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Going "Green" in the Delivery Supply Chain: Evidence and Insights

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Abstract

Given increased consumer interest in green products and practices, this paper will focus on examining sustainable practices within the shipping, packaging and delivery supply chain. "Green" shipping, packaging, and delivery focuses on transporting products from providers (e.g., manufacturers, retailers) to customers to reduce CO_2 emissions, landfill waste, and overall negative impact to the environment. For example, (a) the use of electric powered vehicles in the delivery supply chain has the potential to reduce CO_2 emissions (Nealer, 2015); and (b) using recycled cardboard or materials that are biodegradable would reduce landfill waste. This paper examines the potential benefits of these green practices in the delivery supply chain. Our results are that a case can be made for use of electric-power vehicles and their potential benefit to reduce CO_2 emissions in an environment where power generation in non-coal based. In other words, using electric cars in all delivery supply chains isn't always a solution; firms must recognize the significant impact of the power generation process in their operating area. From a packaging perspective, there is documented consumer interest on using environmentally friendly material for consumer products. However, depending upon the market segment size, this might not always result in better financial outcomes for companies.

Introduction

Companies that build sustainable operations realize not only immediate benefits but this also results in an impetus to enhance future applications of sustainability (Berg et al, 2015). One of the drivers of these benefits is an emerging consumer base focused on not only the product they are buying, but also the manufacturing process used (Brackley, 2017). In general, these consumers would prefer that the environment isn't adversely affected in the production and delivery employed for purchased goods (Dhar, 2010).

It is well documented that consumer tastes are constantly evolving, and with this comes new opinions, beliefs, and practices. Millennials, currently have the largest spending power out of any generation (Shroeder, 2017). With this large influence on the market, companies target this generation in hopes of aligning with some of their beliefs. According to Landrum (2017), this generation values corporate social responsibility, sustainable manufacturing and ethical business

standards. In order to determine the best strategies for targeting the "millennials" market segment, the "America@250" initiative provides some useful anecdotal evidence (Mahler, 2017). For example, utilizing a series of focus groups, Mahler (2017) notes that millennials prefer consumer brands that have a status, or advertise the lifestyle of preference. An additional dimension of interest for millennials is that they do not only negatively view fossil fuel (CO_2) emissions stemming from their own vehicle use, but also for vehicles used to transport the products to the market. In summary, due to an increasing realization of lifestyle choices on the environment, more and more consumers began are favoring sustainable companies since 90% of consumers are "….more likely to purchase products from a company that is making changes with the goal of improving sustainability" (Sons, 2017, p. 2).

According to a Nielsen (2015), six of the top eight consumer purchasing drivers of global consumers focus on some aspect of sustainability. For example, at least 30% of global consumers are driven by product content (primarily organic content), environmentally friendly and socially acceptable brands, and brands offered in environmentally sustainable packaging. An interesting additional finding was that among all global consumers driven by sustainability drivers, at least 40% were willing to pay a premium for environmentally products.

Given this change in customer preferences towards sustainability, what is the business response? Although most firm understand that Corporate Social Responsibility (CSR) is vital for a company's image and reputation management (Du et al, 2010), they often fail to notice the monetary benefits that also come with adopting sustainable principles. This has motivated many companies to be are "more active than ever in pursuing sustainability to align with values and engage stakeholders" (Bove, 2017, p. 1). In order to reap the greatest benefits from sustainable practices, Bove (2017) proposes that businesses: (a) align sustainability strategy with business strategy; (b) enhance governance for better results; and (c) embed sustainability into business functions.

These observations motivate the focus of this research paper. On the one hand, we have a consumer market with distinct preferences for sustainability and individuals also willing to pay more for environmentally friendly alternatives while on the other hand, we have firms struggling to identify the best strategies for serving the "green" consumers more effectively. In order to focus our attention, we consider the following two issues for the delivery supply chain: Are CO_2

emissions reduced through the use of electric vehicles? and; Are there positive environmental impacts stemming from the use of "green" packaging?

The remainder of this paper is organized as follows. In the next section, the research methodology is described and this is followed by a discussion of the key results and managerial insights stemming from our findings. Finally, summary conclusions, implications, and guidelines for future research are discussed.

Research Methodology

The methodology we thought best fit to investigate the two aspects of interest was to utilize secondary data since there is an abundance of data available. Of course, we also apply a set of appropriate set of criteria to select such data for improving research validity and reliability of our findings.[1]

To delve deeper into the subject, secondary data from online and library sources was collected. These resources were used to try and identify variables that could address the purpose of our research questions. Reliability of the sources is enhanced by adopting a holistic approach in analyzing both qualitative and quantitative findings.

More specifically, our research investigation of the delivery supply chain evaluates two specific hypotheses:

1. *CO_2 emissions are reduced through the use of electric vehicles; and*
2. T*here are positive environmental impacts stemming from the use of "green" packaging.*

The overall goal is to propel companies toward "green" supply chain management. Hence, we show that sustainability is not simply a public relations or CSR tool, but also leads to reductions in emissions, waste, and pollutants. Simultaneously, companies can realizes positive financial outcomes by adopting these sustainability practices.

Findings and Insights

The discussion in this section is organized around the two research hypotheses investigated in this paper.

Hypothesis 1: CO_2 emissions are reduced through the use of electric vehicles.

[1] https://research-methodology.net/research-methods/data-collection/, accessed January 14 2019.

The results and insights relating to this question are generated by evaluating the impact of a shift from vehicles using fossil-fuels (trucks) to vehicles using electric power generation (electric vehicles). Of course, key insights associated would relate documenting the trade-off between the "costs" (firm investments) of using electric vehicles versus the "benefits" (reduction) of CO_2 emissions. Although we found it difficult to obtain industry data to directly address this question, there is publicly available information which provides some insights.

CO_2 emissions from cars utilizing fossil-fuels to that of electric cars show a significant difference (DOE, 2017). These direct emissions include smog-forming pollutants, greenhouse gases, primarily carbon dioxide (Biello, 2016). As compared to electric vehicles that produce zero direct emissions, traditional (fossil-fuel) traditional vehicles have a significant impact on poorer air quality in urban areas. The primary reason for this decline in air quality is that in the extraction process for petroleum, harmful pollutants and GHGs are released (Tomlin, 2007). These emissions continue to thin the ozone layer leading to a rise in temperatures (Hossaini, et al 2015).

A confounding aspect when comparing direct CO_2 emissions between traditional and electric cars is that we also need to consider the negative impact of "charging" electric cars for use (Nealer, 2015). In essence, four factors are crucial to understand when determining the CO_2 emissions: (a) manufacture process for the vehicles – typically assumed to be a constant of 70g CO_{2e}/km; (b) arising directly from fuel combustion; (c) indirectly from fuel combustion; and (d) emissions due to losses in transmission and distribution (Wilson, 2013).

It is interesting to observe that total "carbon emissions of grid powered electric cars in countries with coal-based generation are no different to average petroleum vehicles"(Wilson, 2013, p.3). Thus, the environmental benefits of going electric aren't evenly distributed around the globe as seen in Figure 1 below. For example, this figure shows that the "difference between Paraguay and India is a result of changes in the fuel mix" from low carbon hydro at the bottom to high carbon coal at the top. [2]

[2] In this study the assumption was that electric vehicles have manufacturing emissions of 70 g Co_{2e}/km over its lifetime and that "its wall-to-wheels energy use is 211 Wh/km".

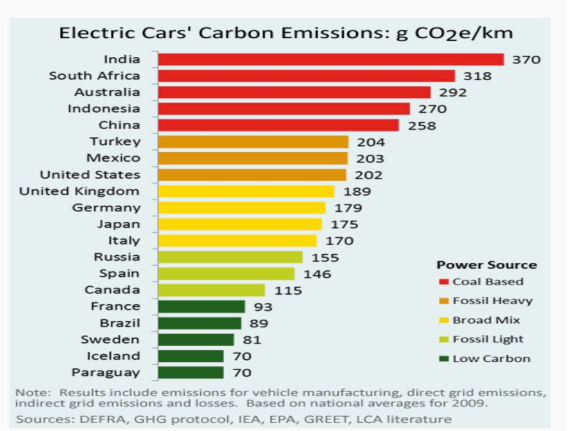

Figure 1: CO_2 emissions – Electric Power Vehicles.[3]

Comparing the variation between CO_2 emissions between electric and petroleum cars for the same countries, it was observed that countries with largely dominated coal grids produced more emissions either way; electric or petrol. This pattern is visible in Figure 2 for China and India (where significant power generation is through coal). On the other hand, this Figure also shows that for countries with grids utilizing low carbon electricity in their grid produced relatively huge differences when comparing petrol and electric as is the case for Paraguay. These results also integrate vehicle manufacturing, fuel combustion, upstream emissions from fuel production, including extraction and refining.[4]

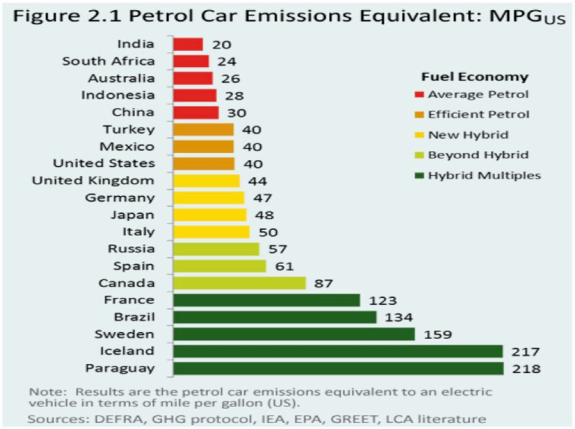

Figure 2: CO_2 Emissions – Petroleum vs Electric Power Vehicles.[5]

[3] http://shrinkthatfootprint.com/wp-content/uploads/2013/02/Shades-of-Green-Full-Report.pdf, Accessed January 14 2019.

[4] Assumptions included holding that manufacturing emission of the petrol vehicle are assumed to be 40g CO_{2e}/km over its lifetime, which is less than "60% that of electric vehicles".

[5] http://shrinkthatfootprint.com/wp-content/uploads/2013/02/Shades-of-Green-Full-Report.pdf, Accessed January 14 2019.

One significant observation stemming from our analysis is that although direct emissions from electric vehicles are substantially lower, emissions stemming from the manufacturing process are almost double of petrol vehicles. This is due to "energy intensive manufacturing and a lifetime mileage" which is typically lower for electric vehicles (Wilson, 2013, p. 16).

In summary, key insights regarding this research question are mixed. On the one hand, if the power generation process is non-coal based, then using electric vehicles as compared to traditional (fossil-fuel) vehicles will provide a significant reduction in CO_2 emissions. However, if the power generation process is coal based, then there is no significant reduction in CO2 emissions (and in fact, total carbon impact might even increase) when a firm chooses to replace traditional vehicles with electric vehicles. Hence, electric cars by themselves are not a solution; firms must recognize the significant impact of the power generation process in their operating area (Tonachel, 2015).

Hypothesis 2: There are positive environmental impacts stemming from the use of "green" packaging.

Our environmental scan reveals that there is a significant consumer base with a preference for a sustainable supply chain reflected in consumer preferences for sustainable packaging practices. Thiollier and Bachl (2014) find that consumer attitudes for making purchase decisions for multiple categories of consumer products to a large extent value the use of environmentally better packaging across a variety of product categories. Their data clearly shows that the type of packaging is an important criterion across multiple product categories. The study participants also provided granular data on key purchase components within multiple decisions and the results are key 'must have' criteria include the use of minimal, environmentally friendly and recyclable packaging. In order to get an even more thorough understanding of consumer preferences for sustainability, all respondents were divided into 5 market segments defined based on their personal focus on sustainability dimensions. A key finding was that across these groups, more than 60% of respondents indicated that it was important to use environmentally friendly packaging material with the highest preference for these materials stemming from the "responsible dedicated" and "critical consumers" segment and lowest by the "self dependent family" segment. More specifically, 35 % of the respondents over all segments indicated that

sustainability in packaging was an important dimension and a closer examination reveals that all (i.e., 100%) customers in the "responsible dedicated" and "critical consumers" segments viewed sustainable packaging as being critical. Given that sustainable packaging is a strong focus from a customer preference perspective, it is also critical to understand whether consumers would "pay more for sustainable packaging?" The same study found that 15.8% of respondents said they would be willing to pay more for such packaging.

These results provide important insights. First, we note that packaging in the delivery supply chain is a critical sustainability dimension for multiple consumer product categories. Second, use of "recyclable" and/or "environmentally friendly" material is strongly preferred by customers. Third, depending upon market segmentation, customers who are critical, responsible, and dedicated are more likely to view this sustainability dimension favorably. Finally, there is some support for such a using environmentally preferred packaging materials (Atkinson, 2008) since there are customer segments who are also willing to pay a premium for using green materials in the packaging process.

Anecdotal industry evidence also supports the trend toward the use of sustainable packaging materials (Bonini, 2012). According to Jim Downham, president of The Packaging Association of Canada, downsizing in packaging provides immediate environmental benefits as well as contributions to the bottom line, "product-to-package ratio is very important, resulting in less over packaging". The method of downsizing relates directly to energy consumed as well. For example, a plastic container that uses 35% less material requires 30% less energy to produce, reducing fuel costs for shipping according to President of JL Clark, Phil Baerenwald (Bonini, 2012).

The packaging in industry in general has been moving toward greater material recovery. This trend is based on the understanding that most recovered materials can be used to replaced virgin materials, resulting in landfill avoidance and huge energy savings. By consolidating storage in regards to packaging the logistics of moving, storing, and displaying items are improved with sustainable packaging. Utilizing creative ways to ensure that companies use only the necessary containers (Kho, 2014) to hold items, in turn ensures that each item takes up less space. These benefits range from fitting more products into each box, reducing load size, increasing number of boxes able to fit on a truck, which allows businesses to transport additional items in one shipment. These changes could also result in savings on transportation, reduced fuel use and

reduction in $C0_2$ emissions. Eco-friendly packaging not only drives top-line growth but also yields bottom-line benefits (Henegan, 2016).

One company that has capitalized on this is PepsiCo. Pepsi's plastic bottles have transformed from containing 10% recycled PET material to all-recylced 7UP container, therefore cutting the use of new plastic in North American Pepsi factories by about 6 million lbs. a year (Koel, 2012). In addition, the company also announced in September 2016, that its sustainability efforts had saved the company more than $375 million since it first set these goals six years period (Henegan, 2016). One specific metric from this overall success included PepsiCo was eliminating 89 million pounds of packaging in 2014 versus 2013, this alone saving the company around $48 million.

In conclusion, our research reveals that there is a large consumer base that highly values sustainability reflected in the products they are purchasing (McCormick, 2016). Although it is clear that the type of packaging is important to customers, it is important to note that two categories "responsible dedicated" and "critical consumers" have the highest preference for green packaging. Moreover, not only did we find that sustainable packaging is important to consumers, but also that if companies implement these practices they can reap monetary benefits. Smaller packaging means less material, more available truck space, less energy used, allowing companies to save money and improve efficiency. This practice could in turn lead to reduced fuel use and $C0_2$ emissions resulting in saving on transportation costs.

Conclusions, Implications, and Directions for Future Work

From our findings it is evident that sustainability in the supply chain provides overall positive monetary and social benefits. Regarding the success of electric vehicles, we found that total $C0_2$ emissions are unaffected if the country utilizes coal-based power sources in order to provide the rest of the grid with electricity. This is important to note, because although countries that are not traditionally coal-based will see improvement in reducing $C0_2$ emissions, countries that are traditionally coal-based will have to seek out other methods in order to reduce their carbon footprint.

We also found support for the second research question. Sustainability initiatives in packaging material usage are an important dimension for multiple consumer product categories, and moreover that "environmentally" conducive packaging material is strongly preferred by

consumers (Dhar 2010). Furthermore, it is important to note that although consumers as a whole prefer sustainably manufactured products, certain demographics will find this characteristic even more important when purchasing a good than others.

It is our recommendation, that pursuing sustainable practices in the supply chain, more specifically in shipping, packaging, and delivery is a positive initiative overall, and if given the opportunity should be exploited. The goal should be to mitigate any and all environmental harm evoked from company practices within the supply chain. Providing external and internal benefits for your company. Cost-effective, "green" shipping practices are going to become the new norm, because they propel quantitative and qualitative success for the company as well as the consumer.

One topic of interest not covered in our research are possible packaging alternatives for companies looking to become more sustainable in their supply chain. I think that investigating different materials that can reduce C02 emissions and waste would be an interesting topic to delve into. By understanding the best alternatives for what suppliers are currently using, our research could better help companies fulfill their sustainability goals.

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