

Green Supply Chain Management Practices and Performance in the US and Mexico

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Jeffrey Brooks

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Advisor: Gioconda Quesada, PhD

Secondary Reader: Marvin Gonzalez, PhD

Abstract

With the increased focus on the environment, this study focuses specifically on Green Supply Chain Management. A survey of 207 Mexican and US firms is used to determine what green practices various companies have implemented and what performances have come about as a result. These firms come from a cross section of many industries, such as healthcare, electronics, packaged consumer goods, automotive, and food. The firms surveyed also include both large and small firms, delineated by number of employees (greater than or less than 500). Ultimately, the goal of this study is to determine if there are differences in practice implementation and/or performance between the US and Mexico or between large and small firms. The data suggests that there is no difference to be found in any construct between the US and Mexico, but that in every construct, the larger firms have either implemented more or seen more significant results than have the smaller firms.

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1. Introduction

Mexico and the US share a border of nearly 2,000 miles and in 2012, total trade in goods between the two countries was approximately US\$494 billion (US Census Bureau). Since the implementation of the North American Free Trade Agreement (NAFTA) in 1994, the US and Mexico have become even more interconnected, and Mexico is the United States' third largest trading partner behind only Canada and China (Krizner, 2012). In the same article, the author mentions that the Boston Consulting Group (BCG) has determined that by 2015, the cost of a Chinese laborer will be 25% higher than that of a Mexican laborer, suggesting even more manufacturing in Mexico. With the obvious importance the two countries have on each other, and the significant amount of trade between them, their supply chains must be, at least to some degree, intertwined.

1.1. *Government Involvement in Environmental Sustainability*

Blackman et al. (2010) discuss the use of voluntary regulation in Mexico. They demonstrate that while in developed countries like the US, laws regulate pollution by limiting emissions. However, in many developing countries, especially in Latin America, the status quo is incentivizing good behavior rather than punishing bad behavior. They conclude that Mexico's Clean Industry Program does not have an effect on environmental performance – participating firms were not fined at a lower rate for environmental issues relative to non-participants.

With the passage of NAFTA, Cole and Ensign (2005) argue that many believed that US industries where environmental regulatory costs are high would begin to shift their presence to Mexico, where, at the minimum, they could enjoy lax enforcement of the regulations. Their results, however, reveal that industries moving to Mexico in the first few years after the implementation of NAFTA did not necessarily do so in order to evade the cost of environmental

regulations in the US. They did find that the cost of compliance was less in Mexico compared with the US, but this was not a driving force for Foreign Direct Investment. This might suggest that while there are differences amongst the two countries in terms of enforcement of environmental law, these differences are not significant enough to warrant industry movement to Mexico.

1.2. *ISO 14000*

The *ISO 14000* environmental standards that came about in 1996 could apply to companies all over the world engaged in any type of business. Elefsiniotis and Wareham (2005) call these standards a way of giving companies a “structured framework to manage their environmental impact and responsibilities” with an “emphasis...on the management process which aims to be consistent and which in turn should generate products of consistent quality.” These authors draw the conclusion that there are numerous weaknesses in the *ISO 14000* framework, namely that they lack performance goals and have broad, ambiguous language that is often applied differently. However, they note that the fact that these standards are so widely used suggests that in practice they do offer a reasonable guideline for managing environmental responsibilities.

1.3. *Definitions*

1.3.1. Corporate Social Responsibility

Although this paper focuses specifically on Green Supply Chain Management, it is important to consider the background to the overall movement regarding social responsibility, which is larger and (perhaps) more difficult to define easily. Wan saiful (2006) offers an overview and a unified definition of CSR. Although the term has not been around *per se* for more than a few decades, the concept can be traced back to thinkers like Adam Smith who

famously used the “invisible hand” as a way of saying that corporations pursuing a profit inadvertently bring about social welfare as well. He finds that there are generally divergent trends between the academic and practical definitions of CSR, including the difference between viewing it as an ethical stance vs. a business strategy. Ultimately, he selects Hopkins’ (2003) definition that it is ““treating the stakeholders of the firm ethically or in a responsible manner.”” This means that seeking a profit is perfectly acceptable and even encouraged, as shareholders are also stakeholders, but the consideration must be broader – perhaps using the triple bottom line framework of concern for people, planet, and profit coined by Elkington in *Cannibals with Forks* (1997).

1.3.2. Supply Chain Management

The term “Supply Chain Management” first appeared in the Financial Times in 1982, referenced by Booz, Allen’s Keith Oliver, who defined it as “the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.” Li, et al. (2012) note that the “green movement” has been around for the last 20 years, and includes four major components: ““green buying’ by consumers,” “Environmentally preferable purchasing” by the government and private sectors, “Environmentally Benign Design and Manufacturing,” and “Socially Responsible Investing.” The first three of these very clearly relate to supply chain management as mentioned above. Companies purchase environmentally friendly goods from suppliers, they manufacture their own products with the environment in mind, and then consumers make purchases based on the environment as well – from point of origin to point of consumption.

1.3.3. Green Supply Chain Management

Diabat and Govindan (2011) discuss the numerous definitions of Green Supply Chain Management (GSCM). They cite Gilbert's (2001) definition that it means to use environmental concerns when making purchases and building supplier relationships, which is taken further by Hwa (2001) and Nunes et al. (2004) who discuss the "triple focus of Green Productivity," of "environment, quality, and profitability." Kogg (2003) along with Zsidisin and Siferd (2001) define it as having a concern for the environment throughout the various stages, starting with design, continuing through all of the production steps, and finishing with the ultimate disposal, a definition similar to that used by Srivastava in 2007. Davies and Hochman (2007), expand the concept to be a consistent concern for the environment at all levels of an organization. For the purposes of this paper, GSCM will be defined as the implementation of various practices focused on reducing the negative environmental impact while designing products, purchasing materials, manufacturing goods, selling products, and disposing of wastes.

1.4. *Doing Good vs. Doing Well*

While one common barrier to GSCM is the perception that the costs of implementation will far outweigh the financial benefits, this is not always the case. Margolis et al. (2007) highlight this debate that has been ongoing since the 1970s – at what point can a firm both be profitable and demonstrate social responsibility? The authors looked at 167 studies conducted since 1972 to attempt to determine if, in fact, there is a positive relationship between environmental performance and financial performance. Note that these results do not focus solely on environmental practices, but rather CSR practices in general, as defined above. This gives a framework for the upcoming discussion of research specifically related to the environment, and even more specifically related to the supply chain. They concluded that there

is a very slight positive correlation between the two, but caution against that being enough evidence to conclude a solid link. Their clearest conclusion was that corporate misdeeds are costly to companies – if a company is caught doing something wrong, it will pay (perhaps BP serves as a recent example). They also found that increasing corporate social responsibility does not cost shareholders directly. However, the slight positive relationship, they concluded, was not strong enough to justify pursuing social responsibility as a means for profit. They also question the fact that the direction of causality is typically that Corporate Social Responsibility causes a change in financial performance. They posit that there may actually be causality in the other direction, namely that as a firm's financial conditions improve, it can focus on (and choose to focus on) socially responsible practices.

The rest of the paper is laid out as follows: Part two is a literature review that discusses current research into GSCM, including what firms are doing to implement it, the effects of GSCM, and other relevant research. Part three is an explanation of the survey and the methodology used. Part four shows the statistical tests and their results. Part five offers a discussion and possible explanation of the results. The final section presents conclusions and offers suggestions for future research.

2. Background Research and Hypotheses

2.1. *Effects of GSCM*

According to Swami and Shah (2013), there are three overarching benefits to GSCM – improved agility, increased adaptability, and upstream and downstream alignment. They also point to numerous examples of companies who have made green decisions that have greatly reduced costs, like PepsiCo's switch from corrugated to reusable plastic containers for moving its bottles. Not only did this save \$44 million, but it also saved hundreds of millions of pounds

of corrugated material. Lee et al. (2012) attempted to find a direct relationship between GSCM practices and organizational performance (using small and medium enterprises – SMEs in the Korean electronics industry). While there was not a direct correlation between the two, they did find that GSCM practices increased operational and relational efficiencies, which in turn can improve overall business performance. Wu and Pagell (2011), however, caution that there are no guarantees of improvements or profitability by implementing green practices. Some tasks, like reducing wastes, help both the environment and efficiency right away. Walley and Whitehead, 1994, make the argument that after a firm completes these easy-to-implement tasks, the real costs start to accumulate. They note that “*Ambitious* environmental goals have real economic costs. As a society, we may rightly choose those goals despite their costs, but we must do so knowingly...Talk is cheap, environmental efforts are not” [emphasis added].

Jacobs et al. (2010) considered the effects of market value of equity following an environmental announcement by a company. They found that over the period of one day prior to an announcement through the day of the announcement, there was a significant difference in the stock returns if the announcement was related to one of three categories within “Corporate Environmental Initiatives.” Announcements regarding environmental business strategies and environmental philanthropy caused for a significantly positive abnormal return, whereas an announcement regarding voluntary emissions reductions actually had the most significant effect, albeit a negative abnormal return. In terms of announcements about awards, *ISO 14001* was the only factor with a significant positive impact, whereas non-governmental awards had a significantly negative impact. Their analysis, however, continues on by saying that over the next 60 days after an announcement there are no significant abnormal returns on stocks after these announcements. Bose and Pal (2012) completed a similar analysis, and found that the effect in

manufacturing firms tends to be more positive than in non-manufacturing firms, as well as in smaller firms (where there was no expectation) vs. larger firms.

2.2. *Small vs. Large Businesses*

Huang et al. (2012) argue that larger businesses have been the first to implement GSCM practices, with smaller businesses lagging behind, due primarily to the lack of resources (money, infrastructure, human capital, knowledge, etc.). They come to the conclusion that there are pressures for Chinese SMEs to implement GSCM, although they do not discuss the actual implementation or the performance related to the implementation. Lee et al. (2012) uses SMEs in Korean electronics, and also brings attention to the fact that these smaller businesses have struggled to keep up with the Green Movement, but will need to in order to remain competitive. By including many SMEs in this research, we are filling a gap where there is limited previous information, as much of the data collected has been in larger, Multi-National Enterprises, although our sample is inclusive of companies of various sizes, not just SMEs.

Larason et al. (2005) also note the dearth of research into SMEs, which make up the vast majority of businesses throughout the world. While this research doesn't focus specifically on GSCM, but rather supply chain management in general, it notes some of the disadvantages that SMEs face when serving as suppliers compared to larger companies. It concludes that smaller suppliers are less integrated with their buyers via Internet-based communication, whereas traditional communication (phone, fax, mail) shows no difference between the two. Face-to-face communication and general relationship building tends to be much greater in larger firms compared with smaller firms. This alone puts the smaller suppliers at a distinct disadvantage, and it could seem to start a cycle – if the smaller company can't get more business, they won't have the money to invest in green practices. If they can't invest in green practices, they may not

be able to get as much business, as more companies move toward implementing GSCM policies, specifically with regard to green purchasing.

2.3. *Pressures for Implementation*

There are numerous reasons why a company would be pressured to choose to implement green supply chain practices, and based on Sarkis et al. (2010), the most important of these to Spanish automotive companies was the pressure from clients (customers), which ranked ahead of even governmental pressures. Granted for many of these companies, their client is probably not the end user of the automobile, but it is interesting to note that they were more concerned with marketplace pressures than by government-imposed pressures. Another pressure, as noted by Zhu et al. (2007), is that as an international business oriented toward exporting, products must not only satisfy requirements and demands of domestic governments and consumers, but also be subject to foreign country requirements and demands. If, say, a car gets 15 miles per gallon of gasoline, that might not be an attractive product in the US market, whereas in other markets, perhaps miles per gallon is a less important indicator to consumers and to the government, and the car would be perfectly acceptable.

2.4. *Green and Lean*

Dües et al. (2013) report that most research that relates green practices to lean practices discuss waste reduction and efficiency as two of the primary overlaps. These researchers offer seven areas of overlap between the two, including a focus on waste reduction, lead time reduction, building supply chain relationships, and involving employees throughout the organization, among others. The authors caution, however, that the two are not completely compatible, and there are some required tradeoffs, notably the customers' focus (purely on efficiency vs. placing importance on the environment) as well as the need to either maintain

more inventory to be green or to partner with suppliers and buyers that are closer to the company (so as to reduce harmful environmental effects from transportation).

Hajmohammad et al. (2013) drew an interesting conclusion relating lean and green. While the implementation of environmental practices correlated with environmental performance, and implementing lean management practices was positively correlated with the extent of environmental practices, there was no “direct” link between lean practices and environmental performance. Although the link was not direct, this does suggest that implementing lean practices does offer the opportunity for companies to in turn implement green practices, which will then increase environmental performance.

Both of these papers suggest that although a company may not become inherently “green” just by focusing on lean concepts, there is certainly a connection between the two. If a lean company also orients itself with a care towards the environment, both can occur simultaneously and will work well together in improving a firm’s overall performance. Adopting green practices can be a logical next step for a company that already practices lean manufacturing. With a focus towards the environment, these companies can apply their knowledge of reducing waste and efficiently using resources to lower pollution and minimize use of the natural resources that so often are a top concern within the context of the environment.

2.5. *Current Research in the US and Mexico*

Becker-Olsen et al. (2011) studied the communication of corporate social responsibility in both the US and Mexico. They point to previous research that suggests that developing countries have not had the same focus on CSR as has occurred in the US and other more developed countries. Muller and Kolk (2009), however, found evidence to support the fact that Mexican firms are in fact engaged in environmental practices. They concluded that these

practices are important to the Mexican auto parts companies in their survey, who demonstrated at least some use of renewable energy, a significant concern for recycling, and environmental training of at least half a day in more than 75% of the firms. While their research does not make any conclusions in this regard, they do go so far as to postulate that Mexico's increasing connectedness in supply chains has had an effect on the need for environmental control. In general, there is a dearth of research focused specifically on differences between the US and Mexico with regard to implementing these practices.

2.6. *Hypotheses*

The following hypotheses will be considered in this paper, each built upon the research as noted above:

Hypothesis 1: Mexico and the US will differ in their implementation and performance measures related to GSCM

Hypothesis 2: SME firms (defined as <500 employees) as compared with larger companies will differ in implementation and performance measures related to GSCM

Hypothesis 3: SMEs in the US and SMEs in Mexico will demonstrate differences in implementation and performances related to GSCM.

3. **Methodology**

3.1. *Data Collection*

Data was collected using a surveymonkey online survey created originally in 2008, with most data collection occurring in 2009-2010. The companies were asked to have someone with knowledge of or power over their environmental practices. Two surveys were made available to respondents, one in English, the other in Spanish (both with the same format and items). Countries represented included USA (n=118), Mexico (n=89), Costa Rica (n=37), Belgium

(n=1), China (n=6), and Colombia (n=1). The survey items were taken from Zhu et al. (2007) who validated and tested for reliability. For results, only the companies from the USA and Mexico were included, as they were the only countries with sufficient data for proper analysis. Note that not all companies responded to all questions, with the response rate within the total respondents from the US and Mexico for practices being about 61%, whereas for performance measures it was closer to 38%.

3.2. *Survey Items*

Within the survey, Likert-scale items were used to determine the companies' implementation of various practices as well as performance indicators based on the implementations. Under the "practices" construct, there were 5 sub-constructs, each consisting of 3-8 items. Under the "performance" construct, there were 4 sub-constructs, each consisting of between 4 and 6 items. A complete list of the items on the questionnaire follows in Table 2. The practices Likert Scale ranged from 1=Not considering it [the given practice] to 5=Implementing successfully. The performances Likert Scale ranged from 1=Not at all [no impact on given performance measure] to 5=Significant. These groupings were determined by Zhu and Sarkis (2007). In practices, this includes: Internal Environmental Management, Green Purchasing, Eco-Design, Cooperation with Customers, and Investment Recovery. The groupings for the performance indicators were environmental performance, positive economic performance, operational performance, and negative economic performance.

3.3. *Factor Analysis and Reliability*

A factor analysis was performed to determine the internal consistency of each of the constructs. Each of the factor loadings was greater than the benchmark for usability of 0.6, signaling internal consistency of the constructs. Beyond that, each construct was tested for

reliability using Cronbach's Alpha. As all of these values were above 0.7 (most were above 0.9), it suggests that these are all reliable constructs and can be used in the analysis. A summary of the factor loadings for each item and the Chronbach's Alpha for each construct can be found in Table 1. This was also consistent with the original research of Zhu and Sarkis (2007) where the Chronbach's Alpha values were similar (all were above 0.8, many above 0.9).

Table 1. Summary of Factor Loadings and Chronbach's Alphas (note that each item listed corresponds with a survey item from Table 2)

Construct (Practices)	Factor Loading	Cronbach's Alpha		Construct (Performance)	Factor Loading	Cronbach's Alpha
Internal Environmental Management				Environmental Performance Measures		
IEM1	.821	.930		PerE1	.884	.954
IEM2	.839			PerE2	.902	
IEM3	.842			PerE3	.880	
IEM4	.868			PerE4	.891	
IEM5	.847			PerE5	.881	
IEM6	.748			PerE6	.909	
IEM7	.829			Positive Economic Performance Measures		
IEM8	.652			PerPE1	.890	.944
Green Purchasing Practices				PerPE2	.843	
GP1	.858	.925		PerPE3	.908	
GP2	.820			PerPE4	.923	
GP3	.905			PerPE5	.884	
GP4	.834			Operational Performance Measures		
GP5	.889			PerInt1	.853	.942
Customer Cooperation Practices				PerInt2	.851	
CC1	.852	.895		PerInt3	.759	
CC2	.911			PerInt4	.891	
CC3	.867			PerInt5	.911	
CC4	.814			PerInt6	.925	
Investment Recovery Practices				Negative Economic Performance Measures		
IR1	.915	.914		PerNeg1	.885	.928
IR2	.921			PerNeg2	.899	
IR3	.923			PerNeg3	.919	
Eco-Design Practices				PerNeg4	.879	
ED1	.897	.891				
ED2	.922					
ED3	.880					

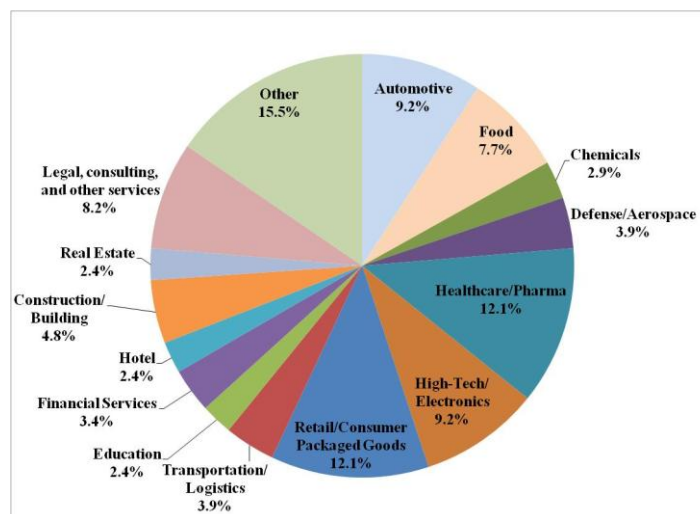
3.4. Demographics

The data also includes various demographic questions, in order to both allow for further splitting of data and for demonstrating a wide range of these factors in each country. The

industries of the respondents were widely varied, with no one industry representing more than 13% of the data. Those that did represent more than 5% included:

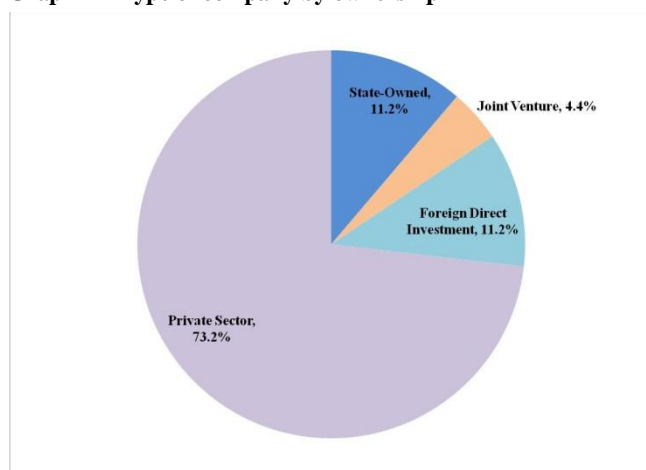
Healthcare/Pharmaceutical (12.1%); Retail and Consumer Packaged Goods (12.1%); High-Tech/Electronics (9.2%); Automotive

Graph 2: Industry Breakdown of companies surveyed



(9.2%); Legal, Consulting, and other services (8.2%); and Food (7.7%). Beyond those industries, many others were represented at lower levels, thus giving the research a broad application to businesses as a whole in the US and Mexico. These can all be seen in the graph below. Note that the “other” category represented industries that were either unclear based on the reporting of the company, or there were under 5 (<2%) companies in similar industries. The

Graph 1 – Type of company by ownership



vast majority of companies were privately-owned (73.2%), although there was representation of state-owned (11.2%), Foreign Direct Investment (11.2%), and Joint Venture (4.4%) (see graph). The companies involved also reported the number of employees, and although the

options were in narrower ranges, for the purposes of this paper, we will consider the breakdown

as either 500 or fewer employees or greater than 500 employees – there is no “agreed-upon” international definition for size of SMEs, so we will use the general US classification of under 500 employees. This will allow us to be consistent between the two countries and serves as a good cut-off point. There were a total of 143 Small and Medium companies, and 64 larger companies. As can be seen in Graph 3, there were 77 SMEs in the US compared with 66 in Mexico. 41 of the larger companies came from the US, with 23 from Mexico.

Graph 3 – Comparison of country and number of employees

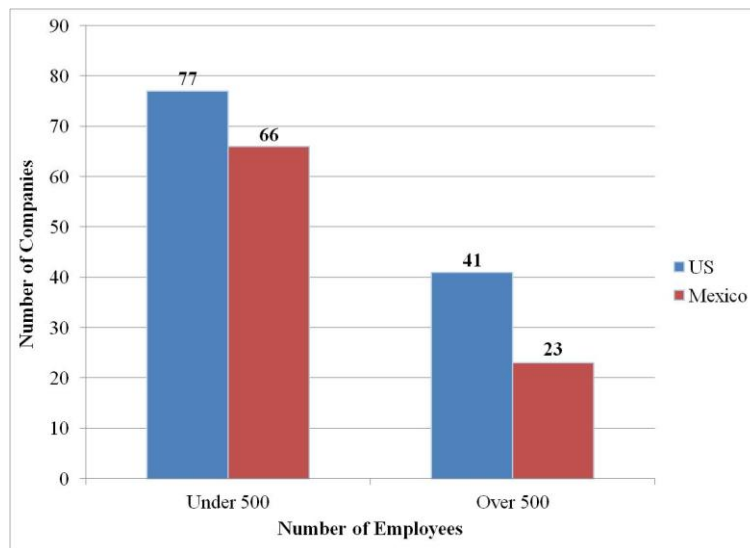


Table 2. Survey Items (Grouped by Construct)

Practices (1=Not considering it, 2=Planning to consider it, 3=considering currently, 4=Initiate implementation, 5=Implementing successfully)	
1. Internal Environmental Management	<ul style="list-style-type: none"> a. Commitment to GSCM from senior management b. Support for GSCM from mid-level managers c. Cross-functional cooperation for environmental improvements d. Total quality environmental management e. Environmental compliance and auditing programs f. ISO 14001 certification g. Environmental Management Systems Exist h. We use eco-labeling of products
2. Green Purchasing Practices	<ul style="list-style-type: none"> a. Providing design specification to suppliers that include environmental requirements for purchased items b. Cooperation with suppliers for environmental objectives c. Environmental audit for suppliers' internal management d. Suppliers' ISO 14000 certification e. Second-tier supplier environmentally friendly practice evaluation
3. Customer Cooperation Practices	<ul style="list-style-type: none"> a. Cooperation with customers for eco-design b. Cooperation with customers for cleaner production c. Cooperation with customers for green packaging d. Cooperation with customers for using less energy during product transportation
4. Investment Recovery Practices	<ul style="list-style-type: none"> a. Investment recovery (sale) of excess inventories/materials b. Sale of scrap and used materials c. Sale of excess capital equipment
5. Eco-Design Practices	<ul style="list-style-type: none"> a. Design of products for reduced consumption of materials/energy b. Design of products for reuse, recycle, recovery of materials, compound parts c. Design of products to avoid or reduce use of hazardous products and/or their manufacturing process
Performance (1=Not at all, 2=A little bit, 3=To some degree, 4=Relatively significant, 5=significant)	
1. Environmental Performance Measures	<ul style="list-style-type: none"> a. Reduction of air emission b. Reduction of waste water c. Reduction of solid wastes d. Decrease of consumption for hazardous/harmful/toxic materials e. Decrease of frequency for environmental accidents f. Improve a company's environmental situation
2. Positive Economic Performance Measures	<ul style="list-style-type: none"> a. Decrease of cost for materials purchasing b. Decrease of cost for energy consumption c. Decrease of fee for waste treatment d. Decrease of fee for waste discharge e. Decrease of fine for environmental accidents
3. Operational Performance Measures	<ul style="list-style-type: none"> a. Increase amount of goods delivered on time b. Decrease inventory levels c. Increase scrap rate d. Promote Product's quality e. Increase product line f. Improved Capacity utilization
4. Negative Economic Performance Measures	<ul style="list-style-type: none"> a. Increase of investment b. Increase of operational cost c. Increase of training cost d. Increase of cost for purchasing environmentally friendly material

4. Results

After constructing initial descriptive statistics to draw broad conclusions about the practices implemented and the performance results from these practices, ANOVA tests were performed to determine the statistical differences between the different groups.

4.1. *Descriptive Statistics*

Table 3 shows all of the descriptive statistics for the various constructs. It is broken down into 5 categories: Overall, USA, Mexico, greater than 500 employees, and less than 500 employees (note that not all participants had responses to every question, so the N displayed varies by construct). Most of the means fell between 2 and 3 on the Likert scales. For the practice implementation, this is between “Planning to consider it” and “Considering currently.” For the performance constructs, this is between “a little bit” and “to some degree.” For the few averages above 3, a response of 4 indicated “Initiate implementation” in the practices constructs and “relatively significant” for the performance constructs. In each of the segments, the lowest-scoring construct for practice implementation was the Green Purchasing Practices. The highest-scoring practice constructs were Investment recovery and Eco-Design. The positive economic performance was the highest (or, in the case of larger companies, almost the highest) performance indicator, whereas (perhaps unsurprisingly considering that), the lowest score came from the Negative Economic Performance. While the descriptive statistics do not account for significance, in the US/Mexico comparison, neither country shows a distinct advantage in practice implementation, whereas Mexican companies seemed to report higher performance improvement scores. In the SME/Larger company comparison, the larger companies had higher averages on every indicator for practices and performance.

Table 3. Descriptive Statistics

Construct	Overall N	Overall Mean	Standard Deviation	USA N	USA Mean	USA STDEV	MEX N	MEX Mean	MEX STDEV
IEM	131	2.22	1.19	89	2.21	1.23	42	2.25	1.11
GP	126	2.14	1.28	85	2.18	1.32	41	2.05	1.20
CC	130	2.25	1.24	87	2.31	1.26	43	2.11	1.19
IR	129	2.81	1.50	85	2.82	1.55	44	2.80	1.43
ED	132	2.78	1.45	88	2.76	1.50	44	2.83	1.37
Environment	82	3.04	1.40	52	2.97	1.44	30	3.16	1.35
Pos. Econ	85	3.11	1.41	54	3.05	1.41	31	3.20	1.44
Operational	73	2.85	1.38	44	2.81	1.37	29	2.91	1.42
Neg. Econ	71	2.65	1.35	43	2.56	1.25	28	2.78	1.50

Construct	<500 Emp. N	<500 Emp. Mean	<500 Emp. STDEV	>500 Emp. N	>500 Emp. Mean	>500 Emp. STDEV
IEM	92	2.01	1.10	39	2.71	1.26
GP	90	1.87	1.15	36	2.80	1.36
CC	92	2.07	1.21	38	2.68	1.21
IR	92	2.60	1.46	37	3.35	1.48
ED	93	2.54	1.45	39	3.36	1.31
Environment	54	2.72	1.43	28	3.67	1.11
Pos. Econ	56	2.84	1.44	29	3.62	1.21
Operational	48	2.57	1.34	25	3.38	1.32
Neg. Econ	48	2.42	1.36	23	3.13	1.22

4.2. Statistical Analysis

Table 4 shows a summary of the statistical analysis of the means and the differences between the populations. ANOVA tests were performed for each of the constructs given the in order to compare the desired populations (note that there were only two populations compared at any given time, so post hoc tests were not necessary). Each of the constructs is a mean value of the response items listed within that construct for each firm. In the first group of tests, the comparison was between the US and Mexico, including all responding firms for each construct. Per the results, none of the differences were statistically significant at 95% confidence (results were considered significant when the p-value was less than 0.05). As noted above, the Mexican firms did have a higher score for each of the performance measures, however this was not significant. In the comparison between larger and smaller firms, each of the results was

significant, with p-values of less than 0.05, many of the results were also significant at 99% confidence levels, with p-values smaller than 0.01. In every case, the larger firms scored higher than the smaller firms. Lastly, the researchers tested to see if the larger firms were eliminated, would there be differences between the US and Mexico. Even when just considering the smaller firms, the data suggests that there were no significant differences in practice implementation or performance between the countries.

Table 4: Summary of Statistical Analysis of Comparisons

Construct	US vs. Mexico		Large vs. SME		SME: US vs. Mexico	
	Mean Difference	p-value	Mean Difference	p-value	Mean Difference	p-value
IEM	-0.05	0.831	0.70	0.002*	0.01	0.977
GP	0.12	0.614	0.93	0.000*	0.09	0.720
CC	0.20	0.382	0.61	0.010*	0.00	0.989
IR	0.03	0.920	0.75	0.009*	-0.06	0.851
ED	-0.07	0.800	0.82	0.003*	-0.12	0.700
Environment	-0.19	0.567	0.95	0.003*	-0.40	0.318
Pos. Econ.	-0.15	0.637	0.78	0.015*	-0.51	0.200
Operational	-0.10	0.764	0.80	0.017*	-0.32	0.414
Neg. Econ.	-0.21	0.519	0.71	0.036*	-0.19	0.634

Note: * Significant at 0.05

5. Discussion of Results

5.1. Hypothesis 1

Hypothesis 1, that there would be differences between the implementation of practices and the performances of firms in the US vs. Mexico was not supported. In each of the constructs, the mean differences were too small to amount to a statistically significant difference. This would suggest that companies in both countries behave the same way toward GSCM. It also seems that US and Mexican companies place special importance on implementing Investment recovery and Eco-design practices. This would include selling items that would

otherwise be scrapped and creating products that do not use an excess of harmful materials, that generate little waste, and that can be reused or recycled.

5.2. *Hypothesis 2*

The second hypothesis, namely that the research would demonstrate differences between SMEs and larger companies with regard to practice implementation and performance from GSCM initiatives, was found to be supported in all constructs. In every case, the larger companies scored significantly higher than the smaller companies. This would suggest that larger companies have the ability (capital, resources, etc.) to pay for green initiatives. Beyond that, it also demonstrates that these companies have made the decision to put a focus on going green – either it is the best investment because of the improved performance or it the managers implement the practices in order to be seen as a green company that does in fact care about the environment.

5.3. *Hypothesis 3*

The final hypothesis came about as a secondary part of the initial hypothesis. The question posed by the researchers was whether there may be a difference in implementation and performance between the US and Mexico when only accounting for the SMEs. This would eliminate the larger companies that could be more multi-national in scope and focus on smaller businesses, which, as demonstrated by the second hypothesis, do not have the same level of implementation as the larger companies. Had the larger companies in Mexico been responsible for raising the average enough that there was no significant difference between the countries, it could be a factor that needed to be eliminated. After eliminating the large companies and comparing the two countries vis-à-vis the SMEs, no significant differences were found in any of the constructs at 95% confidence. This further supports the results from the first hypothesis,

suggesting that the US and Mexican companies have similar practices and performances related to GSCM.

5.4. *Possible Explanations of Results*

A number of factors could have contributed to these results. First, the implementation of NAFTA has also sought to standardize regulations across borders. While there was concern amongst environmental groups at the potential for industry movement to Mexico to avoid environmental fines, Cole and Ensign (2005), as noted above, determined that this was not a deciding factor in movement across the border. Blair (2008) discusses the North American Agreement on Environmental Cooperation (NAAEC), which went into effect alongside NAFTA in order to improve the laws with regard to the environment in the big three North American countries. He concludes that this approach has led to positive progress in Mexico with regard to environmental law, although enforcement was still an issue. Blair also notes that Canada and the US were ranked 24th and 22nd, respectively, on the Environmental Sustainability Index of environmental governance, with 22 of the countries ranked ahead of them being OECD countries. This would mean that as compared to “similar” countries, environmental protection is limited in the US and Canada, which could also make the differences between countries less than expected. Within the context of NAFTA and the ease of trading between the two countries, perhaps there has been a “trickle back” effect, moving upstream in the supply chain. If US companies are insisting on green purchasing practices – including only buying from suppliers who themselves are proven “green” companies, then their Mexican suppliers could be forced to adjust their practices. If this were the case, it would make sense that Mexican companies are on pace with US companies with regard to GSCM, if nothing else as a way to gain access to more companies further down the supply chain.

Beyond this there could have been a bias in the survey. Most of the data collected in the US came from the state of South Carolina. Although much of environmental policy is written at the federal level, the presence of so many companies from one state could skew the results, and not give a clear national-level picture. In Mexico as well, the survey data was limited in its geographic scope. Many companies were from the states of Chihuahua and Jalisco. This opens up the possibility that perhaps environmental control and concern are higher in these states and lower in South Carolina. If that were the case, perhaps these are not good representations of both countries, and could be re-evaluated with a broader sample.

Another potential explanation for the results could be the number of different industries represented. Although this does help to give a broader overview of each country, making a comparison between a company involved in building automobiles and a company that specializes in financial services is very difficult. Much of the research in this field tends to focus on one specific industry and make comparisons within that industry only. Although that perspective gives a narrow view, it may help to single out the differences caused by changing either country or company size.

One consideration with the data is the fact that everything was self-reported. Although the companies had no incentive to lie – there was no benefit to being more environmentally friendly, nor was there a penalty for being less so – there is the concern that they may have erred on the side of generous when responding. Although much less practical, interviews and third party observations would be the best way to deal with the potential inconsistencies. Along with this issue is the fact that the Likert scale is somewhat subjective – what one company might call “significant” could be “relatively significant” to another company. Theoretically, this would still create a fair average in the end, since some representatives might overestimate the impacts while

others would underestimate. The researchers also faced the issue of non-response to some survey items. Although the number of responses was still sufficient (see data in Table 3 above), questions remain as to why some companies did not respond to all of the questions – for many it may have been an issue of time, although for some, there could have been other reasons for not answering, such as the desire to hide the lack of GSCM practice implementation (however this is purely speculative).

6. Conclusions and Future Research

To conclude, it seems that of the demographic data in this survey, the most important factor in determining the level of implementation of GSCM practices and the performance improvements associated with them is the size of the company. Using 500 employees as the maximum size for SMEs, the researchers concluded that the smaller companies have done far less to implement GSCM practices and thus have not seen the same performance improvements as the larger companies. The country, whether US or Mexico, was completely irrelevant in determining these factors, and could suggest that the environmental policy of Mexico is becoming much more in line with that of the US, or at least that companies there are beginning to take the issues more seriously. That is not to say that the US is a prime example of an environmentally friendly country, but certainly is seen as a stronger country than its southern neighbor in that regard.

This research suggests that despite Mexico's "known" record on environmental standards, companies there are not behaving differently from companies in the US. It may lend credibility to the fact that NAFTA has worked in its effort to strengthen the environmental policy in all three countries, or at very least brought Mexican standards up to a similar level as the US. As a manager, this information could be very useful. When evaluating green purchasing

practices for example, looking to Mexico may be a perfectly understandable alternative. This does not, however, mean that all Mexican firms are implementing green practices; in fact the descriptive statistics suggest that in both countries, practice implementation is not all that high. With that in mind, maybe both countries need to improve their standards. It is perhaps unsurprising that the investment recovery construct was amongst the highest implemented practices. That construct goes very much hand in hand with waste reduction from lean management, a topic that has been popular amongst all firms in the recent past, making it one of the easier constructs to implement.

This research lends itself to future research prospects as well. One potential project could be to focus on a few industries and determine if there are differences between Mexico and the US in each of the industries, separate from each other. Another would be to get a broader geographic scope of companies in both countries. This would allow for a stronger sense of a country comparison, rather than comparing firms that were mostly concentrated in a few areas. This also builds the work to include more countries in the survey. Perhaps the most obvious choice would be to include Canada and work on a robust analysis of NAFTA and environmental policy across the three countries. The inclusion of more demographic data might also lead to more analysis as to what characteristics determine a company's implementation of GSCM. From this research, the size of the company plays a role; however that is more than likely not the only factor that contributes to the overall GSCM implementation.

7. References

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