Green Innovation Management in the Automotive Industry
Breno Nunes & David Bennett, Aston University, UK

The 21st century brought new concerns and pressures to the way companies innovate. If in the past innovation was predominantly driven by the intention of exceeding customers’ expectation or to create simpler and less costly processes; today many organisations are required to respond to environmental and social demands.

With regard to the environment, the major environmental concerns in the 21st century are: atmospheric pollution (and its consequences for human health, global warming and ozone layer depletion), scarcity of freshwater, raw material and land availability. All these environmental impacts have a great impact on how companies manage their business, and therefore, they are also a driver to innovation. For instance, the availability of land can create a pressure on the prices for land disposal, which “forces” organisations to innovate in order to reduce the waste from their production sites.

Within this new context for innovation management, we would define green innovation as those innovations in the products, processes or in the business model that lead the company to higher levels of environmental sustainability. A higher level of organisational environmental sustainability is reached by the minimisation of environmental impacts, and mainly by, the creation of positive impact on the environment.

Consequently, Green Innovation Management could be defined as the process to identify, implement and monitor new ideas that improve company’s environmental performance while enhancing its competitiveness. Identification includes not only the understanding of environmental demands (shortage of resources, new environmental legislations, public pressure, etc), but also customer’s requirements and acceptance of environmentally-friendly products, competitors’ actions, amongst other factors that need to be considered in the innovation of processes or products. Implementation refers to the development of the idea in the market. And finally, monitoring is the activity that should feedback the company about its green innovation in order to enhance the learning of innovating in sustainable way.

Green Innovation can happen either to respond to local or global environmental concerns or to construct an environmental leadership in the sector. Interestingly, Green Innovation can have ecological or economical motivation, and as other types of innovation, it can be incremental or radical.

In order to illustrate the management of green innovations, the automotive sector will be taken as an example. The automotive industry is one of the industries that have visibly suffered a strong demand for higher environmental performance. This industry have enjoyed years as the main source of employment and economic growth and still have a strong political influence; nevertheless, today it is being pointed out as one of the major contributors to air pollution in urban centres. Indeed, the benefits of cars are clear: they provide a door-to-door transportation system, the means to gaining access to life’s necessities and employment, and a source of pleasure and social status. However, despite these benefits there are environmental burdens as well: 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 (Vergragt, 2006). Thus, companies in the sector have been trying different strategies to overcome these challenges.

Looking back at the history, it is possible to note that the automobile industry has had few radical changes over the last 30 years. However, these few changes were often remarkable and had a significant impact on practice and academia. The mass production, Toyota Production System – “Just in Time” - and the modular consortium are important innovations from the production system perspective. Also, the transfer of the assembly plants to developing countries and global outsourcing are evident changes in the industry’s business and operations strategy. In addition, the automobile industry was the pioneer in the use of robots and it still is the main destination of the use of robotics, still being responsible for 60% of the total utilisation of robots in the world (The Economist, 2008).

Nevertheless, these changes have been insufficient to make the sector more sustainable. As evidence of this the automotive industry is still struggling against economic, environmental and social challenges. Orsato and Wells (2006) point out the many economic challenges currently facing the industry: notably over-capacity; saturated and fragmenting markets; capital intensity; and persistent problems with achieving adequate profitability. Strong dependence on fossil fuels and large consumption of raw material lead the environmental problems. As a result, in a near future, it is expected that the sector will face strong pressures and take initiatives in order to reduce the environmental burdens from car use and its production process.

Although the environmental impacts of the automotive industry are spread throughout the whole life cycle (e.g. production, use and the end of life of vehicles), the use of the cars is where there is the major energy consumption and emissions. Nevertheless, environmental pressures occur to reduce emissions and waste throughout production, use and end-of-life vehicles.

In this book, we tell the story of two different environmental innovation strategies used by two car manufacturers. Th!nk, a Scandinavian company, is the first company to be presented. We describe its story to introduce electric cars as a green personal mobility solution in urban centres. The second company is a well-know company for its innovative culture – BMW. This German car company innovated by implementing a multi-millionaire landfill gas-project for its production site in Spartanburg (USA), ending up in various environmental and economic gains.

References


www.wileyeurope.com/college/tidd
TH!NK – A green car innovator from Norway

In 1973, the oil crisis made Lars Ringdal, head of the company Bakkelitfabrikken A/S, in Aurskog (Norway), think of a cheap and ecological car to overcome the crisis. As oil crisis did not last much longer, the green project was sent to the grass...
The idea was back in the early 1990s and PIVCO, the Personal Independent Vehicle Company, was established to produce a prototype TH!NK. The car was used at the Winter Olympics at Lillehammer in 1994. Nonetheless, the company could not progress and went bust in 1999.

Because its experience of more than 20 years in developing electric cars, Pivco became attractive to Ford once California passed a law mandating that all car makers had to produce a certain proportion of vehicles with zero emission. The law was responding a series of reports on the smog effects on children’s health and 2% of the cars produced in 1998 should meet the new regulation. Ford, having no model of its own that could meet the new legislation, bought Pivco and invested to TH!NK be developed accordingly to EU/US safety regulation – a struggle to some electrical cars until nowadays.

As California’s zero emission law was scrapped after carmakers sued the state for infringing on the federal government’s sole rights to legislate on national fuel standards, Ford left the electric vehicle sector. This was 2003 and Pivco was by its own again although with a basic infrastructure and considerable competence acquired from its former American owners. The re-emergence of TH!NK came alike its creation purpose. A wave of environmentalism conscience and climate change has swamped the world for alternative mobility solution – definitely something that mirrored what the company was speaking for 30 years. Thus, in 2006, Norwegian investors bought the again bankrupted Scandinavian electric car company. Taking advantage of the momentum, the private investors received support from companies with logistics, marketing and design expertise. Even Porsche and Google were amongst those betting on the resurgence of a new concept of personal mobility. Particularly, Porsche has had an impact on TH!NK helping them to have an small but efficient assembly plant in Europe.

Today, TH!NK is considered ahead of the existing electric cars running on the streets of London, for instance. The main car of the company is called TH!NK City, with maximum speed is 62mph and has an 110 miles range. Its battery can be recharged in 8 hours via household electricity supply. In regard to battery servicing, TH!NK City needs to be serviced every 18 months against every six months of some competitors. The ecological features of the car also reflect in its composition. 16% of the car is made by recycled materials and 95% is recyclable.

The company considers itself not only a car company; but a personal mobility solution. Alongside producing a car that has simply no tailpipe emissions at all, the company offers a mobility pack, which the customer will pay a monthly mobility fee that includes a full maintenance service agreement and carbon offset payments. This would also make TH!NK take responsibility for battery performance throughout the cars life span, exchanging the battery if it is necessary). In addition, a separate franchising car sharing entity “TH!NK About” provides a fleet of TH!NK Citys, centrally placed at a number of stations around the city, where the cars are available for rental on an hourly basis. Customers can book online, via their mobile phones or simply pick a car up in a nearest station. A membership card will provide access to the vehicles through a system using RFID technology. The car should be returned at the agreed time and the drivers will receive the bill at the end of the month. Very much like

The market plan for TH!NK could not be more ambitious at this moment. They are targeting main European cities and US. Their new business model, improved battery technology and internet-based product offering are the new weapons to avoid going bankrupt again, and put electric cars back on the road.

www.wileyeurope.com/college/tidd
BMW receives Environmental award for its investments in clean energy

BMW is a German luxury car manufacturer. Its reputation in the automotive sector is regarded by its quality in process and products as well as its innovative capabilities. When globalising its operations to USA in order to be closer to its largest consumer market, BMW decided to bring the state-of-art technology building one of the most advanced car manufacturing facilities worldwide. The plant in Spartanburg (USA) was regarded by its innovation in the paint shop using water-borne systems. This fact already provided enormous benefits regarding the company’s environmental improvements, once the paint shop is the major source of environmental impacts amongst the car manufacturing processes. The use of water-borne systems reduced substantially the amount of solvents used in the processes, therefore, minimising the emissions of harmful substances to paint the cars.

This fact made BMW an environmental benchmark and although water-borne systems were already used in Germany, the US paint shop had new innovations. Forty percent of the total initial investment in Spartanburg was for the paint shop. The water-borne system was environmentally safer but trickier to launch and operate. It was also challenging because BMW was the first car manufacturer to use water-based paint on four of the five paint layers. The company had to study Harley-Davidson’s success with powder coating and GM’s ground-breaking acrylic powder system.

Because of its paint shop BMW plant in Spartanburg got a green reputation from its birth. It was the first water-based paint shop in USA and the main environmental benefit was the reduction in the emissions of Volatile Organic Compounds (VOC). As environmentally-sound solutions need to accomplish with quality and profitability constraints, the water-based paint shop also avoided investments on pollution control equipment and a better coverage to the car bodies. Today, Spartanburg houses the oldest paint shop of BMW group.

But BMW environmental investments did not stop with the paint shop. A daunting environmental project was in course with the idea of using landfill gas to have combined heat and power for BMW’s production facilities. The idea came from a voluntary programme of US EPA (Environmental Protection Agency).

After US EPA knocked BMW’s door in 1999, explaining the existence and opportunities of Palmetto Landfill, the project was sent to Germany for approval because it was a significant investment requiring Munich’s head-quarter appraisal. After receiving the green light from the head-quarter, the group spent the next two years planning, looking for partners, and finally, in December of 2002, the turbines were burning landfill gas.

During the planning phase, BMW had in mind a very clear picture that it is a car manufacturer and it would not be strategic to address people and effort in some activities of project that BMW does not have expertise; thus, long term partners for construction and operation of the power plant needed to be found. Indeed, there were barriers to implement the project, but the major challenge was the lack of technical knowledge about the operations of an energy supply system as energy is one of the most critical inputs for a manufacturing plant.

References
http://www.think.no
Dresser-Rand provided the gas turbines and the technology to power unit at BMW plant. Ameresco designed, built, and own the pipeline, gas processing and gas compression facilities, which connect the Palmetto Landfill via a 9.5 mile pipeline to BMW’s manufacturing facility. Once completed, Ameresco have been managing the overall operations of the project. What is more, Palmetto Landfill is the gas generator in the project, which basically shows how each partner in this projected were focused on their core competences.

The landfill gas project makes BMW to reduce an emission of 60,000 tons of CO₂ and save one million dollars every year. Having four turbines producing electricity and heat to the plant from the combustion of methane generated from waste also gave BMW operational stability from the financial perspective. BMW signed a 20-year contract, which guarantees costs reduction and price stability for its operations. On the other hand, an Equipment Services associate of group explains that the landfill gas is produced organically and composed of 50% of methane, producing 530 BTU per cubic foot, while natural gas, the fuel used before, is composed of 90% of methane and produces 1,000 BTU per cubic foot. Although the landfill gas supply can vary during the day and is less reliable than the industrial natural gas supply, the operational instability does not create major difficulties as BMW keeps a “back-up” system to inject natural gas and maintain the pressure and energy supply to the plant.

Those initiatives also improved BMW’s image. The company is a charter member of the EPA’s National Environmental Achievement Track that recognizes companies for their environmental stewardship and performance. The company is also a member of the South Carolina Environmental Excellence Program and is on the Dow Jones Sustainability Group Index, which rates environmentally friendly companies.

BMW manufacturing reduce carbon dioxide emissions equivalent to removing 61,000 automobiles from US highways. Today, 63% of its energy needs is supplied by recycled methane gas. It is a two-fold benefit once it captures methane that would be wasted or burned without any utilisation, improving local air quality, while reducing the consumption of industrialised natural gas, and its consequent burn CO₂ emissions.

BMW Manufacturing in Spartanburg (South Carolina) expanded its landfill gas project used for powering and heating its plant to fuelling its paint shop operations, becoming the first company in the world to do so. That work earned it the Energy Partner of the Year award. Interestingly, the paint shop being the largest consumer of energy in the plant and as 100% of its energy comes from burning landfill gas, makes Spartanburg to hold the oldest paint shop of the BMW Group, but probably also the greenest one.

References
http://www.bmwusfactory.com/community/environment/gastoenergy.asp
http://www.epa.gov/lmop/
http://www.epa.gov/landfill/proj/prof/profile/bmwmanufacturinglandfillg.htm
A. Questions for discussion

1. Draw a comparison between the innovation management processes of BMW and Th!nk. How different are they?

2. Discuss the following issues in the way BMW and Th!nk manage their green innovations:
   • The risk of innovation
   • Potential for environmental impact minimisation
   • Their possible major motivation for going green
   • The origin of their green ideas
   • Breadth of their innovation.

Alternatively, we could explore both cases separately, as follows:

B. Questions and Exercises for Th!nk’s story:

1. What were the main innovations of Th!nk presented in the case?
2. What are the characteristics of their innovation? What could you say about their process of managing green innovations?
3. Where the ideas came from?
4. How risky is Th!nk innovations?
5. Why did Th!nk innovate in the product and in the business model? What’s special and relevant on this?

C. Questions and Exercises for BMW’s story:

1. What were the main green innovations of BMW presented in the case?
2. What are the characteristics of their innovation? What could you say about their process of managing green innovations?
3. What was the role of the US EPA (Environmental Protection Agency) in BMW’s innovation process?
4. How risky was BMW landfill gas project? How did they manage it?
5. What are the main environmental benefits from BMW’s investment in green technology?

Guideline Answers to support the instructors

A. Questions for discussion

1. Draw a comparison between the innovation management processes of BMW and Th!nk. How different are they?

From the companies’ stories, it is possible to see that while Th!nk is an ambitious company that want to solve the problems related to personal mobility; BMW’s investments focused on process technology.

Th!nk innovates in the product using better batteries to allow electric car to be competitive and a viable solution for those people who want to have an “green driving”. Cars can be charged at home or in a parking lot. The company also offer a mobility pack and other
environmental benefits such as carbon offset. The business is linked to a car sharing entity that, although it is a separated franchising, uses the brand name TH!NK. Thus, Th!nk is trying to take advantage of the environmental awareness and stricter environmental regulations to boost their business. Nevertheless, it is a very risky investments and the company has bankrupted several times.

The environmental investments of BMW presented in the case are addressing process improvements and energy consumption of the production site. The innovations were incremental once they were already used in other plants and sectors.

One could argue that the paint shop new technology is an investment in advanced technology in itself rather than an environmental investment. However, as it has strong environmental benefits and it minimises the pollution from the paint shop, which is the major source of environmental impacts in the car manufacturing plants. In fact, the benefits are both economic and environmental. While reducing emissions of VOC, it reduces costs with solvents and investments in pollution control equipment.

The other investment in the landfill gas project has interesting particularities. First, it is a voluntary programme from the Environmental protection agency of US. So, the idea came from outside. BMW preferred not to take responsibility for the areas of the project that were not related to their core competence of cars production; so other expert companies in the field play important role in the project. The energy from the landfill is used to heat and power and the main environmental benefits refer to the minimisation of methane emissions to the atmosphere and the use of natural gas too. The investments have benefits for the local air quality and reduce greenhouse gas emissions. Although large amounts of money were invested, the innovation is less risky than green radical innovations in the product because they had great potential for cost reduction and controllable implication to quality of their cars.

2. Discuss the following issues in the way BMW and Th!nk manage their green innovations:

<table>
<thead>
<tr>
<th></th>
<th>Th!nk</th>
<th>BMW</th>
</tr>
</thead>
<tbody>
<tr>
<td>The risk of innovation</td>
<td>Very High</td>
<td>Moderate, Low</td>
</tr>
<tr>
<td>Potential for environmental</td>
<td>Very high – change in mobility systems,</td>
<td>Significant reduction of</td>
</tr>
<tr>
<td>impact minimisation</td>
<td>atmospheric pollution in urban centres.</td>
<td>local and global</td>
</tr>
<tr>
<td></td>
<td>The environmental benefits will happen</td>
<td>environmental impacts</td>
</tr>
<tr>
<td></td>
<td>where the car is used.</td>
<td>(air and water emissions).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The environmental benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>will happen where the car</td>
</tr>
<tr>
<td></td>
<td></td>
<td>is produced</td>
</tr>
<tr>
<td>Their possible major</td>
<td>Oil crisis, environmentalist values</td>
<td>Economic-environmental</td>
</tr>
<tr>
<td>motivation for going green</td>
<td></td>
<td>motivation, cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reduction, image</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management</td>
</tr>
<tr>
<td>The origin of their green</td>
<td>In-home ideas and Porsche for some process</td>
<td>Munich (BMW’s headquarter),</td>
</tr>
<tr>
<td>ideas</td>
<td>improvements (efficiency)</td>
<td>US EPA</td>
</tr>
<tr>
<td>Breadth of their innovation.</td>
<td>Product and business Model</td>
<td>Paint shop and energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>supply to manufacturing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Processes</td>
</tr>
</tbody>
</table>