
GREEN LOGISTICS – A DIFFERENT AND SUSTAINABLE BUSINESS GROWTH MODEL

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Abstract:

Built on the concepts of green logistics and green supply chain management (GrSCM), this paper presents the relationship between logistical activities and its related environmental effects and costs. By greening their supply chain, companies can better use their assets, optimize resources- do more with less, improve and create sustainable technology, ensure continuity and strategic, long-term alliances. Business ethics and social responsibility are important components of organisational effectiveness. Most companies recognize that socially responsible activities improve their image among consumers, stakeholders, the financial community and other relevant publics. They have found that environmental and social responsible practices are simply good business, resulting not only in a favourable image, but ultimately to increased sales and cost reduction. Mars Incorporated is one of the companies that have significantly managed to increase operational and capital efficiency, reaching an environmental conscious, social minded and result oriented triple bottom line.

Key words: resource crisis, green logistics, externalities, green supply chain management, Mars Inc.

1. Introduction

The world is facing a natural resources crisis worse than the financial crunch. The Living Planet report calculates that humans are using 30% more resources than the Earth can replenish each year, which is leading to deforestation, degraded soils, polluted air and water, and dramatic declines in numbers of fish and other species. As a result, we are running up an ecological debt of \$4tr (£2.5tr) to \$4.5tr every year - double the estimated losses made by the world's financial institutions as a result of the credit crisis. The figure is based on a UN report which calculated the economic value of services provided by ecosystems destroyed annually, such as diminished rainfall for crops or reduced flood protection (Jowit J. 2008).

Pollution and more consumption of the natural resources are adding to this problem, because over consumption and pollution are growing faster than technology can support. If nothing changes, it is predicted that by 2030, mankind would need two planets to sustain its lifestyle.

Lesser use of natural resources, emphasizing more on the use of renewable resources and integrating environmental thinking in logistics management as a way of reducing monetary costs but also externalities can make way for the world to 'go green' and to grow in a sustainable way.

Logistics is the term now widely used to describe the transport, storage and handling of products as they move from raw material source, through the production system to their final point of sale or consumption.

Over the past 50 years logistics has come to be regarded as a key determinant of business performance, a profession and a major field of academic study.

Logistics' main goal is to co-ordinate the movement of products through the supply chain in a way that meets customer requirements at minimum cost. This cost was usually defined in purely monetary terms. The prime, and in many cases the only, objective has been to organize logistics in a way that maximizes profitability. The calculation of profitability, however, has included only the economic costs that companies directly incur. The wider environmental and social costs, traditionally excluded from the balance sheet, have been largely ignored – until recently.

Over the past 10–15 years, in a time of rising concern about environmental issues, as corporations and businesses are encouraged to adhere to environmental norms rises, they must also account nowadays for the external costs of logistics associated, among others climate change, air pollution and noise. Green supply chain management consists of integrating environmental thinking in the supply-chain management, from product design and material sourcing to manufacturing processes, and finally to delivery of the product to consumers or other businesses, as well as management of the product after its useful life.

It is estimated that in one minute 33.000 tonnes of CO₂ are emitted worldwide, that means 198.00 tone per hour and ~ 4.8 million tonnes per day. (United Nations Statistics Division, 2012)

Making logistics 'sustainable' in the longer term will involve more than cutting carbon emissions. Despite recent improvements, the potential still exists to cut the other environmental costs of logistics by a significant margin. Furthermore, sustainability does not only have an environmental dimension. Sustainable development was originally portrayed as the reconciliation of environmental, economic and social objectives (Brundtland Commission, 1987). The expression 'triple-bottom line' is often used in the business world to convey this notion of a three-way trade-off, a balance between People, Planet and Profit. The concept also underpins government strategies on sustainable distribution, increasing environmental awareness and promoting a green, sustainable attitude. In practice, however, many of the measures that reduce the environmental impact of logistics, the so-called 'green-gold' measures, also save money, avoiding the need to trade off economic costs against environmental benefits.

During The 6th Millennium Debate, held in Ghent, Belgium, professor Tim Jackson, member of the economics commissioner on the UK government's Sustainable Development Commission and an expert in sustainability, talked about the

Dilemma of Growth - the fact that growth is unsustainable but it should be. As the world faces recession, climate change, inequity and more, he delivers a piercing challenge to established economic principles, explaining how we might stop feeding the crises and start investing in our future. He gave three advices:

1. Establish the limits;
2. Fix the economical system;
3. Change the social logic.

The key process is “green growth” and its components are: efficiency, creating better technologies, doing more with less and decoupling. (Tim Jackson,2011)

In economic and environmental fields, decoupling is becoming increasingly used in the context of economic production and environmental quality. When used in this way, it refers to the ability of an economy to grow without corresponding increases in environmental pressure. In many economies, increasing production (GDP) raises pressure on the environment. An economy that is able to sustain GDP growth without having a negative impact on environmental conditions is said to be decoupled.

In 2011, the International Resource Panel, hosted by the United Nations Environment Programme (UNEP) warned that by 2050, the human race could devour 140 billion tons of minerals, ores, fossil fuels and biomass per year – three times its current appetite – unless nations can start decoupling economic growth rates from the rate of natural resource consumption. It noted that developed country citizens consume an average of 16 tons of those four key resources per capita (ranging up to 40 or more tons per person in some developed countries). By comparison, the average person in India today consumes four tons per year.

The OECD has made decoupling a major focus of the work of its Environment Directorate. The OECD defines the term as follows: the term 'decoupling' refers to breaking the link between "environmental bads" and "economic goods." It explains this as having rates of increasing wealth greater than the rates of increasing impacts.

Tim Jackson believes that “Questioning growth is deemed to be the act of lunatics, idealists and revolutionaries. But question it we must.” The world should choose a different engine of growth; it should focus on “green business” in order to ensure a shared and lasting prosperity.

2. Logistical activity and its related environmental effects and costs

A model has been designed to map the complex relationship between (Figure 1.1). These effects and costs mainly arise from freight transport operations and, for this reason, most of the boxes and links in the diagram are associated with the movement of goods. Reference is also made, however, to externalities from warehousing, materials handling and logistics IT activities. The model can be applied equally to the outbound movement of goods (forward logistics) and the return flow of products back along the supply chain (reverse logistics). In essence it decomposes the relationship between the material outputs of an economy and the monetary value of the logistics externalities into a series of key parameters and statistical aggregates. This

relationship pivots on a set of nine key parameters (McKinnon A., Cullinane S., Browne M, Whiteing A, 2010):

- **“Modal split** indicates the proportion of freight carried by different transport modes. Following this split, subsequent parameters need to be calibrated for particular modes. As road is typically the main mode of freight transport within countries, the rest of Figure 1.1 has been defined with respect to this mode.
- **Average handling factor:** this is the ratio of the weight of goods in an economy to freight tonnes-lifted, allowing for the fact that, as they pass through the supply chain, products are loaded on to vehicles several times. The handling factor serves as a crude measure of the average number of links in a supply chain.
- **Average length of haul:** this is the mean length of each link in the supply chain and essentially converts the tonnes-lifted statistic into tonne-kms.
- **Average payload on laden trips and the average per cent empty running** are the two key vehicle utilization parameters. Average payload is normally measured solely in terms of weight, though as the average density of freight is declining, and an increasing proportion of loads is volume, rather than weight constrained, it would be helpful to measure the physical dimensions of freight consignments.
- **Energy efficiency:** defined as the ratio of distance travelled to energy consumed. It is a function mainly of vehicle characteristics, driving behaviour and traffic conditions.
- **Emissions per unit of energy:** the quantity of CO₂ and noxious gases emitted per unit of energy consumed can vary with the type of energy/ fuel, the nature of the engine converting this energy into logistical activity (such as movement, heating, refrigeration, IT) and exhaust filtration systems. For consistency, full well-to-wheel assessments should be made of the various pollutant emissions, wherever possible.
- **Other externalities per vehicle-km and per unit of throughput:** not all logistics-related externalities are a function of energy consumption. Allowance must also be made for other environmental effects such as noise irritation, vibration and accidents. This can be expressed either with respect to vehicle-kms in the case of transport, or with reference to the throughput of warehouses, terminals etc.
- **Monetary valuation of externalities:** the final stage in the framework converts physical measures of logistics-related externalities into monetary values. Money then becomes the common metric against which the environmental effects can be compared. This valuation also makes it possible to assess the extent to which environmental costs are recovered by the taxes imposed on logistical activity.”

“By altering these nine critical parameters, companies and governments can substantially reduce the environmental impact of logistics. Businesses devising green logistics strategies and government ministries developing sustainable logistics policies need to exploit this full range of parameters rather than rely on a few narrowly defined initiatives.” (McKinnon A., Cullinane S., Browne M, Whiteing A, 2010).

As the ‘determinant’ boxes in Figure 1.1 illustrate, modifying the parameters requires different levels of logistical decision making. McKinnon and Woodburn (1996) differentiated for four levels:

- **Strategic decisions** relating to numbers, locations and capacity of factories, warehouses, shops and terminals.
- **Commercial decisions** on product sourcing, the subcontracting of production processes and distribution of finished products. These establish the pattern of trading links between a company and its suppliers, distributors and customers.
- **Operational decisions** on the scheduling of production and distribution that translate the trading links into discrete freight flows and determine the rate of inventory rotation in warehouses.
- **Functional decisions** relating to the management of logistical resources. Within the context defined by decisions at the previous three levels, logistics managers still have discretion over the choice, routing and loading of vehicles and operating practices within warehouses.

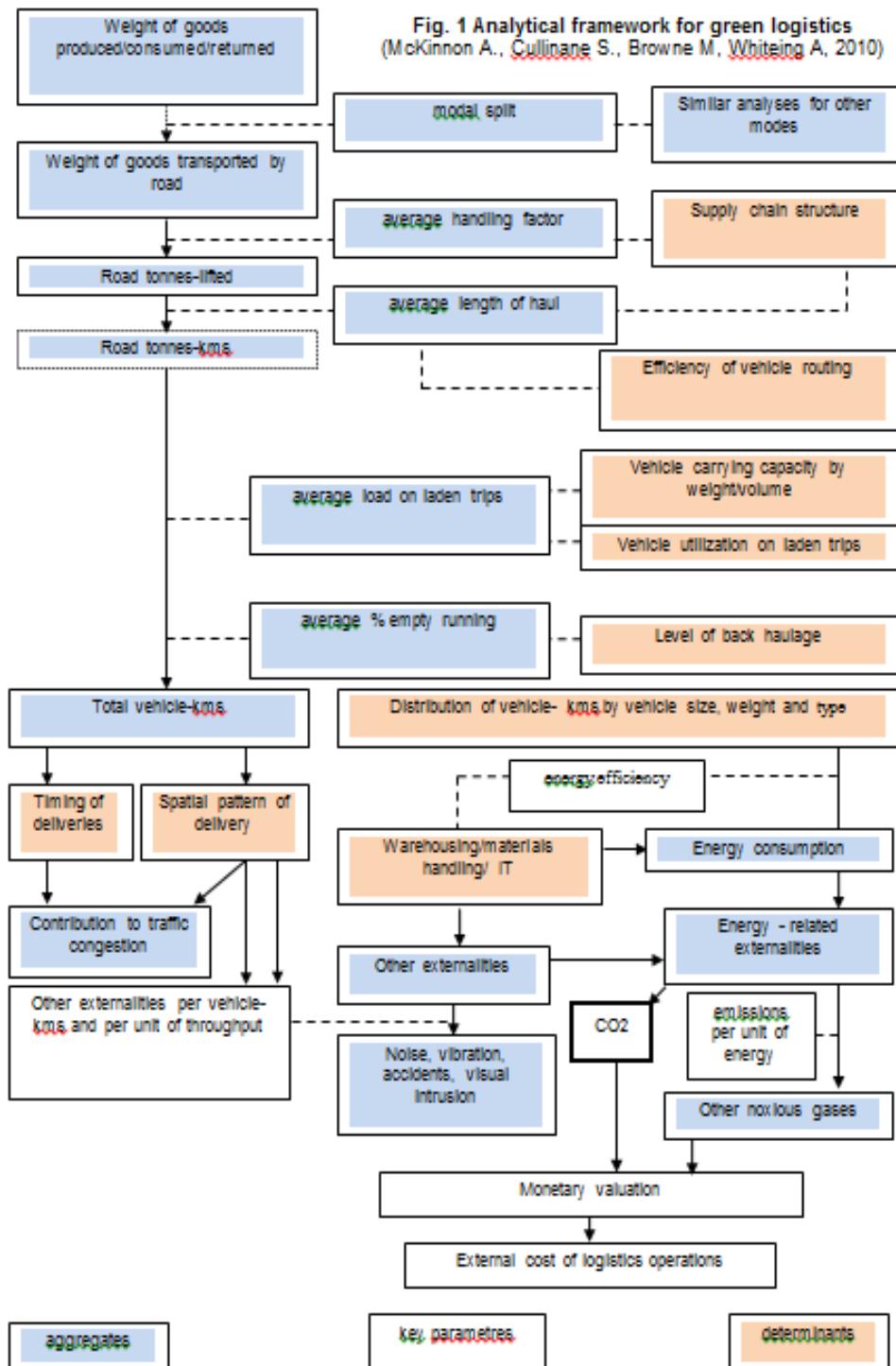
The challenge is now for companies to instil green principles into the strategic planning of logistics and coordinate environmental management at all four levels of decision making.” (McKinnon,Woodburn,1996).

3. Green Supply Chain Management – GrSCM

Historically a supply chain has been defined as “a system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together by the feed forward flow of materials and the feedback flow of information”. (Stevens, 1987)

A Green Sustainable Supply Chain can be defined as "the process of using environmentally friendly inputs and transforming these inputs through change agents - whose by-products can improve or be recycled within the existing environment. This process develops outputs that can be reclaimed and re-used at the end of their life-cycle thus, creating a sustainable supply chain." (Van den Broek F., 2010)

Green SCM leverages the role of the environment in Supply Chain value creation. Firstly, GSCM Programmes increases stakeholders' value, it leads to employee satisfaction, customer satisfaction, environmental sustainability and to improving community's quality of life. Secondly, it leads to better asset utilization, resource optimization - doing more with less, improving and creating sustainable technology, ensuring continuity and strategic, long-term alliances, rising reputation, etc. In conclusion it helps reducing costs and increasing profitability while helping the environment and contributing to making the world a better place.



Implementing a Green Supply Chain

Environmental issues are at in the public eye and businesses have to develop supply chain management strategies that are good for the environment. In order to “green” their supply chain companies should focus on the following practices:

Green Supply Chain Education

Companies are focusing a lot of energy and resources in making modification to their supply chain to make it more environmentally sound, or green. To realize these aims companies have top educate their supply chain professionals. The objective of any green supply chain course should aim to educate the student so they can immediately participate in helping the company achieve its environmental aims. To do this the student should learn about green procurement strategies, understand sustainable business practices, define corporate social responsibility strategies, develop more efficient logistics processes, and learn about aligning supply chain operations to meet the company’s sustainability objectives. (Murray M., 2012)

Reverse Logistics

Reverse Logistics can be defined as all activity associated with a product after the point of sale. The aims of reverse logistics include optimization of aftermarket activity, such as customer service, quality inspection and warehousing, which can produce a new revenue stream, improve customer satisfaction and help the environment. It is related to the 4 R: refund, restock, refurbish and recycle. (Murray M., 2012)

New Green Industries

As traditional industries struggle with the public's increasing environmental consciousness, there is a number of new green industries that are receiving more attention: Green Manufacturing, Green Retailing, Green Chemistry, Solar Energy, Wind Energy, Geothermal Energy, Smart Grid Technology, Building Retrofitting, Advanced Bio fuels and Sustainable Agriculture.

Using Recycled Packaging

Packaging materials are used every day in almost every company that manufactures and sells products. Packaging is used to move raw material to a manufacturer, bulk finished material to a distributor and then the final product to the consumer. As the public's perception about the environment changes, companies must look at greener packaging alternatives in their supply chain to satisfy consumers. (Zhang G., Zhao Z., 2012)

Understanding the benefits of Green Supply Chain

The public have become more aware of environmental issues and consumers are asking companies about their environmental policies. However some companies have seen that this not a bad thing and indeed have been able to convert the public's

interest in all things green into increased profits. A number of companies have shown that there is a proof of the link between improved environmental performance and financial gains. Companies have looked to their supply chain and seen areas where improvements in the way they operate can produce profits. They can obtain cost savings by reducing the environmental impact of their business processes. By re-evaluating the company's supply chain, from purchasing, planning, and managing the use of materials to shipping and distributing final products, savings are often identified as a benefit of implementing green policies. (Wilkerson T., 2005)

Reducing Waste

Businesses are examining every area of their supply chain to reduce costs. Reducing waste has become a key component of any cost reduction program that is implemented. There are a number of processes that can be used in order to reduce waste in a company's supply chain.

- Resource Management - Each production process should be examined to minimize the waste of raw materials. In manufacturing operations processes that waste material that cannot be recycled or reused must be redesigned. Even in processes that do produce waste that can be recycled should be examined due to the costs in recycling processes.
- Use of Scrap Material - As well as minimizing the waste of raw materials in manufacturing processes, the use reuse of waste material can be expanded. Improvements in the technology of reclaiming waste material has meant that companies that previously discarded waste products now have the ability to reuse that material. As the recycling technology becomes more available the costs will inevitably fall helping more businesses with waste issues.
- Improving Quality - Quality control is built into all manufacturing processes but is usually focused on the finished product rather than minimizing waste. Quality management should include the goal of minimizing the waste of raw materials as well as producing a quality product. Improving the overall quality of a company's manufacturing process will reduce waste overall as it will increase the quantity of finished goods that pass quality inspection. (Murray M., 2012)

Making Your Warehouse Green

Warehouses are busy places. Goods are constantly on the move; inbound and outbound deliveries have to be dealt with as well as the movements of items from location to location. Many companies are looking to warehouse operations are an area where they can make environmentally sound decisions. Companies are concentrating on three areas to help them in this endeavour; reduce, reuse and recycle.

The United States Environmental Protection Agency (EPA), in a guide called "The Lean and Green Supply Chain: A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance", provides a systematic approach to implementing a Green Supply Chain. "It's a four step decision making process. The first step is to identify environmental costs within

your process or facility. The next step is to determine opportunities which would yield significant cost savings and reduce environmental impact. The third step is to calculate the benefits of your proposed alternatives. The last step is to decide, implement and monitor your improvement solutions".

4. Study case: MARS INC.

Mars is one of the largest food companies - one guided by the Five Principles of Quality, Responsibility, Mutuality, Efficiency and Freedom – who knows that understanding their impacts on the environment is essential. It was founded in 1932, starting with making candies and gradually covering more and more business segments such as pet care, chocolate, food, drinks and symbioscience.

Currently, Mars has a large portfolio of brands that offers quality and value to consumers all over the world. Most of them are famous brands, such as: Pedigree, Whiskas, Skittles, M&M's, Bounty, Snickers, Twix, Orbit, Uncle Ben's etc.

I. Business approach - understanding their own impact

A company of their size and global scope affects people and the planet in many ways. Therefore, they must identify the social and environmental impacts most relevant and significant (or "material") to the business and stakeholders and focus their efforts appropriately.

In 2010, representatives from across Mars' business segments and functions worked together to formally identify their material impacts for the first time.

There are several impacts that are relevant across a series of aspects of their value chain:

Climate change

Mars is committed to reducing greenhouse-gas emissions both to help mitigate the impacts of climate change on communities around the world and because of the implications for the supply chain and operations.

Meaningful emissions-reduction strategies and targets must address GHGs across the value chain. Using current estimates, GHG emissions have been calculated as follows:

- 2 million tonnes: scope 1 and 2 emissions from energy and fuel use in factories and offices;
- 13 million tonnes: scope 3 emissions from raw material sourcing and other aspects of the value chain, such as packaging materials, raw material and product distribution, business travel, product use and waste.

To date, Mars have set firm reduction targets for factories and offices, which account for roughly 13 percent of total GHG (greenhouse gases) emissions. They will reduce total operational GHG emissions by 25 percent by 2015, from a 2007 baseline, and 100 percent by 2040. This target is based on a commonly referenced estimate of

the GHG emissions reductions needed to keep global warming within 2°C of preindustrial levels. (MARS INCORPORATED Official Website, 2012)

Water use

According to the World Health Organization, water scarcity affects one in three people³. The problem will get worse as populations grow and consumption patterns change, boosting demand for water in agriculture, industry and communities. In addition, climate change is likely to reduce water availability in some regions.

Mars has several projects to develop better methods of measuring the impacts of water use on their business and on communities in the watersheds associated with their value chain. These projects consider the following factors:

- The total quantity of water used;
- The water source, e.g., rainfall or aquifer;
- Levels of local water stress;
- Wastewater quality.

They are helping to define and standardize metrics and methodologies so they can develop the best strategies and long-term goals for reducing their impact on water quality and availability. In 2008, the company began a collaboration with the Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia's national science agency, to develop a method, implemented in 2009, to calculate the water footprint of M&M'S® peanut chocolate candies and DOLMIO® pasta sauce in Australia, where water scarcity is a pressing concern. The volume of water used to grow the ingredients for and produce M&M'S® was much larger than that for DOLMIO®, the local water impact of DOLMIO® was much greater, as tomato production relies on irrigation in highly water-stressed regions. In addition to working with tomato producers to reduce water use, the company is now conducting a more exhaustive study of water use in the rice-producing regions relevant to the business.

Mars is also working to develop more robust water metrics for the manufacturing sites as part of the work with The Sustainability Consortium.

Social impacts

As a global business, Mars can make real and lasting differences in many people's lives. Their social impacts are too numerous and complex to list fully. Some are a direct result of their actions, while others are the indirect outcome of their environmental impacts or the use of Mars products. The areas where the company have made a social impact include:

- Human rights and livelihoods in the communities from which they source, including child labour in the cocoa supply chain;
- Supplier relationships;
- Relationships with Associates;
- Impacts on the communities where they operate;
- Consumer health and nutrition;

- The social impacts of pet ownership.

Child labor and trafficking are serious challenges facing many supply chains that originate in developing countries, particularly for the entire cocoa industry, and most profoundly in West Africa. Mars has worked for years to address these challenges, both on its own, and through cooperative efforts with governments, nongovernmental organizations and industry.

Quantifying their impacts across their value chain — from sourcing, manufacturing and product transport, to the nutritional value of products — is a challenge. These measurements must be done in a scientifically credible and standardized manner because the use of varying methods by different partners can create confusion.

Mars' work in this area rests on four pillars:

- Basing business decisions on what is best for people, the planet and business performance;
- Ensuring this work is integral to existing business processes, not a separate process;
- Understanding, prioritizing and addressing their impacts throughout the value chain — from the supplier to the consumer;
- Basing decisions on scientific data and focusing on outcomes rather than processes. For example, measuring reductions in energy use is more important than measuring investment in energy efficiency.

Mars has created a structured approach to develop their understanding of each aspect of the value chain, as shown in the diagram. It assesses the available science to complete three key tasks:

- Prioritize impacts: identify company's greatest impacts at each stage of the value chain;
- Develop metrics: identify the most scientifically credible way to measure each impact;
- Set targets: identify science-based targets for each metric to improve performance.

Next they assess the feasibility of achieving their targets based on existing knowledge and techniques. If they find that current targets are not feasible using existing approaches, they invest in further research to develop an alternative strategy. Much of that research involves partnerships with others.

Once a strategy is developed, they lay out an implementation plan across their businesses and units. This plan may involve new technologies, practices and training for Associates, which require time and a staged approach.

To measure company's progress against these strategies, its metrics are being tracked centrally, aggregating results based on the performance of each business unit or segment. The results are used to assess the effectiveness of their strategies and define adjustments as necessary.

II. Operation process

They have quantified the impacts at each stage of the value chain. This approach helps to define further strategies, set appropriate targets and improve company's performance.

This process has shown that most significant impacts are created when the raw materials they use are produced and shipped. Addressing these impacts is challenging as they are rarely under their direct control. The company is working with others across the supply chain to drive progress.

Factories and offices (referred to as "operations") represent the second-greatest area of impact. This is where the company has most control, and consequently is where its strategy is most developed. They call this strategy Sustainable in a Generation (SiG) program.

As part of the SiG program, they have set absolute long-term commitments for fossil fuel energy use and greenhouse gas emissions, and are working on similar long-term commitments for water and waste. They have also set hard targets for reducing usage in the short term.

The long-term commitment is to achieve zero fossil-fuel energy use and zero greenhouse gas emissions by 2040 and they are developing similar long-term commitments for water and waste.

Short-term targets are to:

- Reduce direct fossil-fuel energy use and greenhouse gas emissions by 25 percent by 2015 from a 2007 baseline;
- Reduce water use by 25 percent by 2015 from a 2007 baseline ;
- Achieve zero waste to landfill by 2015. (MARS INCORPORATED Official Website, 2012).

Working towards SiG targets is leading the company to think differently about how they design, build and manage operations. They are exploring four strategies to help meet their targets. Some will make an impact immediately, while others require substantial development and will play a greater role in the future:

- Operational efficiency: Decreasing energy use, water use and waste through changes in practices and behaviour
- Capital efficiency: Investing in more efficient equipment and processes
- New technology: Developing and deploying innovations that change the way they do things
- Renewable energy: Working with partners to generate cleaner power

Operational and Capital Efficiencies

Efficiency and technology

In 2010, Mars examined the efficiency of existing practices and invested in equipment and processes that use less power.

Two Wrigley facilities in Poznan, Poland, and Porici, Czech Republic, capture methane from their waste-treatment operations and redirect it to fuel boilers that heat water. This process prevents the methane from being released into the atmosphere and will reduce consumption of fossil-fuel-derived natural gas by approximately 3 percent annually.

Mars pet care in Birstall, U.K., used significant energy during weekends while the factory wasn't running. By changing programming and shutdown procedures, the operation reduced the amount of power used on weekends from more than 60 percent of operational energy use to less than 10 percent. This contributed to a 15 percent annual reduction in energy use.

Mars Food in Olen, Belgium, has invested \$500,000 in a pilot project to research new technologies for drying rice. If successful, the energy needed for drying could be reduced by up to 50 percent. Renewable energy is any source that replenishes naturally over a short period of time, unlike fossil fuels that take millions of years to form. Examples include solar power, methane from landfill, wind, hydropower and geothermal energy.

Renewable energy

Mars explores the use of on-site renewable energy when building new operations, and will also increase renewable-energy installations at existing operations. While renewable energy can initially cost more than non-renewable sources, it can deliver environmental and economic benefits over time.

Solar photovoltaic panels at Mars Chocolate's North American headquarters and M&M'S® manufacturing facility in Hackettstown, New Jersey, U.S., save over 1,000 tonnes of carbon dioxide (CO₂) each year — the equivalent of taking 190 vehicles off the road. The 28,000 ground-mounted solar panels provide up to two megawatts of solar power — about 20 percent of the operation's energy needs at peak output — reducing dependence on electricity from the power grid. The solar garden is located on an 18-acre site next to the facility and is the largest single solar photovoltaic installation at a food-production plant in the U.S.

Mars Chocolate in Waco, Texas, U.S., has replaced 60 percent of the natural gas used in its boilers by harvesting methane from a local landfill site and piping it to the plant. With enough supply to power the plant's boilers for the next 25 years, Mars is significantly reducing its GHG emissions and production costs. Burning the methane rather than allowing it to be released reduces the global-warming effect of this powerful greenhouse gas. The use of methane gas at the plant will save more than half a million dollars each year, based on typical natural gas prices, and will reduce the plant's annual greenhouse gas emissions by more than 10,000 tonnes. That reduction is equivalent to removing 1,900 cars from the road, planting 2,300 acres of pine or fir forest, heating 2,700 homes or saving 24,000 barrels of oil. (MARS INCORPORATED Official Website, 2012)

Product Transport

Mars works with third-party transport providers to reduce transport-related emissions. They also help customers to understand that the way they place their orders impacts the environment.

In 2009, Mars launched GREEN ORDER TM, an initiative to raise awareness of sustainable transport among customers. They print the carbon footprint of each journey on the delivery note and keep a scorecard of the carbon impact of each customer's ordering behaviour.

Their transport contractors use a combination of measures, such as onboard computing and driver training, to improve fuel efficiency. They re-tender these contracts annually and are rolling out a Green Tender program across Mars' global operations to integrate sustainability criteria into transportation purchasing.

The company is also working with other manufacturers to both learn about and encourage the use of sustainable processes across the industry. During 2010, their transport specialists took part in several forums, including the 2020 Future Value Chain workshop. Organized by the Consumer Goods Forum, this event was designed to get industry partners working together to make their distribution networks more efficient. The resulting report will provide a practical framework for companies and industry to mobilize "smart" transport initiatives in the future.

Although the company uses transport contractors, she is the one who plans the routes by which products are delivered and regularly examines the distribution network to determine the best locations for warehouses and to minimize miles travelled.

They also seek opportunities to optimize the modes of transport they use. Different modes of transport, such as road, rail and ship, each have different environmental impacts. By increasing the use of ship and rail transport they can reduce CO₂ emissions and, on some routes, combine these modes with road transport on the same journey to reduce emissions.

In Western Europe, Wrigley applies this approach to transport overseas containers from its Biesheim factory in France to the major European ports of Antwerp and Rotterdam. By sending more than 86 percent of outgoing shipments on river barges, they cut their carbon emissions for this leg of the journey by an estimated 50 percent.

The best solutions are often simple. By seeking ways to store and ship products more efficiently, they can reduce the number of journeys needed. Examples include double stacking items to optimize truck space.

Mars Food operation at King's Lynn, U.K., uses double-decker trucks with nearly twice the capacity of typical trucks. This has almost halved the number of daily journeys between the operation and the warehouses and cut transport CO₂ emissions by 40 percent. In addition, they are converting the trucks to run on natural gas instead of diesel, which will reduce CO₂ emissions by 75 per cent. (MARS INCORPORATED Official Website, 2012)

III. Performance

Mars has committed to eliminating the use of fossil-fuel energy and greenhouse gas (GHG) emissions, regardless of growth.

They measure their progress in two ways:

- By tracking their total fossil fuel energy use (total operational energy use minus direct renewable energy use);
- By measuring their use of renewable energy (renewable energy generated onsite or purchased directly from 100 percent renewable sources. Excludes renewable energy already present in grid electricity).

In 2010, total fossil fuel energy use for all Mars, Incorporated operations was 20,973 terajoules (TJ), a reduction of 6.3 per cent from the 2007 baseline. This reduction was due to three factors:

- Increased use of renewable energy;
- Improved energy efficiency;
- Lower production levels.

In addition, in 2010 Mars used 471 TJ of energy from renewable sources, over three times more than in 2007. This contributed 1.6 percent of fossil fuel energy reduction. (MARS INCORPORATED Official Website, 2012)

WATER

To meet their 2015 water goal, they are focused on reducing the use of water for production processes and general use, from municipal and ground water sources. Their facilities have made good progress in reducing water use, using 13,345 thousand m³ water in total in 2010, 17 percent less than in 2007. Mars Petcare has already reached the SiG target for 2015, having reduced water use by 25 percent from the 2007 baseline. Mars Drinks has seen the second largest reduction, cutting water use by 11 percent from the 2007 baseline.

Mars long-term objective is to cause zero degradation of water quality. They typically treat wastewater so it is clean enough to discharge into municipal wastewater systems, where it receives further treatment.

Mars Petcare facility in Mogi Mirim, Brazil, is the first Mars operation to develop a water self-sufficiency program. This program involves a combination of conservation, reuse, rainwater capture and an on-site well. These measures will save some \$626,000 per year.

The main savings will come from reductions in water use and necessary treatments as well as the transport and disposal of solid waste generated during treatment.

Mars Food Australia (MFA) cut its water use in half by introducing a new wastewater-treatment and -recycling plant in Wyong, New South Wales. The state-of-the-art facility not only recovers and treats wastewater from the manufacturing process, but it has also expanded its spill-management ponds to collect and store storm water from all hard surfaces at the operation. Every drop of rainwater is now captured,

treated and reused. This project has been important for MFA, as it operates in a region heavily affected by ongoing drought.

The MFA's water-conservation project won the Industrial Water Project of the Year at the 2010 Global Water Awards, the most prestigious in the industry. It was commended for not only halving the business' annual water consumption but for its innovative use of technology.

Mars Food in Olen, Belgium, recently installed a new water-filtration system that purifies the factory's industrial wastewater. The new three-step system purifies the water to such high quality that it can be discharged into the creek that runs alongside the factory.

WASTE

Mars is committed to mitigating the impacts of waste creation and are working on a long-term commitment. The company's current approach is based on a simple waste hierarchy. Disposal in landfill is a last resort, and they have committed to sending no waste to landfill by 2015.

The processes required to eliminate all waste can actually create energy or water use with greater impacts than the waste itself. In those cases, finding a beneficial use for the waste, through recycling or incineration with energy recovery, may be the lowest-impact solution. Mars is committed to understanding these dynamics and developing long-term targets beyond landfill avoidance.

In 2010, operations sent 89.5 kilo tonnes of waste to landfill, 37 percent less than in 2007. This puts Mars on track for achieving their 2015 goal of sending zero waste to landfill. Their Chocolate, Wrigley and Symbioscience segments all cut their use of landfill by more than 60 percent between 2007 and 2010. The Drinks segment has already eliminated waste to landfill from its manufacturing sites in West Chester, Pennsylvania, U.S., and Basingstoke, U.K.

Wrigley's manufacturing facility in Poznan, Poland, sends zero waste to landfill — an achievement reached in 2009. The facility repurposes or recycles waste, including excess packaging and wood used for shipping pallets and trays. Excess gum waste is cut and mixed with other materials and used as fuel, while surplus sweeteners are purified and used as an energy source for manufacturing. Wrigley Asquith facility in Australia also sends zero waste to landfill.

Since 2007, Mars Food Australia has halved the amount of waste it sends to landfill by raising awareness of responsible disposal among Associates and investing in new processes, such as segregated bins and composting.

SOURCING

In 2011, Mars standardized their supplier code of conduct, setting globally consistent criteria for selecting and assessing the companies they source from. Once fully implemented, this will be the first set of consistent global sourcing standards for all their business segments. They are rolling it out across the company, beginning with segments and regions where it makes the most strategic sense to their business. The code applies to companies that directly supply Mars with raw materials, packaging

materials, co-manufacturing, and indirect materials or services such as office supplies or advertising support.

An additional component of Mars responsible-sourcing program is the PROGramme for RESponsible Sourcing (PROGRESS), a group of 24 industry partners working together to develop responsible-sourcing practices and sustainable-production systems. PROGRESS uses the Supplier Ethical Data Exchange (Sedex), a secure database for companies to store and share ethical information about suppliers. This approach creates access to information about suppliers and reduces the time suppliers spend responding to similar information requests. (MARS INCORPORATED Official Website, 2012)

5. Conclusion

This paper examined the relationship between operational efficiency and green logistics with highlight on the implementation of a green supply chain management.

I have begun with some general data about the current ecological state of the planet, insisting on the resource crisis and presenting some current initiatives regarding this crunch. The world is running up an ecological debt of \$4tr (£2.5tr) to \$4.5tr every year - double the estimated losses made by the world's financial institutions as a result of the credit crisis (UN report). The members of OECD are currently focusing on breaking the link between "environmental bads" and "economic goods" and companies are making efforts towards greening their activity and increasing operational and cost efficiency.

Secondly, I have presented in a complex scheme the relationship between logistical activities and its related environmental effects and costs. By minding the optimization of their logistical activity, companies can substantially reduce their environmental impact, make savings and reduce costs.

All these can be obtain by implementing a green supply chain management. Green SCM leverages the role of the environment in Supply Chain value creation. Firstly, GSCM Programmes increases stakeholders' value, it leads to employee satisfaction, customer satisfaction, environmental sustainability and to improving community's quality of life. Moreover, it leads to better asset utilization, resource optimization - doing more with less, improving and creating sustainable technology, ensuring continuity and strategic, long-term alliances, rising reputation, etc.

Green Supply Chain Management is based on: Green Supply Chain Education, Reverse Logistics (the 4 R: refund, restock, refurbish and recycle), New Green Industries, Using Recycled Packaging, Promoting Green Practices, Reducing Waste etc. Those should be implemented in 4 steps:

1. Identify environmental costs within the process or facility;
2. Determine opportunities which would yield significant cost savings and reduce environmental impact;
3. Calculate the benefits of the proposed alternatives;
4. Decide, implement and monitor the improvement solutions.

Finally, I have presented the logistical activity of Mars Incorporated, a private global company that has significantly managed to increase operational and capital efficiency, reaching an environmental conscious, social minded and result oriented triple bottom line.

In conclusion, we can observe that it has become a trend for companies around the world to promote their green credentials through the management of logistics. However, in my opinion, it is difficult to stipulate how far this reflects a true desire to help the environment and the society as opposed to improving and strengthening public relations. Moreover, I agree indeed that big corporations can afford making those substantial environmentally conscious investments in order to achieve, on a long term, operational and capital efficiency. Nevertheless, on the fundaments of the economy lays the small and medium enterprise sector. Therefore, the question remains: will those be able to follow the trend?

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