The greening of a luxury car manufacturer

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Abstract

Within the context of sustainability in operations management the aim of this paper is to investigate the environmental initiatives and decisions of a British manufacturer of luxury cars. Through case study research, our investigation sheds light on why and how the company is taking environmental decisions for manufacturing, the origin of ideas for environmental improvement, and how they are measuring environmental performance. The knowledge contributions are in the field of sustainability in operations management, mostly related to environmental decision making.

Keywords: environmental management, luxury cars, operations management.

Introduction to the Automotive Industry and Sustainability

This research paper describes and discusses the environmental initiatives in manufacturing operations pursued by a luxury car manufacturer in the United Kingdom together with their decisions drivers, the origin of ideas implemented, and the environmental performance measurement used in production. The rationale for the study derives from the relevance of automotive industry for local employment and economy as well as the need for environmental impact minimisation.

In conjunction with its global impact, the automotive industry's local development benefits are also significant, which is particularly so in the case of a British manufacturer of luxury cars that provides a significant contribution to the regional economy in the North West and Midlands of England. In addition to the jobs they create, car companies also bring significant value to UK exports (SMMT, 2009).

In contrast to the positive economic and social benefits, there are potentially significant negative environmental impacts of the industry, which are spread across car production, distribution networks, use, and end-of-life of vehicles. Due to its topicality and perceived environmental burden, the sustainability of the automotive industry's operations has been studied by several researchers (van Hoek, 2002; Orsato and Wells, 2007; Rothenberg, Schenck, and Maxwell, 2005; Vergrat and Brown, 2007; Zhu, Sarkis and Lai, 2007; Mildenberger and Khare, 2000).

The scope of this study is limited to the environmental initiatives and decisions within the manufacturing processes of the British luxury car company. Our literature review shows that other manufacturing strategy researchers have also identified the need to include environmental issues in their studies (Azzone and Noci, 1998; Dangayach and Deshmukh, 2001). For example, Van Hoek (2002) argues for the integration of green issues into business strategy, which can be seen as calling for an extension of Hill's studies to include environmental concerns, complementing the

importance of the alignment of corporative objectives, marketing and operations strategy Hill (1993).

Luxury cars and sustainability

The benefits of cars are widely accepted: they provide a door-to-door transportation system, the means for gaining access to life's necessities and employment, and a source of pleasure and social status. However, so are their environmental impacts such as local air pollution, greenhouse gas emissions, road congestion, noise, mortality and morbidity from accidents, and loss of open space to roads, car parks and urban sprawl (Vergrat and Brown, 2007). Although the automobile industry has been consistently present in academic studies, few scholars have investigated a traditional niche of this sector, namely luxury car manufacturers. The relationship between luxury car manufacturers and sustainability is still obscure, and therefore vulnerable to random and not well-founded assumptions.

Most manufacturers of premium products, such as luxury cars, tend to have low-volume production facilities, highly-aggregate value, and carry innovations that are afterwards passed on as standard features for the mass production and high-volume markets (Catry, 2003; Reinhart and Illing, 2003). As sometimes the cradle of such features, luxury manufacturers also have important role in developing expertise in engineering, the development and maturation of advanced technologies alongside the provision of high-skilled jobs. For instance, there is a path of technologies that starts in luxury cars and then cascades to volume markets due to their high initial investments or production cost (e.g. airbags, ABS - Anti-lock Braking Systems, telematics devices, etc). Luxury car manufacturers are therefore important for the development, test and maturation of driver and passenger safety technologies before their migration to volume markets.

Thus, it might be argued that luxury cars can be used as a strategic platform for the introduction of green technologies into the industry. For example, Axon Automotive is a newly formed car company based within the UK, which aims to use Formula 1 technology to make cars light, safe and fuel efficient (Axon, 2009), while in the US Tesla Motors aims to develop electric roadsters (Newman, 2009).

Their unique nature in relation of the value of the product puts interesting issues onto the research agenda once their products extrapolate simple functionality for the customer. For instance, luxury car manufacturers have a clear commitment to status beyond personal mobility, which is the same for other products sold in premium markets such as watches, food, clothes etc.

At a first glance, they could be spotted as a significant source of environmental impact; however, due to their high value and low volume they might score well when looking at their ratio of emissions per economic value contribution units. For instance, a novel approach has been used by researchers at the IZT – Institute for Future Studies and Technology Assessment in Berlin and Queen's University Belfast (UK) (Hahn, Figge and Barkemeyer, 2008). Hahn, Figge and Barkemeyer (2008) have assessed 16 automotive companies (groups) based upon the sustainable value methodology. Their results show Toyota and BMW groups as leader ahead from other competitors. Furthermore, their sustainable value methodology (which includes economic, financial, environmental and social criteria) shows that premium brands like BMW could be well valued (above several small car manufacturers – Fiat, Renault, etc) for the sustainable value of their manufacturing systems.

Using a different methodology to rate environmental performance, Nieuwenhuis and Wells (2009) argue in favour of sport cars. Because they are built to purpose, they may

have the potential to be amongst the greenest cars according to the authors. In their analysis, Morgan cars are as green as the Toyota Prius Hybrid based on the Environmental Rating for Vehicles methodology developed by Clifford-Thames and Cardiff University (Nieuwenhuis and Wells, 2009). Also surprising, a research done by Bentley shows that an average Bentley travels approximately 11,000 Km per year, and emits 4.4 tonnes of CO2 – the equivalent of travelling 23,000 Km in a medium size family saloon. In fact, the unique characteristics of luxury cars have made them to lobby for an exemption for low-volume car manufacturers from the EU legislation on CO2 emissions per kilometre (Financial Times, 2009).

At one time the production of these cars could be justified by their economic contribution, mainly from exports - e.g., 78% of all Land Rovers produced in England are exported (International Trade, 2009) and the reduced total emissions from their use due to their relatively small fleets. However, luxury car manufacturers' environmental initiatives have increasingly come under scrutiny and it has become necessary to understanding of the role and influence of this market niche within the whole automotive sector. For instance, they have played an important role in the development of engineering expertise, engine efficiency and power, alternative materials, and driver and passengers' safety features among other advanced driving technologies.

Methodology

The methodology used in this investigation is case study analysis, and the scope of analysis is the manufacturing function.

The intention with this paper is to understand the current drivers for environmental initiatives in the luxury car manufacturing sector. Alongside this objective, we also wish to explore how the case company is taking environmental decisions and where the ideas for environmental improvement are coming from, as well as how they are measuring environmental performance in manufacturing.

This first phase of the investigation comprised two interviews with the Environmental Manager of the company. These interviews were guided by a semi-structured questionnaire covering company and interviewee profiles, environmental perceptions, the decision drivers, environmental performance measures, origins of ideas, and finally the process by which management takes environmental decision. The variables were adapted from previous studies on environmental management in automobile manufacturers (Zhu, Sarkis and Lai, 2007). Besides personal interviews, secondary data about the company's environmental initiatives was collated in conjunction with items in the business press, in order to better contextualise the external pressure and possible drivers for the green operations strategy.

It is important to highlight the fact that this study is part of a broader research project, in which the authors are testing an environmental decision making model developed under the principles of systems thinking. Thus, this paper reveals only the primary data that were collected and the discussions raised from the exploratory research, together with a comparison against the mass-producers of cars.

As with most case study research there are issues of generalisability of the findings (Yin, 2003). In this investigation it relates to theory building on green operations and environmental decision making for car manufacture rather than to the results from previous studies that have focused largely on the achievements of companies after the implementation of environmental initiatives.

Findings

Our findings are based on primary data from personal interviews with the Environmental Manager as well as secondary data from corporative reports, including internal environmental reports.

Company and interviewee profiles

The case company is a British luxury car manufacturer that is part of an international automotive group. We have given the fictitious name of ***"Waltham"*** to the company and ***"Popular Cars Group (PCG)"*** to the automotive group it belongs to.

Waltham is one of the major local employers and in 2008 the company's production exceeded 10 thousand cars. In the factory, the production of highly customised cars in low volumes creates a combination of factors that, together with the company's employment benefits, keeps the attendance rate for employees (or "associates") to 97.7%. The level of customisation reduces the amount of repetitive work and the low volume, coupled with high quality, although requiring enormous attention, demands less physical work and pressure from the assembly line associates. The turnover of associates at Waltham is around 3% per year. An internal report shows that manufacturing facilities occupy 50% of the covered area of the plant, i.e. 70,000 m^2 out of 140,000 m^2. The total site area is 335,000 m^2.

There are very few robots and most of the work undertaken in assembly is manual. Car bodies are manufactured and painted in the plant, but the press shop is located in another city. The factory also produces two types of engine, the W8 and W12.

The principal interviewee was the current Environmental Manager (EM) in the company. The EM has been working at Waltham since 1977. He has been responsible for several departments in the past as maintenance engineer, plant engineer, and technical engineer. He became the Environmental Manager at Waltham in October 2007.

According to the EM, Waltham had little to be proud of regarding its environmental performance in the past. A combination of old facilities and infrastructure (mainly out-of-date equipment) did not help the company in its figures for harmful emissions. A lot has been improved, but the plant is still close to the local council's permitted emission limits.

The EM believes that Waltham has improved a lot over the last 20 years. An Environmental Management System (EMS) is in place, and the company has moved from a situation of simply legal compliance to a more ethical and environmental position. "In the beginning, the main drivers were legal compliance and cost savings. Some of ethics and environmental issues were a motivation. Now, ethics and environmental argument has become top of the reasons for what we do".

The EM explains that his role today is to make Waltham's Environmental Management System (EMS) meet its environmental objectives and goals.

Drivers, justification and support for actions

A milestone for the environmental initiatives taken by the company was the acquisition by the Popular Cars Group (PCG) in the 1990s. Although only in 2007 PCG Principles were formally applied to Waltham, the initial investments (£120 million) contributed considerably to the alterations in the plant, and therefore to its environmental improvements. As Waltham is still repaying PCG for its investments, PCG has a big influence on what Waltham does today.

The justification for environmental initiatives includes the need for more efficient technologies to achieve better environmental performance, mainly to stay ahead of the environmental legislation (the city council's emissions limits), rapid return on investments and cost reduction. Also, being part of an international Group raised awareness about benchmarks and environmental management systems standards.

For example, the ISO 14001 EMS was implemented in 1999 and the reasons behind this initiative was basically because it was the standard across the globe as well as the best system they could have for controlling the environmental aspects in the plant. In the early 1990s, Waltham was producing around 1,400 cars a year, mostly old models under the roof of an old infrastructure. At that time, the company was facing financial problems so the environmental technologies and initiatives needed to have a good return on their investment.

Further to the involvement of PCG in Waltham's strategic decisions, an important adjustment for environmental projects' payback time broadened the horizons for "green" investments. The payback was extended from 2 years (still used for "normal" projects) to 5 years. This would play an important role as the teams previously had to be very intuitive about how an environmental investment would perform over such a short period.

Process of environmental decision making

Regarding the decision making process, the decisions are usually taken by hybrid teams. The EM says that these teams are composed of "appropriate people" (i.e. people whose department is related to the decision). For instance, maintenance, environment, small projects and production planning are often among the departments that have representation in the decision making teams. So far, there is not a structured approach to take environmental decisions although an improvement model is in the course of being introduced in order to aid the strategic and operational decisions.

The improvement model is still in a conceptual stage but it seeks to integrate strategically the engineering and business plans. Also, the model should take into consideration short term activities such as recycling, energy saving and materials as well as long-term leadership action to make Waltham a credible green company.

Origin of ideas

The ideas that result in environmental initiatives at Waltham come from different sources: external consultants, in-house experts, local teams and a PCG "best practices database". External consultants are more involved with strategic decisions and highly specialised technical solutions for operations (e.g. they are also used in the implementation of new technologies). On the other hand, local teams participate in waste minimisation challenges to identify potential savings in the plant regardless of their department.

Those local teams are involved in a programme called "environmental champions on site". For instance, in production, they have a monthly meeting to present "ideas to save". According to the EM, this changes peoples' behaviour, not only in the top administration but everywhere in the company. As a concrete result it was estimated that £120,000 per year was saved in energy costs due to the environmental champions' challenges.

In addition to these sources of ideas, a survey is also used to foster and collect environmental initiatives.

Environmental Initiatives, performance measures and benefits

Waltham has been certified with an ISO 14001 EMS for about 10 years. The EM also says it is his responsibility that Waltham meets the Popular Car Group‘s Environmental Principles. He also reveals that Waltham has joint the PCG group database for knowledge sharing recently and as a benchmark Waltham scored higher than some other PCG units.

Environmental initiatives in Waltham include ISO 14001 EMS, and minimisation of CO2 emissions, water usage, energy utilisation, and waste generation. Besides CO2 emissions, energy, water and waste, there are other key performance indicators for the plant such as green travel and car parking.

More specifically relating to Waltham’s manufacturing processes, the paint shop uses water-borne systems to reduce to use of solvents. Some of the key processes have individual metering to check their environmental performance, e.g. those that emit Volatile Organic Compounds (VOCs) or use solvents etc.

Investments in boilerhouse technology have proved effective in reducing fuel consumption by 31% from 1999 to 2006, even though a second shift was started in 2002. In addition, despite production having increased by more than 500% from 1998 to 2007, the total energy used was reduced by 28% and energy used per car by 86%. Following a similar pattern, absolute plant CO2 emissions were reduced by 23% while plant emissions per car fell by 85%. Also total water consumption, water used per car and total waste produced were reduced by 28%, 86% and 86% respectively. Waltham’s 2008 status within PCG recognises these environmental achievements and the legal compliance of permitted processes.

With respect to Waltham’s future strategy, its short term goals include a further reduction in plant carbon emissions per car by 20% compared to 2006 through continued cross functional energy team activities.

Waste management is another important programme in Waltham’s EMS. There is an environmental goal of making 85% of all waste go to recycling or for reuse purposes rather than landfill disposal. Today, this rate is around 65%. Another example of waste management is provided by the recognition of the value of leather as by-product. All the leather waste is commercialised and sold locally. Also, total waste recycled has increased by 66%.

Waltham’s Environmental Strategy 2008-2017 encompasses its long term goals under the motto to be a world-class sustainable manufacturer.

Together with the environmental concerns, there are goals for health and safety issues. The company had an 85% reduction in incidents between 2001 and 2006, which reflects a highly positive approach to the management and control of onsite environmental aspects.

Discussion of findings

Based upon the primary data and results shown in the environmental reports, we can note the company has been experiencing a positive change in its environmental awareness and attitudes. While in the past there was a lack of initiatives, in the past 10 years the company has been investing with a more balanced view of environmental-economic concerns. Although the main objectives for manufacturing continue to be compliance to environmental legislation and cost reduction, there is a better understanding of how low environmental performance can damage the image of the company, and no less important, about the opportunities of higher manufacturing performance, cost reductions, and better productivity.

Now, being part of a wider international automotive group, Waltham has had access to greater investment in order to improve the old infrastructure, and as a result of this, to improve environmental performance. The group has also enhanced the access knowledge for a greener manufacturing and provides environmental benchmarks. Nevertheless, the company has only had recently had access to the data base for sharing knowledge with other companies in the group. From this the pressure to be more competitive and reduce costs continues to be applied more strongly, although the environmental project has an extended payback which increases the possibilities for environmental-friendly technologies for manufacturing processes, mainly when do not meet short-term return on investment goals. This is particularly important since the literature discusses whether win-win alternatives will not always be possible (Orsato, 2006).

In fact, due to the number of variables included in the decision making process for greener manufacturing, the company looks for a formal structure to take strategic environmental decisions since it has not had one so far.

The primary data reveals that the company obtains help from consultants for strategic decisions, specialists and in-house experts for technical issues, mostly tactical decisions, and finally internal personnel contribute for operational decisions ("ideas to save").

The environmental and economic gains are indeed impressive; but they are likely to be high because of the lack of initiatives in the beginning – much in the same way as it happened with the high-volume manufacturers (see next section). Moreover, the relative gains per unit are also high due the low production volume, which could increase 500% in 10 years. This demonstrates the potential for low-volume luxury goods manufacturers when implementing environmental initiatives.

Comparative analysis of findings against high-volume manufacturers

Toyota is regarded as the most efficient automotive company and was rated with the highest sustainable value in the IZT study (Hahn, Figge and Barkemeyer, 2008). For this reason, Toyota has been chosen to illustrate the historical evolution in production and production emissions as the benchmark for high-volume manufacturers. From 1998 to 2007 Toyota increased its production by 84.18% and reduced total CO_2 emissions in production by 24.53%. The production emissions per car were also reduced by 52.58%. Table 1 presents the production and emissions figures for Toyota.

Table 1 – Figures of Toyota Motor Corporation for production, total CO_2 emissions and emissions per car (Toyota, 2007 and 2008)

Toyota			
	1998	**2007**	**Δ%**
Production Worldwide (millions)	4.6340	8.5347	84.18%
Total CO_2 emissions (millions of tonnes)*	2.12	1.60	-24.53%
Emissions per car (in tonnes)**	291	138	-52.58%*

* These numbers include the emissions from production and non-production sites; however, production is responsible for about 95% in 1998 and about 87,5% in 2008 of the total emissions.

** These numbers are accordingly to Toyota's environmental report – note that for some reason they do not match to the ratio CO_2 / Production

On the other hand, the luxury car manufacturer Waltham increased production by 506% from 1998 to 2007, almost 600 times more than Toyota. From 2000 to 2007, production increased by 383%, while total emissions reduced by 24.82% and emissions per car by 84.44%. Although having a similar reduction for total emissions, the luxury

car manufacturer was able to reduce even more per unit in a shorter period of time than Toyota (see table 2).

Table 2 – Figures of Waltham for production increase and reduction of total CO_2 emissions and emissions per car (from Waltham's environmental report 2007)

Waltham	
	Δ% (between 2007 and 2000)
Production	383.01%
Total CO_2 emissions	-24.82%
Emissions per car	-84.44%

We would argue that the difference in the emissions per car between the two companies can be explained by three major reasons: outsourcing of key manufacturing processes such as the press shop, level of automation, and finally, effluent and water treatment stations.

Despite having a similar reduction pattern in a shorter period of time, and even higher reduction in the CO2 emissions per car, based on their environmental reports it seems that companies such as Toyota, and also General Motors, have been implementing more sophisticated environmental initiatives than the luxury car manufacturer in our case study, including the use of alternative energy (solar and wind power) in production and non-production sites.

For example, Toyota's Sustainability Report (2007) shows that to reduce the environmental impact from its production sites and processes it has adopted initiatives such purchasing of green (wind-generated) power, personnel training on green issues, and reduction and recycling initiatives. Reduction initiatives relate to water and energy, materials and toxic substances. The main source of environmental impact in production is usually the paint shop, so one of the main improvements was achieved when Toyota converted its topcoat paints to a water-borne type. Similar innovative techniques were applied to reduce VOC emissions from cleaning solvents through the substitution of conventional cleaning solvents with water-borne types.

According to the report, Toyota had achieved zero landfill waste at its production plants by December 2000. Moreover, it has promoted efforts to recycle the entire volume of fly ash generated by its incineration furnaces as raw material for the cement industry rather than sending it to landfill. Also, Toyota has started to evaluate methods for recycling the small quantities of difficult-to-process waste currently being sent to landfill. In order to strengthen environmental responses and at the same time ensure transparency of initiatives, Toyota constantly renews ISO 14001 certification at all major plants and housing works in Japan, as well as in specific areas such as engineering, production engineering and logistics.

General Motors' new Lansing Delta Township Assembly Plant, for example, has received a gold certification from the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program (General Motors, 2007). According to GM's environmental report, the building is the only automotive manufacturing plant in the world, as well as the largest facility and the most complex manufacturing site, to ever receive any level of LEED certification. In addition, "green building" certification and concepts are being applied to the company's non-manufacturing facilities. GM has also embraced the use of solar panels, installing them on the roof of some their buildings. Also, for powering its facilities, GM participates in the US EPA (Environmental Protection Agency) Landfill Methane Outreach Programme, a voluntary programme to use landfill gas for plant heating and electrical generation.

The EM in Waltham thinks it will not be easy for its plant to be an environmental leader in the automotive sector. Literature on the car industry and sustainability shows that small plants working with a different business model (such as product-service systems) may be in the vanguard for green leadership in car manufacturing (Wells and Orsato, 2005). However, most conventional factories may need a bigger effort in pursuing this goal.

Conclusions and limitations

Manufacturing strategy researchers have identified the need to include environmental issues in their studies. For example Dangayach and Deshmukh (2001) undertook a literature review on the topic of manufacturing strategy and they warned of the need for more progress with research related to manufacturing strategies in the context of green manufacturing. Van Hoek (2002) also discusses the integration of environmental issues and business strategy, which could be understood as a call for an extension of Hill's studies to include environmental issues, as part of the alignment of corporative objectives, marketing and operations strategy (Hill, 1993).

In undertaking the investigations for this paper we had the opportunity of looking in loco at how a manufacturing environmental strategy is being implemented in a luxury car manufacturer in Britain. We have found that the role of ownership change may play an important part in introducing environmental concerns into the manufacturing strategy agenda. Also, this study shows that luxury car manufacturers may accommodate better to the daunting task of increasing production and reducing emissions simultaneously due to their low-volume production systems. Although we did not investigate product-based initiatives, we could infer from the history of technological development for safety and advanced driving features that luxury car manufacturers may play a strategic role in building a greener car. Luxury cars can serve for experimentation and maturation of green technologies, and therefore, test eco-materials, clean fuels, etc. Indeed, those possible changes in the product will affect manufacturing processes and this is where luxury car manufacturers could become a platform for process-based environmental excellence – perhaps including a new concept of small factories suggested by Williams (2006) and Wells and Nieuwenhuis (2006).

Nevertheless, as mentioned previously, the figures for reductions in waste, energy and water might not be replicated if another company in a different market segment tries to implement the same environmental initiatives, and this is one of the limitations of our work. Other limitations relate to the single common approach of dealing within a similar business environment between the company and the group it belongs to. Nonetheless, this paper reinforces the idea that luxury goods manufacturers may be able to reduce emissions while increasing production more easily than high-volume manufacturing companies.

The practical implications begin with the fact manufacturers of luxury goods can pursue and benefit from environmental initiatives. Within the new competition context, luxury goods will also need to have an environmental-friendliness image associated with a brand, thereby, they will need to take better environmental decisions. Our future research includes the application of our environmental decision making model, which would help car companies in approaching this task.

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