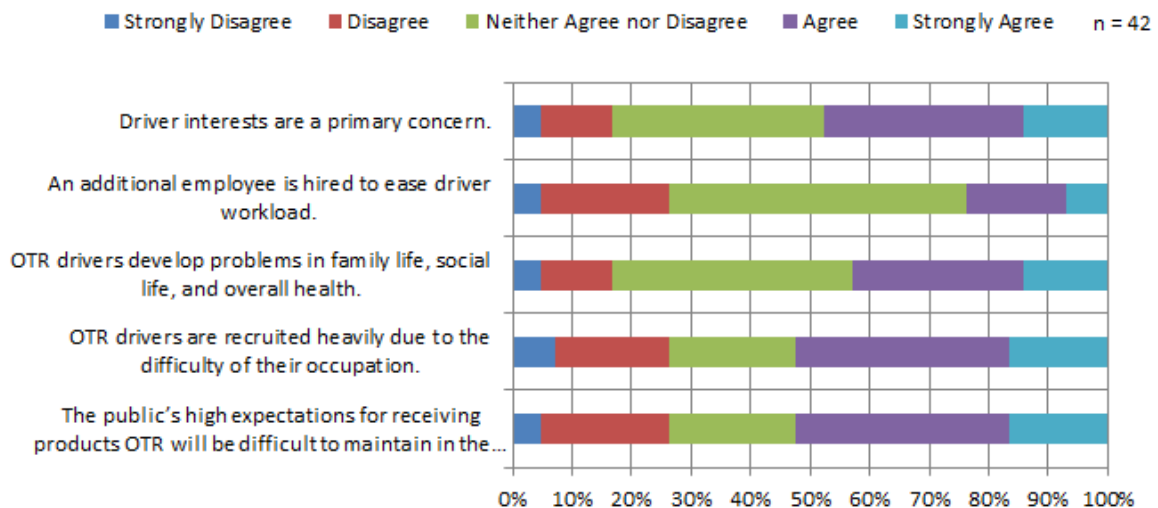


Figure 4.5.1 Societally Sustainable Questions & Responses

All of these questions have a much higher response rate in the “disagree” or “strongly disagree” category than in the economical and environmental sections. There was a high response occurrence in the neutral and agree categories. Roughly half of the respondents agreed that driver interests were a primary

concern for his or her company. The second question prompted a 50% neutral response rate. Many companies did not have a strong positive or negative feeling about hiring an extra employee to ease the drivers' workload. However, nearly 43% responded that they believed OTR drivers developed problems in family life, social life, and overall health. Also, over 50% believed that drivers were heavily recruited because of attrition due to difficulty associated with the OTR logistics driving occupation. Finally, approximately 52% predicted that the public's high expectations for promptly receiving products OTR would be difficult to maintain in the future due to the current shortages of truck driving professionals. Figure 4.5.1.1 shows the breakdown of how large and small companies responded to the societally sustainable questions.

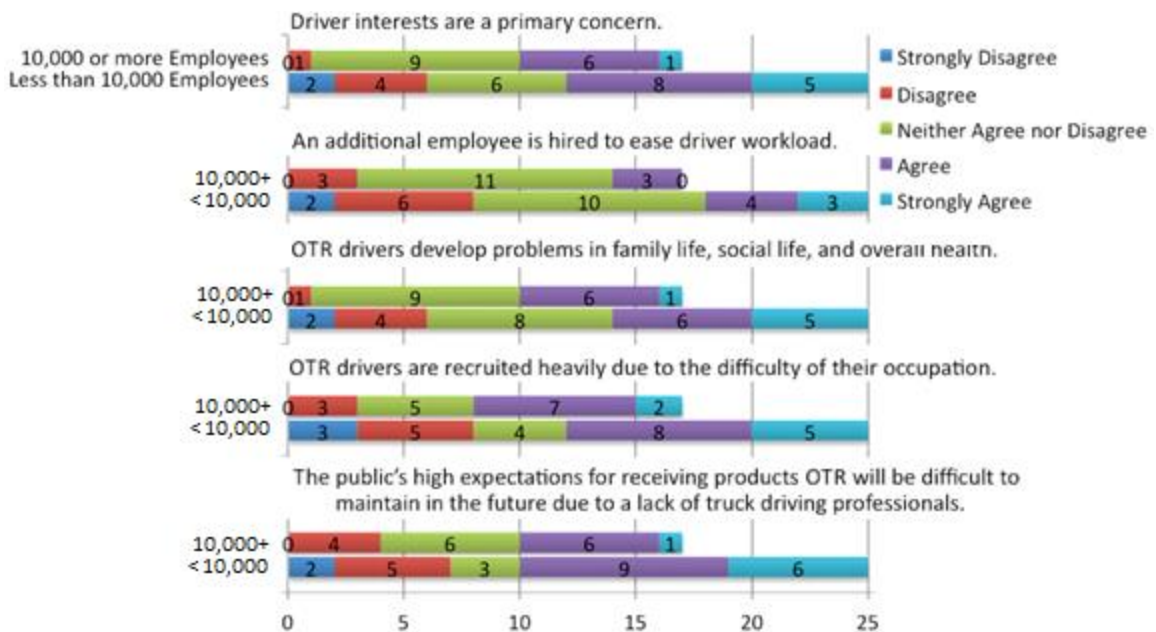


Figure 4.5.1.1 Societally Sustainable Questions & Responses by Company Size

When looking at the responses, the larger companies had a much greater percentage of people who neutrally answered the questions. They also had fewer respondents who strongly agreed or disagreed with the questions. These results appeared to show that smaller companies cared more than larger companies about the societal sustainability aspects of logistics.

4.6 Chapter Summary

In this chapter, the findings were presented and the significant data were highlighted through statistics, and then described. The reader was able to visualize the information through the use of charts and graphs. Pie charts were used to show the demographic results from the questionnaire. Horizontal diverging stacked bar charts were used to show the responses of the 18 survey questions incorporating a 5-point Likert scale. Grouped bar charts were also utilized to show response differences between respondents' from small and large companies.

CHAPTER 5. DISCUSSION AND CONCLUSIONS

This chapter discusses the statement of purpose then draws conclusions to the information provided through the survey's findings. These conclusions are intended to answer the study's research questions through the digestion of the samples' responses. This chapter also uses the findings and conclusions to provide recommendations and further research within the examined field.

5.1 Discussion

This section examines the findings from the survey and explains the collected data to generate discussion. The purpose was to answer two main questions: What is the awareness of sustainable OTR practices among logistics companies operating in Indiana? What are the prevailing attitudes and practices adopted by OTR logistics companies operating in Indiana with respect to sustainability?

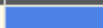





Responses from small and large companies are further analyzed in this section. The results were additionally split up by employee size because small and large companies normally have different amounts of resources and purchasing power. Larger companies also primarily operate internationally and are therefore, under more legal requirements and have to follow stricter

regulations. By separately small and large companies' responses, policy makers will be more capable of generating policies that better fit differently sized companies.

5.1.1: Respondents' Ages

Table 5.1.1 shows the respondents' ages in order from the most responses to the least.

Table 5.1.1 *Respondents' Ages*

| # | Ages | | Response(s) | % |
|---|-------------|---|-------------|------|
| 3 | 30-36 |  | 9 | 21% |
| 1 | 18-24 |  | 8 | 19% |
| 6 | 53-65 |  | 8 | 19% |
| 2 | 25-29 |  | 6 | 14% |
| 5 | 46-52 |  | 6 | 14% |
| 4 | 37-45 |  | 5 | 12% |
| 7 | 65 or older | | 0 | 0% |
| | Total | | 42 | 100% |

The chosen age group brackets were balanced with nearly the same amount of respondents from each group and with no participants over the age of 65. This was beneficial because it showed a wide variety of sustainability experience and knowledge amongst the sample. The largest age group bracket fell between 30-36 years. This evidence suggests that the majority of respondents had previous work experience, more knowledge, and probably held higher positions within a company.

5.1.2: Respondents' Education Levels

Table 5.1.2 displays the highest education levels achieved amongst the respondents.

Table 5.1.2 *Respondents' Education Levels*

| # | Education | Response(s) | % |
|---|-----------------------|-------------|------|
| 5 | Bachelor's Degree | 23 | 55% |
| 6 | Master's Degree | 13 | 31% |
| 2 | Completed High School | 5 | 12% |
| 3 | Some College | 1 | 2% |
| 7 | Doctor of Philosophy | 0 | 0% |
| 4 | Associate's Degree | 0 | 0% |
| 1 | Some High School | 0 | 0% |
| | Total | 42 | 100% |

Nearly all of the respondents had obtained college degrees of various types. Only six respondents did not receive a bachelor's or master's degree. Because such a large majority of the sample was filtered towards Purdue University alumni and managers of logistics companies, the education and age breakdown made intuitive sense. It also added credence and verification to the expectation that the survey was accurately interpreted and completed by qualified individuals.

5.1.3: Respondents' Company Names

There were 25 different company names listed on the survey out of 42 responses. One company was listed five times from different respondents. Another company was listed twice from separate respondents. Only 12

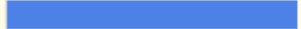

respondents did not provide any company name on his or her survey. There were a few respondents from the same company; it could be believed that some of the results were skewed due to repetitiveness. However, after looking at the responses from these same company names, this was not the case.

Interestingly, many answers varied greatly on the Likert scale between respondents identified from the same company. This phenomenon was very intriguing and it most likely occurred because this study captured the employees' knowledge and perceptions of their company. The study also found that most employees had a different knowledge base and perspective of the sustainable logistics practices within his or her company. Many employees had differing roles and positions within his or her company. These differences, along with age and experience, greatly affected the way people responded to the survey.

5.1.4: Respondents' Company Ownership Types

Table 5.1.4 depicts the respondents' company ownership types among the sample.

Table 5.1.4 *Respondents' Company Ownership Types*

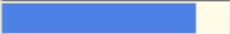




| # | Companies | | Response(s) | % |
|---|-----------------|---|-------------|------|
| 1 | Publicly Owned |  | 27 | 64% |
| 2 | Privately Owned |  | 15 | 36% |
| | Total | | 42 | 100% |

Out of 42 respondents, 27 came from companies that were publicly owned. This statistic directly coincides with the fact that most publicly owned companies contain larger amounts of employees. The majority of the sample consisted of companies with 10,000 or more employees.

5.1.5: Respondents' Company Employee Sizes

Table 5.1.5 shows the breakdown of the number of employees within the companies who responded.

Table 5.1.5 Respondents' Company Employee Sizes

| # | Company Employees | | Response(s) | % |
|---|-------------------|---|-------------|------|
| 5 | 10,000 or more |  | 17 | 40% |
| 1 | 1-500 |  | 12 | 29% |
| 3 | 1,501-5,000 |  | 8 | 19% |
| 2 | 501-1,500 |  | 4 | 10% |
| 4 | 5,001-9,999 |  | 1 | 2% |
| | Total | | 42 | 100% |

Most of the responses came from the largest employee bracket. The second most came from the smallest employee bracket. This great dispersion in company size and overall responses allowed for better results. Both ends of the company employee spectrum were represented. Roughly 71% of the sample came from companies consisting of 501 or more employees. For this reason, many of these companies operated on very large scales either nationally or internationally.

5.1.6: Respondents' Company Geographical Area of Operations

Table 5.1.6 shows an intriguing breakdown of the companies' operational area.

Table 5.1.6 *Respondents' Company Geographical Area of Operations*

| # | Company Geographical Area of Operations | Response(s) | % |
|---|---|-------------|------|
| 4 | Internationally | 30 | 71% |
| 3 | Nationally | 9 | 21% |
| 2 | Regionally | 2 | 5% |
| 1 | Statewide | 1 | 2% |
| | Total | 42 | 100% |

Nearly all of the respondents worked at a company operating internationally or nationally. A total of only three responses were regional or statewide. This statistic is related to the amount of employees in the sample's companies as well as their ownership type. Companies with many employees tend to be publicly owned and generally operate on a large geographical area.

5.1.7: Respondents' Sustainability Attitude/Awareness

The bold numbers on the horizontal diverging stacked bar charts below represent the amount of responses from that color category out of 42. Figure 5.1.7 shows the current attitude or awareness level of sustainable practices among the sample.

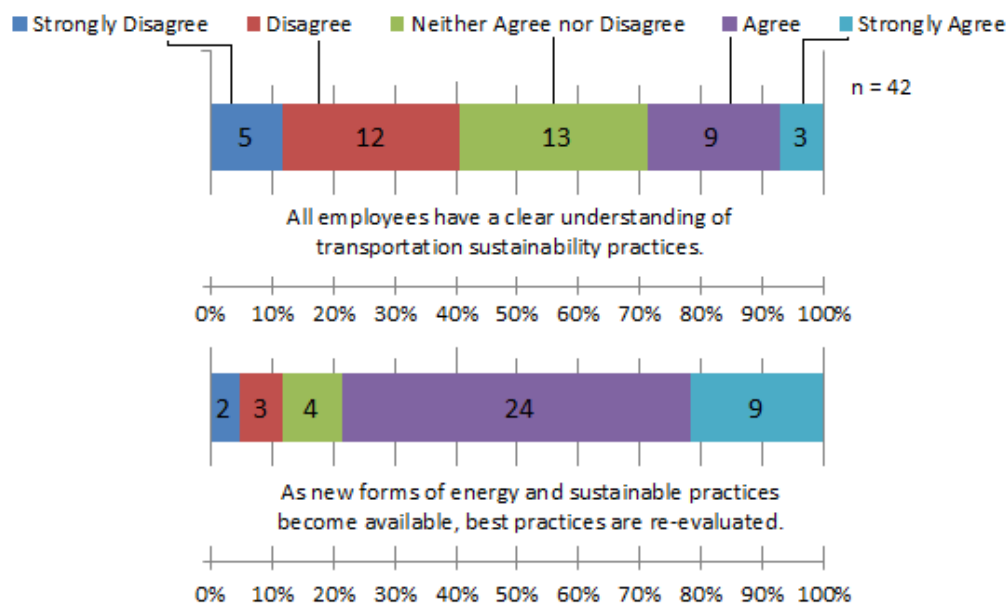


Figure 5.1.7 Respondents' Sustainability Attitude/Awareness

There was a good mixture of responses from the first question testing whether all employees clearly understood transportation sustainability practices at their company. This was a positive indicator for the accuracy of the results within the entire survey due to the variation of understanding among the sample. The second question had 24 respondents who agreed that as new forms of energy and sustainable practices became available, best practices were re-evaluated. Approximately 83% of these respondents came from companies operating internationally.

Referring back to 4.2.1.1, the respondents' attitude or awareness results greatly differed when they were separated by small and large companies. While the second question about new sustainable practices and company re-evaluation displayed 88% of large company employees who "agreed or strongly agreed,"

the first question was much less positive. Only four people out of 17 gave a response of “agree” or “strongly agree,” resulting in a very low percentage of large company employees with a clear understanding of transportation sustainability practices. It is concerning to consider the vast numbers of employees this information entails, when taking into account they are coming from companies containing 10,000 or more workers. Eight additional respondents agreed or strongly agreed with the first question when companies, employing less than 10,000 employees, were included. Sadly, both groups reflected less than half who had an understanding of their companies’ sustainable transportation policies. Awareness is the first step toward future changes in policies and practices. Without an employee knowing or understanding his or her company’s present transportation policies, it is unlikely he or she should be compared to best practice expectations. Improving upon those practices would be highly unlikely in the future and there would be minimal efforts towards the improvement of results.

Professional development programs, designed to educate administration and managers about future transportation sustainability problems and current company lapses, is crucial. Based upon the data gathered, all transportation personnel should be encouraged to attend training sessions. They should also become informed of best practices within their departments and have a clear picture of what areas their company intends to improve upon in the future.

On-going development programs within companies to encourage participation and “buy in” must be initiated. Employees should be informed of

selected target initiatives in order to guarantee that transportation, from their company, prioritizes sustainable efficiency. They must also feel that everyone has an important role to fulfill in order to achieve the target initiatives and to ensure a brighter sustainable future.

5.1.8: Respondents' Economically Sustainable Practices

Figure 5.1.8 displays the sample's economically sustainable practices within their company.

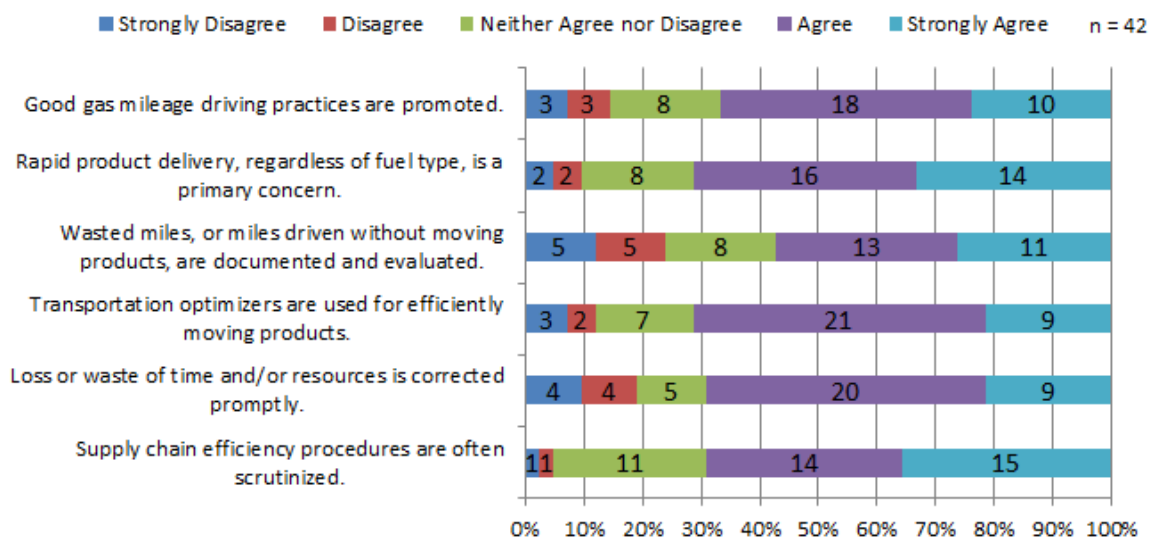


Figure 5.1.8 Respondents' Economically Sustainable Practices

An overall pattern existed between all of these responses. Approximately each response aligned vertically between questions. All of these questions had a majority of responses that either agreed or strongly agreed. This can be interpreted as: Of the population who were surveyed, economical sustainability

factors were very important to their companies. Nearly 70% of the respondents believed that their company promoted good gas mileage driving practices. Most of the companies, who strongly disagreed with this question, had a response showing that his or her company agreed that rapid product delivery was a primary concern regardless of fuel type. Overall, 30 respondents felt this way. Just five out of the 42 respondents claimed that their company did not use any kind of transportation optimizer for efficiently moving products. This leads one to believe that, within this sample, very few wasted miles were driven when transporting multiple loads by truck and trailer. For the companies that had wasted miles, 10 respondents claimed that their companies did not document and evaluate them. Also, eight respondents' companies did not promptly correct loss of time or when a waste of resources occurred. The last question had the greatest amount of respondents who chose a neutral answer. Eleven of the respondents had no idea whether supply chain efficiency procedures were frequently scrutinized at his or her company. All logistics employees should be made aware of this information in order for sustainable supply chain procedures to effectively work.

When looking back at the economically sustainable practices in Figure 4.3.1.1, responses from large companies had percentages almost identical to the combined survey responses in the first four questions. It is clear that good gas mileage, rapid delivery, wasted miles, and traffic optimizers for efficiency held great importance regardless of the company size. These factors were considered very important to maintaining customers. The final two survey

questions had more prominence for companies of 10,000 or more employees. These questions referred to loss of time and resources needing to be corrected promptly and efficiency procedures being scrutinized often. Large companies had 14 out of 17 respondents who agreed or strongly agreed with both factors. Larger companies generally had more manpower available to address these two areas. Also, the sheer volume of transportation in large companies would require these logistics areas to have constant vigilance. Policies should be generated to encourage and assist smaller companies in regularly scrutinizing and adapting their own supply chain procedures to become more efficient and sustainable.

5.1.9: Respondents' Environmentally Sustainable Practices

The sample's environmentally sustainable practices within their company can be seen in Figure 5.1.9.

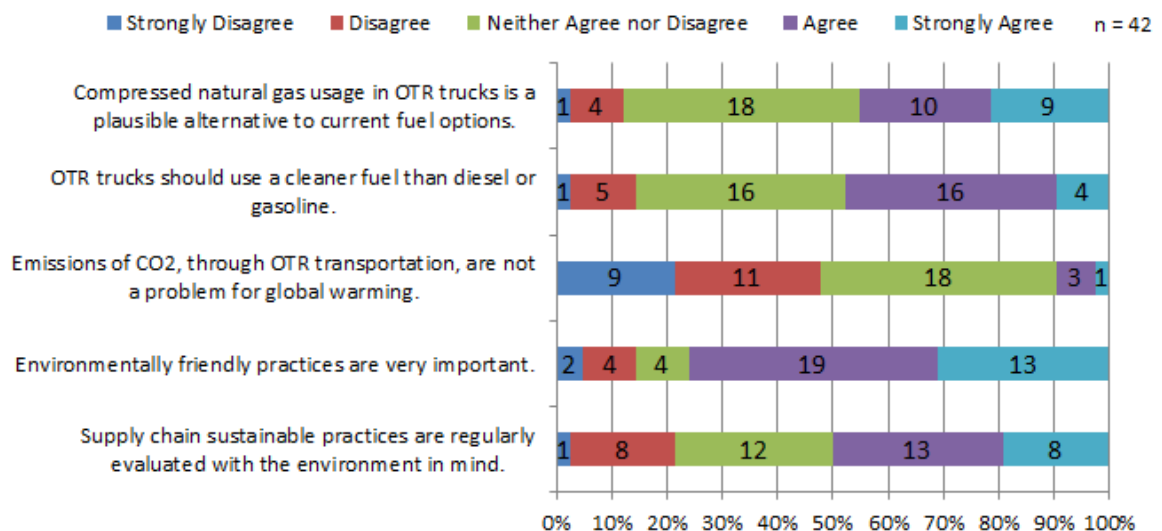


Figure 5.1.9 Respondents' Environmentally Sustainable Practices

This section contains many responses of “neither agree nor disagree.” One could infer that this reaction occurred because these questions were unclear, unknown, or unimportant to a company’s goals or objectives. Twenty of the respondents believed that OTR trucks should use a cleaner fuel type and 19 respondents thought that natural gas was a plausible alternative to current fuel options. Nearly half of them felt that CO₂ emissions were a major problem for global warming. Exactly 60% of these companies had international operations. This showed that companies with global operations tended to believe CO₂ emissions needed to change in order to decrease global warming. Environmentally friendly practices were very important to 32 of the respondents’ companies but only 38% of them believed their employees had a clear understanding of transportation sustainability practices. All employees should be informed about sustainable practices within their companies since so many companies felt environmentally friendly practices were important to logistics. The last question showed that only half of the sample’s companies evaluated supply chain practices with the environment in mind. When comparing to the economical survey section, it appeared that companies cared more about rapid product delivery than fuel type and how it affected the environment.

Referring back to the environmentally sustainable practices in Figure 4.4.1.1, a significant variance was identified between small and large companies on the first question asking if compressed natural gas was a plausible alternative fuel option for OTR trucks. On the combined survey, there were 19 out of 42 who agreed or strongly agreed with this question. However, 11 out of 17 came

from larger companies. This occurred because many of the larger companies have already started transitioning OTR trucks to alternative fuels. Smaller companies need more assistance and incentives to start switching to cleaner fuels.

Another large variance between the two groups reflected a 25% difference in the results from the last survey question about regularly evaluating supply chain practices with the environment in mind. Once again, the companies with the most employees rated higher than the joined survey population. Eleven out of 17 agreed or strongly agreed compared to only 10 out of 25 from smaller companies. Based upon these responses, large companies of 10,000 employees or more have a higher commitment to evaluating sustainable practices with the environment in mind. Attainable environmental regulations should be generated to ensure all companies are doing everything possible to maintain harmless environmental practices.

5.1.10: Respondents' Societally Sustainable Practices

The sample's societally sustainable practices within their company can be seen below in Figure 5.1.10.

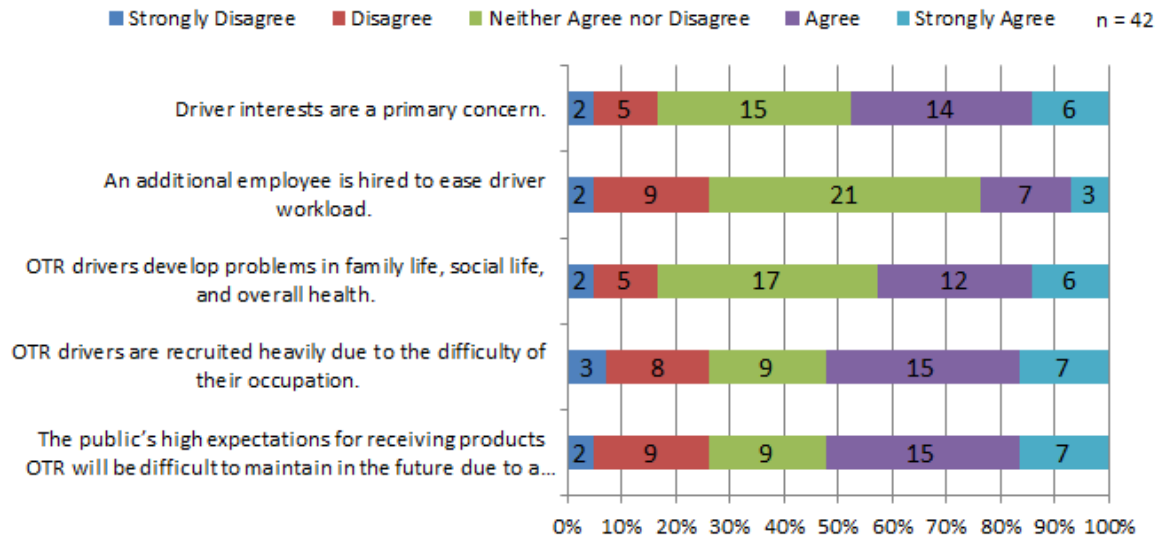


Figure 5.1.10 Respondents' Societally Sustainable Practices

These responses had higher percentages disagreeing with the societally sustainable practices than in the previous two sections. Essentially, this showed that companies did not focus as much on the social impact but rather the economical and environmental impacts. Twenty out of 42 responded that driver interests were a primary concern for his or her company. Specifically, 70% of these companies performed logistics operations internationally. Half of the respondents neither agreed nor disagreed that their company should hire an extra employee to ease a driver's workload. This is interesting because 48% believed driver interests were a primary concern and 43% believed that OTR drivers developed various problems in their family life, social life, and overall health. Despite thinking this way, they were reluctant to consider hiring an extra employee to reduce these problems. The last two questions each had 22 respondents supportive of the idea that OTR drivers were recruited heavily due

to their difficult occupation and that the public's high expectations for receiving products would be hard to maintain in the future due to the lack of OTR truck driving professionals. Better incentives are needed in order to fill the future demands of this difficult occupation.

When looking back at the societally sustainable responses from Figure 4.5.1.1, there are significant results in questions two and five. When asked if an additional employee should be hired to ease a driver's workload, the largest companies had nearly 65% who neither agreed nor disagreed. This was much higher than the percentage within the smaller companies. Companies with lower amounts of employees also had a higher percentage of respondents who agreed or strongly agreed with this question. It could be assumed that smaller companies do a better job easing the workload for their drivers. Larger companies also only had about 40% who agreed or strongly agreed that the lack of truck drivers would create future problems for receiving products OTR. Smaller companies comparatively had 60%. All companies, small or large, need to do a better job addressing societal issues associated with logistics before they get worse.

5.2 Conclusions

The information provided in this study can be used to draw one's own conclusions about the current situation of logistics operations throughout Indiana. It may also stimulate further research within sustainable OTR logistics. The primary intention of this study was to provide motivating data in a field of very

little previous knowledge supported by documentation. These findings may urge subsequent research in the future by forming test hypotheses delving into the correlation between OTR sustainable logistics and reducing carbon footprints worldwide.

The future goal of this research study was to promote ideas for exploration and consideration in order to achieve sustainability while moving products all around the world. This would essentially reduce carbon footprints and their negative effects globally. Economical, environmental, and societal sustainability within OTR logistics is greatly lacking understanding. This oversight needs to be changed in the near future before our global population rapidly rises, and product demands increase the need for OTR logistics.

The total amount of respondents who disagreed that their companies used sustainable practices was 13.9% in the economical section, 14.3% in the environmental section, and 22.4% in the societal section. The total amount of respondents who agreed their companies used sustainable practices was 67.5% in the economical section, 53.3% in the environmental section, and 43.8% in the societal section. Lastly, the total amount of respondents who did not agree nor disagree that their companies used sustainable practices was 18.7% in the economical section, 32.4% in the environmental section, and 33.8% in the societal section. These results suggest that companies incorporate supply chain practices thinking first about the importance of economical impacts and to a lesser extent the environmental effects. Also, societally sustainable aspects of logistics are the least important aspect to the companies captured in this survey.

A pattern that can be drawn from these results shows: Larger companies, which contain more employees and that operate to farther distances, generally have better awareness and practices with regards to economic, environmental, and social sustainability. However, employee awareness appeared to differ within the same company and drastically between companies. For true sustainable practice buy-in, all employees must be made aware of sustainable logistics practices. The proper implementation and progression of sustainability practices within companies is essential to global interests. In order for this to happen, sustainable practices need to be a part of companies' mission statements and goals.

Two companies, that did not promote good gas mileage driving practices, stated they did believe rapid product delivery was a primary concern for their company. This occurrence implies that their companies may experience a tradeoff between customer service, associated with rapid product delivery, and operating in a sustainable manner. In logistics, product delivery is very dependent on speed and punctuality. Unfortunately, companies may not have the ability to financially balance the pressures of operating sustainably. To remain profitable, for some companies, one factor has to give into another or else the risk of going out of business becomes a reality.

Approximately 76% of the companies, which responded to this study, believed environmentally friendly practices were very important. Therefore, at least three fourths of the logistical respondents should ensure that their employees become aware of current sustainable logistics practices and how to

correctly implement them. More companies must also regularly evaluate their sustainable practices. It is imperative they find ways to improve practices with the environment in mind. Nearly half of the survey respondents believed OTR trucks should use a cleaner fuel type than diesel or gasoline. Results supported concern that CO₂ emissions are a serious problem for global warming.

Companies need to create a plan to phase-in trucks that use fuel associated with cleaner emissions. With worldwide compliance, this would significantly help climate changes and global warming.

Many questionnaire respondents believed that drivers developed problems with his or her family life, social life, and overall health. However, the survey results reflected that nearly half of the respondents believed driver interests were a primary concern. Exactly 70% of these respondents had international logistics operations. Questionnaire responses from the smaller, more national, companies were more likely to answer that they did not feel that driver interests and health were a primary concern to their company. Also, most companies did not feel that an extra employee should be hired in order to ease the driver workload. Unfortunately, studies predict heightened demand in the future. If driver workloads are not reduced to safe levels, the health and safety of all drivers are in jeopardy. When sitting behind the steering wheels of massive 18-wheel rigs, exhausted drivers could become detrimental to society. Reverting back to Figure 2.1.6, large truck-related fatalities occur all over the United States with Indiana as one of the most dangerous states. If drivers are not mentally prepared, more large truck-related accidents and fatalities could occur as a result

of the demand increase in OTR logistics. With the increase in demand coming soon, more trucks will be on the road and more miles will be driven. It is imperative that drivers stay well rested and capable of driving safely.

5.3 Recommendations

In order to achieve a “greener” planet through the reduction of carbon emissions, countries and companies need to work together to adopt sustainable practices. Educating OTR logistics businesses about the serious effects of operating unsustainably is imperative. Then, providing logistics management with current sustainability information, needed to implement efficient practices and to educate their employees, is a task the government should complete. OTR logistics is just one part of the many contributing factors to harmful emissions, but it needs to be analyzed and addressed in order to initiate change and optimization. Best practices for reducing the carbon footprint are needed in order to give sustainable logistics, throughout Indiana as well as the United States, a push in the positive “green” direction.

The discussion section separated responses of companies with 10,000 or more people from the rest of the sample. The primary reason, for segregating this group, was to provide policy makers with information about the attitudes, awareness, and practices of companies with differing amounts of resources. Larger companies normally have more money and resources to implement transportation optimizers, cleaner fuel, or aerodynamic trailers. By looking at the types of companies and their sustainable knowledge or practices, policy makers

can more accurately create laws that fit the types of companies they are trying to address. They can also create policies that do a better job protecting the health of truck drivers. These regulations need to ensure that all companies implement sustainable practices before OTR logistics demands increase. When referring back to Figure 2.1.1, this demand increase in Indiana is expected to nearly double by 2035. If these practices are not in place as soon as possible, the harmful effects may not be irreversible by 2035.

In the United States, a massive shortage of truck drivers currently exists. The demand for this mode of product transportation greatly outweighs the supply of drivers. Incentive plans, that ensure driver safety and health, need to be put into place in order to increase the attraction of professional truck driving careers. Professional long haul driving careers must find a way to combine earning a lucrative salary with the ability for drivers to maintain both a family and social life. Perhaps looking at studies of other occupations requiring similar time away from home might offer insight. Occupations such as airline pilots, firefighters, and doctors who must balance time away from home with their careers could provide plausible ideas.

Economically speaking, the costs associated with moving products over-the-road could greatly be reduced if all companies started using transportation optimizers and alternative fuel types. Roads and interstates will continue to become more and more congested due to the amount of trucks on the road. This is significant because future large truck-related fatalities threaten to increase subsequently. Highway planners need to consider methods that will alleviate

congestion for large trucks and small cars alike. Trapped in the center of the “Crossroads of America,” Indiana may become a driver’s worst nightmare by 2035. Adversely, without an infrastructure to accommodate the highway congestion of the future, society’s overall mentality and disposition towards truck drivers may worsen. A more adequate and efficient transportation infrastructure is needed in order to combat this problem. Government funding and initiatives are the best way to ensure this transportation infrastructure is immediately implemented. With the knowledge and data provided from this research study, Indiana must begin building for tomorrow right now.

5.4 Future Research

Future research may be motivated in numerous directions guided by the information provided in this research study. Primarily, a follow-up descriptive study could take place on a national scale. Results would help civil planners get a better idea of the current problems and concerns for OTR logistics companies with relation to sustainability. More extensive and comprehensive surveys could be used in order to get vast numbers of detailed results from companies’ sustainable practices economically, environmentally, and societally.

After a thorough understanding has been reached, the prevailing attitudes, awareness, and practices of logistics companies should emerge. Hypotheses can be created, and specific methods for motivating companies to incorporate extensive sustainable procedures can be determined. Ultimately, once the present lack of sustainable procedures have been identified and corrected,

positive intervention and change for the future can take place. When companies discover methods to operate sustainably and effectively, the negative economical, environmental, and societal impacts will be reduced. This is the critical, eventual goal behind performing this initial descriptive study in an area lacking prior complete knowledge.

5.5 Chapter Summary

This chapter added discussion and conclusions about the results from the research study. Recommendations, for handling many sustainable logistics problems, were presented later in this chapter. Companies must focus on implementing more sustainable OTR logistics practices. Plans and methods, to assist in implementation by creating or changing policies, were suggested. Future research possibilities were presented with the hope of stimulating further exploration into sustainable logistics. People and companies need to plan for the future because that is where they will spend the rest of their lives. Without a plan that makes sustainable logistics a reality in the near future, a grim world will soon begin to form.

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APPENDICES

Appendix A - Survey Email

Subject: IMPORTANT: Graduate Student Research Survey

Good Day,

My name is Rob Crull and I am a Master's Degree student at Purdue University performing a study on sustainability practices and attitude/awareness level in industry. I am in need of your assistance to participate in the very short survey I have created which should take you no more than 5 minutes to complete. The intent of this survey is to better understand the use of sustainability practices in logistics. When the results are being collected, any identifying information will be removed. There will be no way to trace responses back to a specific person. I ask that you provide the name of your company for research purposes only. No company names will be published. Thank you in advance for your participation and assisting me in completing my research and graduate degree.

You may access the survey by clicking on the link below:

ENTER LINK HERE

Best Regards,

Robert Crull

M.S. Candidate Purdue University & Universitat Politècnica de Catalunya

RCrull@Purdue.edu

Appendix B - Survey



Examining Sustainability Practices Among Over-The-Road Logistics Companies

The information you provide in this survey will be kept anonymous to maintain your privacy. Please answer all questions to the best of your knowledge and provide the company for which you work. The name of your company will not be published; it will be used to better understand the results of the survey.

Definitions to clearly understand before starting the survey:

Global Warming-Climatic changes causing the earth's atmosphere to gradually increase in temperature.

Logistics-The part of the supply chain process which plans and implements the flow and storage of goods efficiently.

Over-The-Road (OTR)-Carriers or trucks that travel via highways or roads moving freight or products.

Sustainability-Ability to meet the needs of the present without compromising the capability of future generations to meet their own needs.

Which of the following represents your age group (years old)?

- 18-24
- 25-29
- 30-36
- 37-45
- 46-52
- 53-65
- 65 or older

What is your highest level of education?

- Some high school
- Completed high school
- Some College
- Associate's Degree
- Bachelor's Degree
- Master's Degree
- Doctor of Philosophy
- N/A

What is the name of your company? This information will remain unpublished. **(OPTIONAL)**

Is the company where you are currently employed publicly or privately owned?

- Publicly owned
- Privately owned

How many employees does your company have?

- 1-500
- 501-1,500
- 1,501-5,000
- 5,001-9,999
- 10,000 or more

In which of the following does your company operate?

- Statewide
- Regionally
- Nationally
- Internationally

Responses refer to **YOUR** present company's practices:

| | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| As new forms of energy and sustainable practices become available, best practices are re-evaluated. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Supply chain efficiency procedures are often scrutinized. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Supply chain sustainable practices are regularly evaluated with the environment in mind. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Environmentally friendly practices are very important. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Loss or waste of time and/or resources is corrected promptly. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| All employees have a clear understanding of transportation sustainability practices. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Transportation optimizers are used for efficiently moving products. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Wasted miles, or miles driven without moving products, are documented and evaluated. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Emissions of CO2, through OTR transportation, are not a problem for global warming. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| OTR trucks should use a cleaner fuel than diesel or gasoline. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Rapid product delivery, regardless of fuel type, is a primary concern. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Compressed natural gas usage in OTR trucks is a plausible alternative to current fuel options. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Good gas mileage driving practices are promoted. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The public's high expectations for receiving products OTR will be difficult to maintain in the future due to a lack of truck driving professionals. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| OTR drivers are recruited heavily due to the difficulty of their occupation. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| OTR drivers develop problems in family life, social life, and overall health. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| An additional employee is hired to ease driver workload. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Driver interests are a primary concern. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

I sincerely thank you for taking the time to take part in this survey. Please make sure you have answered all questions before submitting the document.

Appendix C - IRB Consent Form



HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To: EDIE SCHMIDT
YONG

From: JEANNIE DICLEMENTI, Chair
Social Science IRB

Date: 11/22/2013

Committee Action: Exemption Granted

IRB Action Date: 11/22/2013

IRB Protocol #: 1311014195

Study Title: Examining Sustainability Practices Among Over-The-Road Logistics Companies Operating in Indiana

The Institutional Review Board (IRB) has reviewed the above-referenced study application and has determined that it meets the criteria for exemption under 45 CFR 46.101(b)(2) .

If you wish to make changes to this study, please refer to our guidance "**Minor Changes Not Requiring Review**" located on our website at <http://www.irb.purdue.edu/policies.php>. For changes requiring IRB review, please submit an **Amendment to Approved Study** form or **Personnel Amendment to Study** form, whichever is applicable, located on the forms page of our website www.irb.purdue.edu/forms.php. Please contact our office if you have any questions.

Below is a list of best practices that we request you use when conducting your research. The list contains both general items as well as those specific to the different exemption categories.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the student's attendance and enrollment decision will not be shared with those administering the course.
- If students earn extra credit towards their course grade through participation in a research project conducted by someone other than the course instructor(s), such as in the example above, the students participation should only be shared with the course instructor(s) at the end of the semester. Additionally, instructors who allow extra credit to be earned through participation in research must also provide an opportunity for students to earn comparable extra credit through a non-research activity requiring an amount of time and effort comparable to the research option.
- When conducting human subjects research at a non-Purdue college/university, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not

submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Category 1

- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Categories 2 and 3

- Surveys and questionnaires should indicate
 - only participants 18 years of age and over are eligible to participate in the research; and
 - that participation is voluntary; and
 - that any questions may be skipped; and
 - include the investigator's name and contact information.
- Investigators should explain to participants the amount of time required to participate. Additionally, they should explain to participants how confidentiality will be maintained or if it will not be maintained.
- When conducting focus group research, investigators cannot guarantee that all participants in the focus group will maintain the confidentiality of other group participants. The investigator should make participants aware of this potential for breach of confidentiality.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Category 6

- Surveys and data collection instruments should note that participation is voluntary.
- Surveys and data collection instruments should note that participants may skip any questions.
- When taste testing foods which are highly allergenic (e.g., peanuts, milk, etc.) investigators should disclose the possibility of a reaction to potential subjects.

Appendix D - Survey Results

| Demographic 1 | Demographic 2 | Demographic 4 | Demographic 5 | Demographic 6 | Question 1 | Question 2 | Question 3 | Question 4 | Question 5 | Question 6 | Question 7 | Question 8 |
|---|--|--|--|--|---|---|--|--|---|---|---|--|
| Which of the following represents your age group (years old)? | What is your highest level of education? | Is the company currently employed publicly or privately owned? | How many employees does your company have? | In which of the following does your company operate? | As new forms of energy and sustainable practices become available, best practices are re-evaluated. | Supply chain efficiency procedures are often scrutinized. | Supply chain practices are regularly evaluated with the environment in mind. | Environment friendly practices are very important. | Loss or waste of time and/or resources is corrected promptly. | All employees have a clear understanding of sustainability practices. | Transportation optimizers are used for efficiently moving products. | Wasted miles, or miles driven without moving products, are documented and evaluated. |
| 53-65 | M.S. | Privately Owned | 1-500 | Nationally | 5 | 3 | 2 | 4 | 2 | 2 | 4 | 3 |
| 30-36 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 3 | 5 | 1 | 5 | 1 |
| 46-52 | M.S. | Publicly Owned | 1,501-5,000 | Internationally | 4 | 3 | 4 | 4 | 2 | 2 | 3 | 4 |
| 53-65 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 3 | 3 | 5 | 3 | 4 | 4 |
| 53-65 | B.A. | Publicly Owned | 10,000 or more | Internationally | 3 | 4 | 4 | 5 | 4 | 2 | 4 | 4 |
| 46-52 | M.S. | Publicly Owned | 501-1,500 | Internationally | 2 | 1 | 2 | 2 | 2 | 2 | 4 | 2 |
| 53-65 | M.S. | Publicly Owned | 1,501-5,000 | Internationally | 4 | 4 | 4 | 5 | 4 | 3 | 4 | 4 |
| 46-52 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| 25-29 | B.A. | Publicly Owned | 10,000 or more | Internationally | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 2 |
| 37-45 | B.A. | Publicly Owned | 10,000 or more | Internationally | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| 25-29 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 25-29 | B.A. | Publicly Owned | 1,501-5,000 | Internationally | 4 | 5 | 4 | 4 | 4 | 2 | 4 | 5 |
| 30-36 | B.A. | Publicly Owned | 1,501-5,000 | Internationally | 5 | 3 | 5 | 5 | 4 | 4 | 5 | 5 |
| 30-36 | B.A. | Publicly Owned | 1,501-5,000 | Internationally | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 5 |
| 30-36 | B.A. | Privately Owned | 1-500 | Internationally | 4 | 5 | 3 | 4 | 5 | 2 | 5 | 5 |
| 25-29 | B.A. | Privately Owned | 1-500 | Nationally | 3 | 4 | 2 | 2 | 3 | 2 | 3 | 2 |
| 18-24 | B.A. | Privately Owned | 1-500 | Internationally | 2 | 3 | 2 | 4 | 4 | 4 | 4 | 1 |
| 25-29 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 4 | 5 | 3 | 1 | 3 | 3 |
| 18-24 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 |
| 37-45 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 5 |
| 53-65 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 4 | 4 | 2 | 3 | 5 |
| 46-52 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 |
| 30-36 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| 37-45 | M.S. | Publicly Owned | 1-500 | Regionally | 5 | 3 | 2 | 4 | 4 | 2 | 4 | 4 |
| 37-45 | M.S. | Publicly Owned | 5,001-9,999 | Regionally | 5 | 5 | 3 | 3 | 4 | 3 | 4 | 5 |
| 30-36 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 3 | 4 | 4 | 4 | 2 | 3 | 4 |
| 53-65 | Some College | Publicly Owned | 1-500 | Regionally | 4 | 3 | 4 | 4 | 3 | 3 | 2 | 3 |
| 46-52 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 |
| 30-36 | B.A. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| 37-45 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 5 |
| 53-65 | Completed H.S. | Privately Owned | 1-500 | Nationally | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 5 |
| 46-52 | Completed H.S. | Privately Owned | 1-500 | Statewide | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| 53-65 | Completed H.S. | Privately Owned | 1-500 | Nationally | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 |
| 18-24 | B.A. | Publicly Owned | 1,501-5,000 | Internationally | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 |
| 46-52 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 4 | 5 | 4 | 3 | 5 | 5 |
| 30-36 | Completed H.S. | Publicly Owned | 1-500 | Nationally | 5 | 3 | 5 | 5 | 4 | 5 | 5 | 5 |
| 37-45 | B.A. | Privately Owned | 10,000 or more | Nationally | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 3 |
| 18-24 | B.A. | Privately Owned | 1-500 | Internationally | 4 | 5 | 3 | 4 | 4 | 3 | 4 | 5 |
| 25-29 | B.A. | Privately Owned | 501-1,500 | Internationally | 4 | 3 | 2 | 4 | 4 | 3 | 4 | 4 |
| 18-24 | B.A. | Privately Owned | 1,501-5,000 | Nationally | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 1 |
| 18-24 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 5 | 4 | 4 | 4 | 3 | 3 | 3 |
| 18-24 | B.A. | Publicly Owned | 501-1,500 | Internationally | 4 | 4 | 2 | 4 | 3 | 2 | 3 | 2 |
| 37-45 | M.S. | Publicly Owned | 10,000 or more | Internationally | 4 | 4 | 4 | 4 | 5 | 3 | 3 | 4 |
| 53-65 | Completed H.S. | Privately Owned | 1,501-5,000 | Internationally | 3 | 4 | 4 | 5 | 1 | 2 | 1 | 1 |
| 30-36 | B.A. | Publicly Owned | 1-500 | Nationally | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 |
| 18-24 | B.A. | Publicly Owned | 501-1,500 | Internationally | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 |
| 30-36 | B.A. | Publicly Owned | 10,000 or more | Internationally | 5 | 5 | 4 | 5 | 4 | 2 | 4 | 5 |

| Question 9 | Question 10 | Question 11 | Question 12 | Question 13 | Question 14 | Question 15 | Question 16 | Question 17 | Question 18 |
|---|---|--|--|--|---|--|---|--|---|
| Emissions of CO ₂ , through OTR, transportation, are not a problem for global warming. | OTR trucks should use cleaner fuel than diesel or gasoline. | Rapid product delivery, regardless of fuel type, is a primary concern. | Compressed natural gas usage in OTR trucks is a plausible alternative to current fuel options. | Good gas mileage driving practices are promoted. | The public's high expectations for receiving products OTR will be difficult to maintain in the future due to a lack of truck driving professionals. | OTR drivers are recruited heavily due to the difficulty of their occupation. | OTR drivers develop problems in family life, social life, and overall health. | An additional employee is hired to ease driver workload. | Driver interests are a primary concern. |
| 2 | 4 | 3 | 3 | 2 | 4 | 4 | 4 | 3 | 3 |
| 2 | 3 | 5 | 2 | 1 | 4 | 4 | 3 | 3 | 3 |
| 3 | 4 | 4 | 3 | 4 | 2 | 2 | 3 | 2 | 4 |
| 2 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 |
| 2 | 4 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 2 |
| 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 |
| 3 | 3 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 3 |
| 3 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| 1 | 4 | 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 |
| 2 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 4 | 4 | 5 | 3 | 3 | 5 |
| 3 | 4 | 5 | 4 | 5 | 4 | 5 | 4 | 3 | 4 |
| 3 | 3 | 4 | 3 | 5 | 5 | 4 | 5 | 3 | 5 |
| 1 | 4 | 5 | 3 | 5 | 5 | 4 | 5 | 4 | 4 |
| 1 | 2 | 5 | 2 | 4 | 3 | 4 | 3 | 3 | 2 |
| 1 | 4 | 1 | 3 | 2 | 2 | 4 | 4 | 2 | 2 |
| 3 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 4 |
| 3 | 2 | 3 | 5 | 3 | 5 | 2 | 2 | 3 | 5 |
| 3 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 |
| 2 | 5 | 3 | 5 | 4 | 4 | 4 | 4 | 3 | 4 |
| 3 | 3 | 4 | 3 | 4 | 4 | 2 | 3 | 3 | 4 |
| 1 | 1 | 5 | 2 | 4 | 4 | 4 | 4 | 3 | 4 |
| 3 | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 3 | 3 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 |
| 1 | 3 | 4 | 3 | 4 | 1 | 1 | 5 | 1 | 1 |
| 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 3 | 3 | 5 | 3 | 4 | 5 | 3 | 4 | 4 | 4 |
| 3 | 4 | 2 | 5 | 4 | 3 | 5 | 3 | 4 | 4 |