Integrated Product Policy in the automobile industry

policies, strategies and challenges

Smink, Carla; Nielsen, Eskild Holm

Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

AALBORG UNIVERSITY

Carla K. Smink and Eskild Holm Nielsen

Integrated Product Policy in the automobile industry – policies, strategies and challenges

No. 2009-4
ISSN 1397-3169-pdf

PUBLICATION*SERIES*
DEPARTMENT OF DEVELOPMENT AND PLANNING

Integrated Product Policy in the automobile industry
– policies, strategies and challenges

Publication series 2009-4
ISSN 1397-3169-pdf

Department of Development and Planning
Aalborg University
Fibigerstraede 11-13
DK-9220 Aalborg

Integrated Product Policy in the automobile industry – policies, strategies and challenges

Carla K. Smink and Eskild Holm Nielsen

Abstract

The importance of a move towards sustainable production and consumption patterns has been topical since the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The increasing significance of production and consumption issues goes along with a transformation from a government to governance approach in environmental policy (Scheer and Rubik, 2006). Scheer and Rubik (2006: 11) judge this a 'traditional' environmental policy approach against a 'modern' environmental approach. Integrated Product Policy (IPP) exemplifies this new paradigm in environmental policy.

In this article, it will be analysed how and in what way IPP has been applied in the automotive product chain. The automotive industry currently faces increasing regulatory pressure to improve both its methods in production and the sustainability of its products. Many automobile manufacturers have adopted proactive environmental strategies and it is common practice to implement an Environmental Management System (EMS) at the production facilities. However, seen from a life cycle perspective, the automobile has an impact on the environment at each stage. The automobile is considered to be one of the most polluting consumer products.

1. Challenges and opportunities

In the developed world, the automobile is the principal means of personal transport. Without doubt, this will also become the case in developing countries in the 21st century. Historical data are consistent the world over: when incomes rise, people buy cars (MIT, 2001). In the EU, car ownership is growing even faster than per capita income (EEA, 2003). With this increase in car ownership, people have become more mobile, which has led to an increase in commuting. In Denmark for example, the average adult travels 35.5 kilometres a day, and commuting accounts for 30% of this, while the remaining transport is for leisure activities, shopping and other activities (Danish Transport Council, 2000).

Transport is vital for modern lifestyle. From an environmental point of view, transportation uses a significant amount of non-renewable resources. In Europe, the transport sector is one of the most polluting sectors in terms of CO_2 emissions, even though automobiles have become more effective in terms of CO_2 emissions. European individual automobiles today produce only around a tenth as much pollution for every kilometre driven as they did 35 years ago (Zaccaï, 2006). But environmental impacts are not really reducing because the steadily increasing number of automobiles on the road has outbalanced these improvements. A WHO study shows that health effects of transport-related air pollution in urban areas have increased substantially, and it is estimated that more than ten thousands people in the EU die each year because of transport-related air pollution (Krzyzanowski et al., 2005). Understandably, if emissions are not reduced, the current and the expected increase in the number of vehicles on the roads will have a huge impact on aspects such as human health and global warming.

Within an automobile's life cycle, the use-phase makes the greatest impact on the environment. Therefore, product development often focuses - among other things - on reducing climate-relevant

emissions during the use-phase. The remaining environmental impacts are shared by production and disposal or recycling.

All these issues discussed above do also make clear that a strict focus on products (here: the automobile) is not suitable to deal with the challenge of sustainable production and consumption. Or as Nuij (2006: 181) argues, "a better starting point would be the societal functions that are fulfilled by the combination of products and services such as (…) transport. At this level people make the choices between taking the car or the train (…) and it is here that large potential improvements could be realised". Nevertheless, in this article we will analyse how and in what way IPP has been applied in the automotive industry. From an environmental point of view, the automobile – as a product – can still be improved and become significant more efficient.

2. Modernisation of environmental policy: from government to governance approach

In order to reduce environmental impacts from products the EU has adopted the Integrated Product Policy (IPP) strategy, which is one of the cornerstones in the 6th Environmental Action Programme. The IPP framework reflects a preference from less command and control regulation towards more economic and voluntary instruments and from less end-of-pipe towards more precautionary and internal production-process approaches (European Commission, 2001b). With this, IPP reflects a new paradigm in environmental policy: a transformation from a government to governance approach in environmental policy. Scheer and Rubik (2006: 11) judge this a 'traditional' environmental policy approach against a 'modern' environmental approach (see table 1).

	'Traditional' environmental policy	**'Modern' environmental policy**
Political guideline	Control of risks and damages	Sustainability
Main policy principle	Command and control	Push and pull
Responsible actors	Government	Society ('shared responsibility')
Type of policy	Confrontation	Co-operation
Issues	Separation of issues, single issues	Integration of issues, system issues
Behaviour principle	Reactive behaviour	(Pro) active behaviour
Regulation principle	Government regulation, governmental control	Self-regulation, self-control, self-organisation

Table 1 Idealised characterisation of trends of environmental policy approaches (Scheer and Rubik, 2006: 11)

IPP is an example of the "modern" environmental policy approach. It is possible to express IPP in five key principles (European Commission, 2003: 5):

1. Continuous Improvement
2. Life Cycle Thinking
3. Stakeholder Involvement;
4. A Variety of Policy Instruments
5. Working with the market

Together, these five principles look at the whole of a product's life cycle, from cradle to grave. In other words, environmental impacts throughout the life cycle are addressed in an integrated way – and are not shifted from one part of the life cycle to another (European Commission, 2003). In the following sections, it will be analysed how the automobile industry has applied continuous improvement and life cycle thinking in the process of 'greening' the automobile. Furthermore, it will be analysed how the other principles of IPP (i.e. stakeholder involvement, a variety of policy instruments and working with the market) have influenced and involved the automobile industry. This distinction represents both the environmental side as well as the organisational aspects.

At present, the EU IPP policy is still fragmented, lacking data and mostly on a voluntary basis (Scheuer, 2005). Nuij (2006: 177) argues that 'ever since the start of discussions about a product policy in the Community, the Commission has struggled to present a clear vision of its aims and objectives and, more importantly, of the ways in which these were to be achieved. Instead of becoming clearer and stronger, IPP seems to have become more vague and weaker'. We will come back to some major weaknesses, as distinguished by Nuij (2006), later. However, according to Scheuer (2005), the political agreement of April 2005 on the Ecodesign framework for Energy Using Products is an important step towards establishing legislative product policy. However, EU's IPP strategy has so far failed to materialise in any concrete form (Scheuer, 2005: 262).

3. Analysis of the environmental improvements of products: the automobile

It will be a huge challenge for the automobile industry to implement an IPP *strategy*. Several reasons can be mentioned that support this assumption. In the first place, so far, environmental regulations aimed at the automobile industry have been merely directed at single production phases of the automobile: raw materials extracting and processing phase, manufacturing phase, in-use phase and the dismantling phase. There is no area of the life cycle of the automobile, which is not subject to regulation. However, a holistic approach that aims at the interconnections between the different areas is currently lacking. In the second place, environmental regulation aimed at the automobile industry has been dominated by command and control regulation (e.g. IPPC permit, emission limit values, taxes on the use of virgin materials and so on). The dominant environmental discourse in the era of command and control has been based on a process-oriented strategy and it has neglected the product dimension (Smink, 2002). Nevertheless, the command and control paradigm has been successful. For example, since the 1960s tailpipe emissions have been reduced by 90-95%. However, these emission reductions have largely been realised through technological advances. In the third place, the automobile product chain consists of two more or less independent networks: a production network and a use-, recycling and disposal network. Co-operation and communication between the two networks are not institutionalised (Smink, 2002). Finally, consumer demand for 'greener' cars is still limited. Consumers in especially industrialised countries tend to buy bigger and heavier cars.

In order to analyse how and in what way IPP has been applied in the automotive industry we will present a model that will be used as a framework for understanding the relations within companies and between product chain actors. Figure 1 presents a simplified model of a product life cycle of a single product. As shown in the figure, materials and services, information and value/money flow throughout the product chain. So far, attention has been paid mainly towards the flow of materials, e.g. life-cycle assessment (LCA). However, the value and money flow is important as well (Smink et al., 2006). For example, it is important to know what expectations consumers have about a product's environmental characteristics, and how consumers rate environmental considerations related to other aspects such as price, quality, functionality, design etc. (Danish EPA, 2003). A major challenge is to connect the links in the product chain in order to focus on both environmental optimisation of the material flow in the supplier chain and on the consumer's expectations regarding environmental considerations in the value chain. Ideally, information exchange between all stakeholders involved will build connections between the supplier chain and the value chain (Danish EPA, 2003). To make information broadly accessible, information agencies, public Internet-based databases and other forms of publications can make large contributions (Illge et al., 2001). Since the automobile product life cycle is global in scope, informational instruments are needed on the global level to involve all stakeholders.

Figure 1 will also be used to analyse initiatives to implement IPP in the automobile product chain at three different levels: the micro, meso and macro level. The automobile product life cycle is highly complex and global in scope; therefore, national governments may have only a limited ability to influence product development. At the macro level, focus will be on the role of the government in implementing and facilitating IPP. Government is only one of the actors related to the product chain. Due to time restrictions, we will not pay attention to other relevant stakeholders (e.g. trade unions, NGOs or political parties). A major challenge for governments in implementing and facilitating IPP is to promote 'Life Cycle Thinking' and 'Stakeholder Involvement'. 'A Variety of Policy Instruments' will in this article be used as the way in which government facilitates IPP.
'Life Cycle Thinking' and 'Stakeholder Involvement' will also be analysed at meso level. The meso level refers to the product chain. That is how product chain actors – those actors that do have a commercial relationship to each other – co-operate, exchange information, make demands on each other and so on in order to produce 'greener' products. Obviously, there is an interaction between the macro and meso level.
Finally, at the micro level, we will pay attention to how automobile manufacturers have strived towards "Continuous Improvements". Due to insufficient empirical material, we will at the micro level not deal with "Working with the Market". Ideally, there is also an interaction between the micro level and the meso/macro level. It is our hypothesis that the more interaction between the different levels, the more an IPP *strategy* has been implemented.

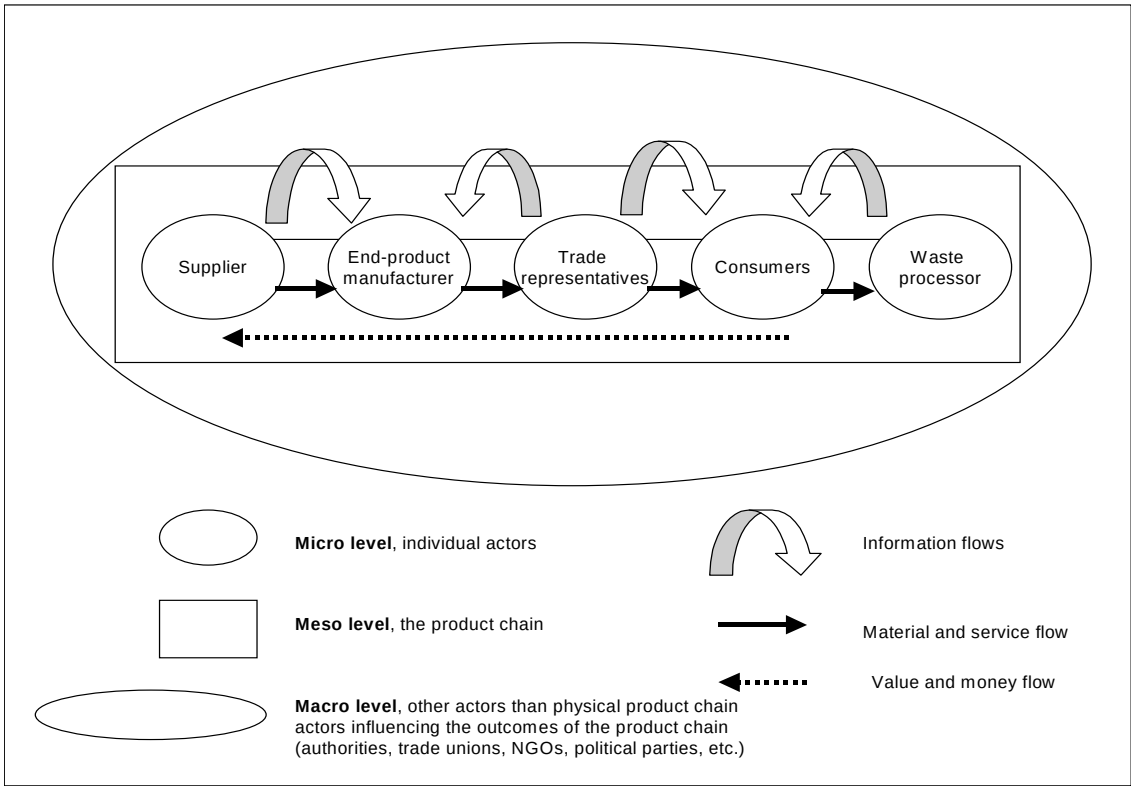

Figure 1 Different levels of analysis of the environmental improvement of products (adapted to Kärnä, 1999: 27)

4. Continuous improvement and life cycle thinking

In this section, we will pay attention to how automobile manufacturers have strived towards continuous improvement and life cycle thinking. According to the Commission's Communication on IPP (European Commission, 2003: 5) '*can improvements often be made to decrease a product's environmental impacts across its life-cycle, whether in design, manufacture, use or disposal, taking into account the parameters set by the market. IPP aims for a continuous improvement in these rather than setting a precise threshold to be attained. As a result, companies can set their own pace and can focus on the most efficient improvements'*.

In our viewpoint, continuous improvement represents the physical improvements of environmental performance. Environmental continuous improvements can be obtained by applying cleaner production in each phase of the product chain. Cleaner Production can be divided in the following stages:

1. Good housekeeping
2. Substitution of raw materials
3. Technical optimisation of production
4. Radical change of productions processes
5. Cleaner products and services (advanced product design)

Continuous improvements can be achieved by applying cleaner production. The first four stages must be addressed in each phase of the product chain, whereas cleaner products can be achieved by incorporating environmental concern into designing the product. Life Cycle Management system (LCM) can be used to secure application of the cleaner production categories in the product chain.

So far, the automobile manufacturers have concentrated on the implementation of Environmental Management Systems (EMS) in their production facilities and to a certain extent of their tier-one suppliers (see also below).

Continuous environmental improvement requires incentives for manufacturers to make new product generations greener than their predecessors (European Commission, 2003). These incentives can be triggered by public environmental regulations (we will come back to this later), self-regulation and market regulations. At the micro level, company-specific features are important as well. These company-specific characteristics lead to different initial conditions of the companies in terms of their innovation activities, and these different conditions can explain the different effects and intensities of the determinants and effect of product-specific environmental innovations (Rehfeld, 2006: 304).

Table 2 shows various instruments implemented by the automobile industry in order to decrease the automobile's environmental impacts across its life cycle. Many of the instruments mentioned in the table do have an impact within the whole product chain. Most of these instruments are targeted towards environmental improvements in a number of phases within the product chain and thereby include different levels and actors. The significance of environmental improvements depends on the automobile manufacturer's ambition on product orientation. Automobile manufacturers can choose an incremental approach by redesigning their automobiles or they can choose to create totally new products – a technological break through. The targets for environmental improvement set by automobile manufacturers, based on the company-specific features, reflect different levels of ambition and different approaches: manufacture without producing hazardous waste, reduce product energy consumption, increase the use of recycled materials and reused components or improving the recyclability of products. Of course, public environmental regulations do already regulate most of these aspects, but automobile manufacturers can choose to move beyond compliance. In terms of cleaner production, manufacturers can make changes to the process design, to the material design and/or to the energy efficiency design.

Development	**Production**	**Use**	**Recovery**
Design for Recycling (DfR) Fuel efficiency programmes Design for the Environment (DfE) Design for Disassembly (DfD)	Use of recycled materials Certified EMS	Dealership waste management Spare parts	Market-base ELV-recovery Dismantling manuals

Table 2 Examples of product-oriented initiatives

To a large extent, automobile manufacturers have created many product-oriented initiatives in their corporate strategies. Most of the initiatives mentioned in table 2 have been implemented as single initiatives and are more or less uncoordinated with other environmental efforts. It is symptomatic that none of automobile manufacturers have implemented integrated product-oriented system covering the whole product chain. For example, at the corporate level, BMW has a number of environmental programmes, which can be labelled product-oriented initiatives and which aim at continuous improvement. Examples are programmes on Mobility, Life Cycle Assessment (LCA), Design for Recycling (DfR), Design for the Environment (DfE) and Design for Disassembly (DfD). All these programmes are placed in the Research and Development division. However, these different environmental programmes are organised in a fragmented way. The activities are not yet

incorporated in all divisions and all sites of the BMW Group. Different initiatives are taken at each production facility. For example, so far, DfR has only been an issue within the Research and Development division. Furthermore, BMW is working on a LCA. As we will come back to later, in a new series BMW, introduced in autumn 2004, steel has been replaced by aluminium. This means, unfortunately, that water consumption in the production phase has increased (see Table 3). This example shows that LCA has 'not' functioned, as the EMS will not allow an increase in water consumption. The LCA is used as an analytical tool for specific development issues. So far, two persons in the development department and two in the waste department use LCA. If BMW wants to use LCA more strategically, it must be integrated in all divisions. So far, BMW has no further plans for promoting LCA in the corporate strategy and specifically not in the development of new products. Therefore, these initiatives cannot be characterised as a product-oriented *strategy*. Consequently, environmental improvements remain at the micro level in a specific chain in the cycle.

4.1 Continuous improvement: Environmental Management Systems

The development of IPP builds largely on experiences with existing environmental tools, like EMSs. An EMS is an example of a process-oriented strategy striving towards continuous improvement at the micro level. However, a growing number of companies include some level of supply chain issues in their environmental policy. In addition, it is becoming more common for companies to include ISO 14001 compliance as a minimum standard in their procurement policies (BSR, 2003). General Motors (GM), for example, requires its tier-one product suppliers – those that directly supply parts for use in the vehicle production – to have an ISO 14001 compliant EMS in place at all manufacturing facilities that supply GM with materials or parts (GM, 2007). GM is one of the first automobile manufacturers to develop management systems that reward suppliers for responsible use of resources (ACEA and UNEP, 2002: 28).

In order to ensure a continuous improvement in process-oriented environmental protection – all major automobile manufacturers have implemented certified EMS at their production facilities. GM was the first automobile manufacturer to implement a certified EMS in 1995. Since then, it has become a trend in the automobile industry to have a certified EMS (ISO 14001 and/or EMAS). Globalisation can be mentioned as one of the major reasons why the automobile industry has such a large interest in implementing a certified EMS. All automobile manufacturers do have production facilities all over the world and an appropriate way for automobile manufacturers to implement a corporate environmental policy, which is applicable to all production facilities worldwide, is to implement an (certified) EMS. Implementing a certified EMS does have various advantages for automobile manufacturers, as automobile manufacturers can:

- be sure that all their production facilities comply with (local) environmental regulations
- compare the environmental performance of the different production facilities
- ensure that all production facilities live up till the corporate environmental policy

GM, Ford, Volkswagen and BMW have implemented EMSs at all their production facilities around the world. By implementing EMSs at all their production facilities, BMW – for example – was provided with an integrated approach to address the environmental impacts of their activities. In the period 1998-2002, implementing EMSs has contributed to a reduction of environmental impacts from production – measured per unit, see table 3. However, since 2003, environmental impacts from production have increased for production process water input and waste. The increase in production process water input can be explained by the fact that in the new series BMW, introduced

in the autumn of 2004, steel has been replaced by aluminium. From an IPP line of thinking, this has had some major consequences, as we have discussed above.

	1998	1999	2000	2001	2002	2003	2004
Energy consumption (MWh/Unit)	3.56	3.42	3.16	3.08	3.21	2.94	2.94
Production process water input (m^3/Unit)	3.87	3.51	2.97	2.52	2.10	2.23	2.33
Production process wastewater (m^3/Unit)	1.23	1.15	1.06	1.07	0.92	0.98	0.83
CO_2 (t/Unit)	1.14	1.10	1.04	0.99	0.98	1.00	0.94
Waste (kg/Unit)	367	368	349	354	291	357	318

Table 3 BMW Group key figures: environment (BMW, 2003; BMW, 2005b).

As mentioned before, a growing number of companies include some level of supply chain issues in their environmental policy. The promotion of the diffusion of EMSs along the product chain becomes more and more common. For example, BMW promotes the diffusion of EMS along the product chain by demanding most of their suppliers of their production facilities to be certified according to ISO 14001 or EMAS. One of the major reasons for this is that BMW had recognised that suppliers collectively bring more than 70% of the value of each car to the line and the supply chain failure impacts directly on the reputation of BMW. Approximately 90% of BMW's suppliers have an ISO 14001 certification or an EMAS registration (BMW, 2003) Furthermore, BMW communicates the results of its EMSs to their surrounding communities and their customers in a meaningful and personal manner in order to benefit the company as a whole. These supply chain issues reflect the interaction with the meso level.

Both BWM and GM have a common framework for EMS, which has to be taken as a point of departure, when EMS is implemented at the specific (production) facilities. BMW is in the process of developing a transnational environmental standard that reflects best environmental practice for relevant environmental issues that shall be applied in all corporate production units. So far, GM has adopted a common standard for a more limited amount of specific environmental issues. For environmental problems that are not covered by a common standard, they will ideally be regulated by local environmental regulations. Consequently, the environmental objectives for BMW sites are more or less determined by headquarter, whereas at GM both corporate as well as the local (national) environmental regulations are taken as point of departure.

EMSs are often not used in isolation. Other management programmes are used to ensure continuous improvement. GM for example, uses – in addition to EMSs – specific management programmes for certain issues, like Resource Management and Chemicals Management (GM, 2007). Resource Management and Chemicals Management have to ensure – among other things – that every effort is made to reduce, recycle and reuse resources before disposal (ACEA and UNEP, 2002). Ford, on the other hand, has developed a "Product Sustainability Index" (PSI) and a "Manufacturing Sustainability Index" (MSI) in order to track whether Ford's new products and production plants are moving toward the goal of sustainability (Ford, 2006). Both PSI and MSI are used in addition to certified EMSs.

5. Stakeholder involvement

According the Commission's Communication on IPP (European Commission, 2003: 5), stakeholder involvement "*aims to encourage all those who come into contact with the product (i.e. industry, consumers and government) to act on their sphere of influence and to encourage cooperation between the different stakeholders. Industry can look at how to better integrate environmental*

aspects in the design of products while consumers can assess how they can purchase greener products and how they can better use and dispose of them. Governments can set the economic and legal framework conditions for entire national economies and also act directly on markets, for instance by purchasing greener products".

Nuij (2006) regards the way in which the European Commission recommends the involvement of stakeholders as a particular weakness of the current EU IPP policy. Nuij (2006: 177) argues, "the IPP Green Paper (2001) argued for the 'strong involvement of all stakeholders on all potential levels of action' in its development and 'local initiatives were seen as a major building block of a Community policy as they allow a practice-oriented bottom-up approach'. The Communication on IPP (2003) toned down this enthusiasm, stating that 'IPP aims to encourage all those who come into contact with the product to act in their sphere of influence and to encourage co-operation between the different stakeholders'. While the Green Paper still talked about product panels as a possible way to bring all these stakeholders together, the Communication refers to the use of voluntary pilot projects to ensure their involvement". Nuij (2006:177) concludes his argumentation by stating that both documents lack any significant detail on how such a stakeholder process should be organised, who should be involved at what stage and what is expected from whom.

As mentioned before, a major challenge for governments in implementing and facilitating IPP is to promote 'Life Cycle Thinking' and 'Stakeholder Involvement'. In Denmark, for example, stakeholder involvement has been established by the formation of product panels. The purpose of establishing a product panel is to bring together stakeholders from all stages of a product's life cycle in order for them to co-operate on trying to minimise the environmental impact caused by a product (Danish EPA, 2005). It is doubtful, however, whether product panels can be used with regard to automobiles, if facilitated by national governments. The automobile is pre-eminently a product that is global in scope, which might make it difficult for national governments to establish product panels that include foreign stakeholders. Besides, as mentioned above, in line with Nuij's (2006) argumentation, the Communication on IPP does not mention product panels as the way to organise 'involvement of stakeholders'; the use of voluntary pilot projects should ensure stakeholders involvement.
Nevertheless, at least one automobile product panel does exist. In 1995, the Bavarian government and the Bavarian business community concluded the Environmental Agreement for Bavaria. Initially the agreement was limited to five years, but in October 2000, the environmental agreement was renewed (Industrie- und Handelskammer für München und Oberbayerns and Bayerisches Staatsministerium für Landesentwicklung, 2001). IPP is one of the themes the government and business work on. In the framework of the Bavarian Environmental Pact II, two automobile manufacturers, i.e. BMW and Audi, work on the IPP pilot project for product-related environmental management. In 2000 – among other things – the partners to the Environmental Pact decided to (Steinmetzer and Furnier, 2006: 139):

- Install a permanent working group between economy and government for a continuous dialogue on matters of IPP
- Realise a common pilot project 'IPP using the automobile as an example'

In the IPP pilot project, as carried out in Bavaria, the authorities, the industry and consumers are regarded as the main actors. In table 4, it is shown which steps should be taken to make IPP a success (based on Industrie- und Handelskammer für München und Oberbayerns and Bayerisches Staatsministerium für Landesentwicklung, 2001: 79).

.

To make IPP a success, the *industry* must	**To actively promote IPP, the *authorities* should**	**IPP can only be successful if the *consumer***
Make IPP instruments an integral element of entrepreneurial actions	Create reliable framework conditions in line with market requirements	Actively demands information from manufacturers and service providers
Increasingly provide consumer-friendly and traceable information on product properties relevant to IPP	Limit itself to setting out the framework and allow sufficient scope for voluntary agreements and self-regulation of industry	Seeks information on the sustainability aspects of a product system
Further develop and use IPP tools on its own initiative and cooperate within industry on a comprehensive basis	Not interfere in product planning	Through his decision to buy, requires the development and preparation of products with minimum environmental impact
Formulate IPP-relevant goals for the sector, and use self-regulation as an instrument	Examine the provisions of existing state legislation and formulate an environmental law comprising all environmental aspects	Is ready in individual cases to pay more for products with low environmental impact
Comprehensively integrate all decisions, sequences and management systems throughout the economic and ecological product life cycle	Commit itself to international harmonisation	Assumes environmental responsibility during the usage stage
	Prepare and support society at large in terms of environmental education and training	
	Provide incentives for the introduction of environmentally friendly products	

Table 4 Conditions to success of IPP (based on Industrie- und Handelskammer für München und Oberbayerns and Bayerisches Staatsministerium für Landesentwicklung, 2001: 79)

The environmentally more pro-active companies will typically expand their environmental initiatives beyond the company's own property. These companies will expand their environmental initiatives to include, for example, environmentally optimised goods transports, co-operation with suppliers regarding phase-out of harmful substances, information to consumers regarding environmentally friendly product use etc. (Danish EPA, 2003).

The automobile industry faces some other barriers 'to encourage stakeholder co-operation' as well. As mentioned above, the automobile product chain consists of two more or less independent networks, a production network and a use-, recycling and disposal network (see figure 2). Especially in Europe, contacts between actors in these two networks are limited (Smink et al., 2006). According to den Hond and Groenewegen (1993: 351), a reason for this weak link is that automobile manufacturers have had no specific interest in connecting with car-dismantling companies. In fact, they may even have tried to avoid association with dismantling activities which are often dispersed, sometimes semi-legal or illegal, and often directly competitive with dealers for the spare-parts market. Most interactions are incidental, focused on specific activities, or informal based on personal relations (Smink et al., 2006: 159). Co-operation and communication between the two networks are not institutionalised (Smink, 2002). This weak linkage has its roots in the specific history of the automobile-dismantling sector, a history that cannot be explained by economic considerations alone (Smink et al., 2003). The automotive chain is very much transnational in nature, and is subject of substantive environmental pressures put on them by local and international agencies. These pressures have resulted in the development of new, more sustainable products and production processes. However, retailers in the automobile chain do hardly make any efforts to

establish a link between the sustainable production and the sustainable consumption of automobiles. Green automobiles are not made into selling points by car salespersons; they are promoted by public environmental regulations (Smink et al., 2003). Consequently, the predominant situation has been that environmental regulations have developed independently in both networks (Smink, et al., 2003).

The objective of IPP is to reduce the overall environmental burdens across the whole life cycle of a product. In other words, in order to implement IPP in the automotive product chain, the two networks have to be integrated.

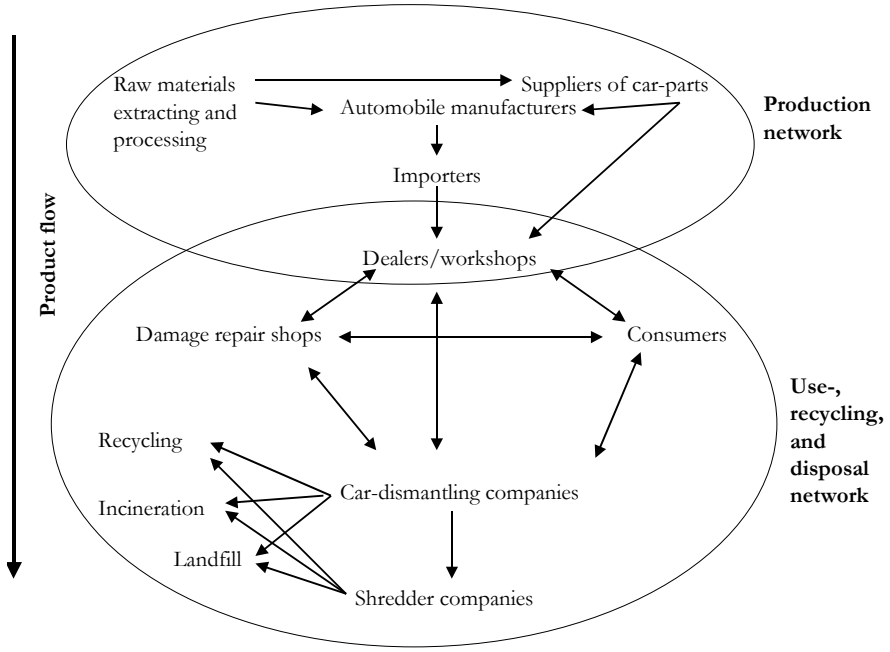

Figure 2 The automobile product chain and its two networks (Smink, 2002:163)

Another reason why it will be a huge challenge for the automotive industry to encourage stakeholder co-operation is because of the huge number of actors involved in producing an automobile. As shown in figure 2, in the production network, the automobile manufacturer purchases parts from suppliers of car-parts. These suppliers will also purchase parts from their suppliers etc. (not shown in the figure). For example, an automobile manufacturer purchases a seat from a supplier, a so-called first-tier supplier. This supplier is in charge of delivering complete seats to the automobile manufacturer. The first-tier supplier has a number of second-tier suppliers, which are companies that produce the different parts of the seat. These companies may, in turn, engage helpers in a third or even fourth tier of the supply pyramid. If we consider that an automobile is often made up of more than 10,000 parts, it might become clear that a wide variety of companies are involved in the production of an automobile (Smink, 2002).
Finally, it will be a huge challenge for the automotive industry to encourage stakeholder co-operation because the automobile industry involves a long and complex product life cycle. Take for example initiatives to reduce greenhouse gas emissions. Greenhouse gas emissions vary at each stage of the automobile life cycle. Ford (unknown: 5), for example, states: “approximately 10 percent of the greenhouse gas emissions associated with any given automobile or truck are emitted directly by our plants and facilities. Most of the remaining 90 percent of the emissions attributed to any automobile over the course of the lifetime is emitted during its use by the consumer”. To act on

their sphere of influence, a challenge for automobile manufacturers is – among other things – to engage consumers on their purchase decisions, driving behaviour and their choice of fuels. Ford systematically investigates the influence of driving style on fuel consumption and CO_2 per kilometre driven (Ford, 2004). Since 1998, Ford in Germany has jointly run a comprehensive test and training programme "Ford Eco-Driving" with the German Federation of Driving Instructor Associations and the German Road Safety Council. The Ford Eco-Driving resulted in three major programmes designed for various target groups like professional drivers, private drivers and driving instructors (Ford, 2004). Driving instructors, for example, can be seen as a promising target audience for Ford's train-the-trainer seminars due to their multiplier status teaching young drivers the "right way to drive" (Ford, 2004). The objective is to enhance consumers' influence for a transformation towards sustainable mobility (Ford, 2004).

6. A variety of policy instruments

As mentioned in section 4, continuous environmental improvements require incentives for manufacturers to make new product generations greener than their predecessors (European Commission, 2003). In this section, focus will be on how public environmental regulations facilitate continuous improvements.

In the Communication on IPP the European Commission (2003: 5) writes about 'a variety of policy instruments': *"The IPP approach requires a number of different instruments because there are such a variety of products available and different stakeholders involved. These instruments range from voluntary initiatives to regulations and from the local to the international scale. Within IPP, the tendency is clearly to work with voluntary approaches, although mandatory measures might also be required. The determining factor is the effectiveness of the tool to achieve the desired result with regard to sustainable development"*

According to the Communication on IPP (European Commission, 2003: 8), an effective IPP does require the economic and legal framework to be conductive to greening products and to their purchase, ideally with minimum government intervention. Table 5 shows the tools for establishing the framework conditions for continuous environmental improvement as outlined in the Communication on IPP.

Tools for creating the right economic and legal framework	• Taxes and subsidies • Voluntary agreements and standardisation • Public procurement legislation • Other legislation
Promoting the application of Life-Cycle Thinking	• Making life-cycle information and interpretative tools available • Environmental Management Systems • Product Design Obligations
Giving consumers the information to decide	• Greening public procurement • Greener corporate purchasing • Environmental labelling

Table 5 Establishing the framework conditions for continuous environmental improvement

It is clear that the IPP approach focuses on a mix of policy instruments. It is however, less clear at which level of governance these instruments are most efficiently introduced (Danish EPA, 2006). Nuij (2006) does discuss the same point.

Nuij (2006) regards the way in which the European Commission recommends the use of a variety of policy instruments a particular weakness of the current EU IPP policy. More specifically, Nuij (2006) mentions the integration of different instruments and the use of non-legislative tools as particular weaknesses. About the 'Integration of different instruments', Nuij (2006: 177-178) argues, "the Communication states that the most important role of IPP is to 'strengthen the co-ordination and coherence between existing and future environment-related product-policy instruments. In addition, … it will make product-related environmental policy measures more effective by highlighting the necessary trade-offs and, once political decisions are taken, co-ordinating their implementation. This strengthened co-ordination will benefit both business competitiveness and the environment'". Nuij (2006) concludes that there is no detail on how all this is to come about. About the 'Use of non-legislative tools', Nuij (2006: 178) argues, "the Green Paper and the Communication focus almost exclusively on the 'softer' side of the policy toolbox. While this might be the right approach to the problems, the Union does not necessarily have a great track record when it comes to establishing and implementing such instruments. The woes of the EMAS and the EU Eco-label schemes, and the difficulties encountered when establishing a framework for voluntary or negotiated agreements, point towards inherent problems with developing non-legislative instruments with an institutional context specifically set up for making legislation". Nuij (2006: 178) concludes "these weaknesses make it rather difficult to be optimistic about the future of IPP, at least at the European level".

7. Conclusion

A strict focus on the automobile is not suitable to deal with the challenge of sustainable production and consumption. Ideally, the starting point of our analysis should have been on the societal functions that are fulfilled by the combination of products and services such as transport. At this level, people make the choices between taking the car or the train and it is here that large potential improvements could be realised (Nuij, 2006: 181). Nevertheless, in this article we have analysed how and in what way Integrated Product Policy (IPP) has been applied in the automotive product chain. From an environmental point of view, the automobile – as a product – can still be improved and become significant more efficient.

In order to move towards a more sustainable automobile production both environmental policies and environmental strategies must move towards a more integrated product-oriented approach. It is necessary to extend the scope and focus of the IPP and it must be reflected to corporate environmental policies of companies. Especially for the automobile manufacturers, the global production system with changing preconditions and the wide range of stakeholders make it a huge task to incorporate and implement a product-oriented strategy. More dialogue, co-operation and exchange of information are needed, especially between the production network and the networks of use, recycling and disposal where the contacts so far are limited.

It is important to develop coherent integrated product policies that involve the relevant stakeholders and create a "green market" in order to stimulate automobile manufacturers to move towards an integrated product orientated strategy. This could bring forward radical innovation for automobiles but also other modes of transportation.

Automobile manufacturers could play a more active role by recognising their responsibility for reducing the environmental impacts through out the product chain and participate more closely in the other phases of the product chain. New types of policy instruments are needed. For instance, in the use-phase, training of drivers is able to reduce energy consumption for transportation by a car or

truck with about 10%. This type of training, like implemented by Ford, could be offered in collaboration between automobile manufacturers and authorities and this offer could be included in the price of an automobile. It is a challenge for both authorities as well as for automobile manufacturers to develop an IPP.

Furthermore, it can be concluded that most automobile manufacturers have taken product-oriented initiatives but so far, the initiatives are isolated from the corporate "mainstream" strategy. Many initiatives seem to be "showcases" that have little impact on the corporate environmental practice of automobile manufacturers. The product-oriented initiatives from authorities and manufacturers can potentially be a part of a more integrated product policy, which must be initiated and transformed by relevant actors and implemented in whole product chain in an integrative manner. Integrating products policies must be a common target for the relevant domains, i.e. state, civil society and industry.

The expected rapid increase in the number of cars the next 15 years (about 75%) enhancing increased mobility, globalisation of trade, creation of wealth etc. will also result in a huge increase in the environmental impact in the whole life cycle of the automobile. This prognosis asks for a wide range of methods and incentives to reduce the pollution of automobiles if we are to obtain significant improvements of automobiles environmental performance. Though, governments do not seem willing to discuss and create more strict and radical regulations to promote new technologies like automobiles powered by hydrogen and alternative types of transportation. This is due to the important economic impacts on society from automobile production and the use of automobiles for transportation.

8. Literature

ACEA and UNEP (2002) Industry as a partner for sustainable development. Automotive. International Automobile Manufacturers.

BMW (2003) *Sustainable Value Report 2003/2004. Innovation. Efficiency. Responsibility*. BMW Group.

BMW (2005b) Sustainable Value Report 2005/2006. Taking Responsibility.

BSR (2003) Supplier Environmental Management. Business for Social Responsibility. http://www.bsr.org [16 May 2007]

Danish EPA (2003) An Introduction to Life-cycle Thinking and Management. http://www.mst.dk/udgiv/Publications/2003/87-7972-458-2/html/kap09_eng.htm [29 November 2004]

Danish EPA (2005) The Integrated Product Policy (IPP) in Denmark. Product Panels. http://glwww.mst.dk/indu/06010100.htm [18 May 2007]

Danish EPA (2006) Strengthening Environmental Integration in the EU. Exploring opportunities for advancing Integrated Product Policy. Chapter 3 Integrated Product Policy, pp. 22-25. Danish Ministry of the Environment. Working Report No. 23.

Danish Transport Council (2000) Pendling og transportfradrag. Rapport no. 00-04. http://www.trg.dk/transportraadet/pup/RA/RA-00-04.pdf [9 June 2005]

Den Hond, F., and Groenewegen, P. (1993) Solving the automobile shredder waste problem: co-operation among firms in the automotive industry. In: Fischer, K. and Schot, J. (eds.) Environmental Strategies for Industry: International Perspectives on Research Needs and Policy Implications. Washington, DC: Island Press. Pp. 243-368

European Commission (2001a) Green Paper on Integrated Product Policy. COM (2001) 68 Final.

European Commission (2001b) Integrated Product Policy (IPP). A statement by the European Consultative Forum on the Environment and Sustainable Development.

European Commission (2003) Communication from the Commission to the Council and the European Parliament. Integrated Product Policy. Building on Environmental Life-Cycle Thinking. COM (2003) 302 Final.

European Environment Agency (EEA) (2003) Indicator fact sheet. TERM 2002 32 EU – Size and composition of the vehicle fleet.
http://themes.eea.europa.eu/Sectors_and_activities/transport/indicators/technology/TERM32,2002/TERM_2002_32_EU_Size_of_the_vehicle_fleet.pdf [13 April 2007]

Ford (2004) Ford Eco-Driving. The Clever Move
http://www.ford-eco-driving.de/download/Eco-Driving-Leaflet-ENG-5-2004.pdf [11 May 2007]

Ford (2006) Sustainability Report 2005/6. Managing Environmental Performance.
http://www.ford.com/go/sustainability [8 May 2007]

Ford (unknown) Ford Report on the Business Impact of Climate Change.
http://www.ford.com/NR/rdonlyres/e6vzmdwyz2ycyehpwvuj5sdkrmfknipsreoyznmwwfqtzlwqfbfbcq44ckquxgn5xfir532knjvkq3ovbyhuscz7sfh/fordReptBusImpClimChg.pdf [10 May 2007]

GM (2007) 2005/06 Corporate Responsibility Report. Environmental Performance / Management Systems. http://www.gm.com/company/gmability/sustainability/reports/06/600_environment/601.html [8 May 2007]

Illge, L., Hubacek, K. and Giljum, S. (2002) Is there a role for EU Integrated Product Policy (IPP) in Solving Global Environmental Problems? Investigating IPP's Capacity for Correction at Source in a Global Context. In: Bierman, F., Brohm, R. and Dingwerth K. (eds.) Proceedings of the 2001 Berlin Conference on the Human Dimensions of Global Environmental Change "Global Environmental Change and the Nation State". Potsdam: Potsdam Institute for Climate Impact Research pp. 183-191

Industrie- und Handelskammer für München und Oberbayerns and Bayerisches Staatsministerium für Landesentwicklung (2001) IPP integrated product policy. Instruments from practice using the automobile as an example. A Project by State and Business Community as part of the Environmental Agreement of Bavaria.

Kärnä, A. (1999) Managing environmental issues from design to disposal – a chain reaction? Experiences of product chain actors in the Finnish electrical and electronics industry. Federation of Finnish electrical and electronics industry.

Krzyzanowski, M., Kuna-Dibbert, B. and Scheider (2005), Health effects of transport-related air pollution, WHO Regional Office for Europe. Copenhagen. 2005

MIT (2001) Mobility 2001. Press release "MIT worldwide mobility study warns of chronic gridlock, pollution; outlines 'grand challenges' http://esd.mit.edu/Headline/pr110301.htm [04 May 2007]

Nuij, R. (2006) Integrated product policy and governance. A necessary symbiosis. In: Scheer, D. and Rubik, F. (eds.) Governance of Integrated Product Policy. In search of sustainable production and consumption. Greenleaf Publishing.

Rehfeld, K-M. (2006) The determinants and effects of env product innovations. In: Scheer, D. and Rubik, F. (eds.) Governance of Integrated Product Policy. In search of sustainable production and consumption. Greenleaf Publishing.

Scheer D. and Rubik, F. (2006) Introduction. Governance towards sustainability: meeting the unsustainable production and consumption challenge. In: Scheer, D. and Rubik, F. (eds.) Governance of Integrated Product Policy. In search of sustainable production and consumption. Greenleaf Publishing.

Scheuer, S. (ed.) (2005) EU Environmental Policy Handbook. A Critical Analysis of EU Environmental Legislation. Making it accessible to environmentalists and decision makers. European Environmental Bureau (EEB).

Smink, C.K. (2002), Modernisation of Environmental Regulations. End-of-Life Vehicle Regulations in the Netherlands and Denmark. Ph.D.-thesis. Aalborg University, Department of Development and Planning.

Smink, C.K., van Koppen, C.S.A. and Spaargaren, G. (2003) Ecological Modernisation theory and the changing dynamics of the European automotive industry: the case of Dutch end-of-life vehicle policies. International Journal of Environment and Sustainable Development. Volume 2, No. 3 pp. 284-304

Smink, C.K., Nielsen, E.H. and Jørgensen, T.H. (2006) Process- and product-oriented environmental policy within the car chain. Examples from BMW and General Motors. In: Nieuwenhuis, P., Vergragt, P. and Wells, P. (eds.) The Business of Sustainable Mobility. From vision to reality. Greenleaf Publishing.

Steinmetzer, H-C. and Furnier, U. (2006) Integrated product policy as a tool in environmental protection. In: Scheer, D. and Rubik, F. (eds.) Governance of Integrated Product Policy. In search of sustainable production and consumption. Greenleaf Publishing.

Zaccaï, E. (2005) Assessing the role of consumers in sustainable product policies. Environ. Dev. Sustain. DOI 10.1007/s10668-006-9038-3