



Technology transfer – Bringing new technology from R&D to the customer

Project within FFI – Vehicle Development

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FFI in short

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. FFI has R&D activities worth approx. €100 million per year, of which half is governmental funding. The background to the investment is that development within road transportation and Swedish automotive industry has big impact for growth. FFI will contribute to the following main goals: Reducing the environmental impact of transport, reducing the number killed and injured in traffic and Strengthening international competitiveness. Currently there are five collaboration programs: **Vehicle Development, Transport Efficiency, Vehicle and Traffic Safety, Energy & Environment and Sustainable Production Technology.**

For more information: www.vinnova.se/ffi

1. Executive summary

A company's ability to introduce new products is a key success factor for sustaining a competitive advantage. Increasing environmental concerns are an even stronger incentive to innovate. Environmental regulations will exert immense pressure on manufacturing industries, which will increase in the future, enabling a more sustainable world for coming generations. Facing the automotive industry, an aggravating circumstance is, however, that the industry is deeply affected by the paradigm grounded in mass production, a dominant design and incremental development.

A common view in the innovation literature is that large, established firms usually experience difficulty fostering radical innovations. Taking on the environmental challenge, it is argued that companies lack the methods, tools and processes to scan markets and to find opportunities beyond their existing businesses. Further challenges fostering radical innovations are the conflicting demands to explore new opportunities in parallel with daily business.

The aim of this project is to explore the prerequisites embracing innovations in terms of what hinders and enables the development and implementation of new technologies in future products. The research question is answered through qualitative studies at Saab Automobile, Volvo Cars and the lightweight project SÅNätt. It also draws upon experience working in the automotive industry for many years.

The empirical studies revealed different approaches to develop radical innovations. While one of the companies focused on radical development of new concepts aiming to build a supplier structure for collaboration, the other company's focus was on incremental development of technical solutions to be implemented in a shorter time horizon. However both companies were stuck in the paradigm where the first focused on more explorative projects and through significant interest in technology and a more informal way of working, they managed to bypass several parts in the paradigm. The other company was managing the projects through a formal process governed by strategic plans and a strong implementation focus and was more deeply committed to its infrastructure for body manufacturing thus hindering more radical changes. The result from the project shows that some inertia in the paradigm can indeed be challenged, but it also shows that in order to succeed in an environmentally driven transition, the paradigm dominating the automotive industry has to be questioned.



2. Background

During recent decades increasing environmental concerns have become a strong incentive to innovate. Environmental regulations will exert immense pressure on manufacturing industries, which will increase in the future, enabling a more sustainable world for coming generations.

The automotive industry is one of many industries causing environmental pollution where cars have a significant impact on all phases of the life cycle; manufacturing, use, recycling and disposal. Furthermore, an increasingly global world with rapidly growing populations implies a growing demand for transportation.

However, automakers have shown an increasing awareness of the environmental impact of their products as environmental regulations and market demands for environmentally less destructive cars have increased. The environmental challenge, particularly the need to reduce CO₂ emissions due to imminent regulations on fuel economy in Europe, the US and Japan, has exerted immense pressure on automakers.

An incremental development characterizing the automotive industry will not be sufficient. An aggravating circumstance is that the industry is mature and characterized by mass production, a dominant design and incremental development. It is argued that companies lack the methods, tools and processes to scan markets and to find opportunities beyond their existing businesses. A common view in the innovation literature is that large, established firms in the automotive industry usually experience difficulty fostering radical innovations and instead emphasize the development and implementation of incremental innovations. The knowledge of how to manage radical innovations is limited since the actors, activities and processes are inherently uncertain resulting in incremental improvement which is perceived to bring low risk and immediate reward.

3. Objective

This project deals with the challenges of managing product development processes in the context of implementing new technologies and aims to make a contribution towards understanding the circumstances in which mature automotive companies develop and introduce innovations in the light of the environmental challenge.

Understanding actual managerial practices on an operative level is still limited. In summary, there is a call for more research to investigate the prerequisites for mature



firms to implement innovations in the automotive industry, illustrating how innovations are managed in the product development process.

The environmental demands facing the automotive industry will require the management and implementation of new technologies that will facilitate the introduction of more environmentally friendly products. The aim of this project is to explore the prerequisites embracing innovations in terms of what hinders and enables the development and implementation of new technologies in future products. An overall research question guiding the project is:

What hinders and enables automotive manufacturers in implementing innovations in future cars?

The purpose is to increase the knowledge of how mature companies manage the prerequisites for innovation development and thereby how the environmental challenge is dealt with.

4. Project realization

The project has been performed as a PhD project. This has been realized in close collaboration with the automotive industry in which the data collection has occurred but also through seminars presenting and discussing the result from the different studies.

The research question is answered through qualitative studies at Saab Automobile and Volvo Cars and the lightweight project SÅNätt. It is also draw upon experience working in the automotive industry for many years. The result from the project contributes empirically and conceptually through an analysis of how two manufacturers enacted the barriers and enablers for innovation implementation, particularly environmental innovation.

5. Results and deliverables

Defining innovation

To understand what hinders innovations from being implemented and what enables (radical) such implementation, there has to be some idea about what we mean by innovation. The literature is ambiguous in its interpretation of innovation, which has resulted in divergence and contingency. Thus, it became important to investigate how the concept of innovation was perceived within Saab to make common sense, a common



ground when talking about innovation, working towards the same goals when discussing the subject. The findings revealed that engineering used the word new to include the most common “combination of things to something new” related to a technology, while design and market used the word value, which, in relation to an innovation, should mean improved value. The perception of innovation as incremental or radical was identified as subjectively assessed, meaning the degree of novelty is not only context dependent but also person dependent.

A balance between explore and exploit projects

In enabling radical innovations, risk taking was regarded as necessary to allow for long-term growth in parallel with daily business. To be competitive over time and adapt to changing conditions, companies need to explore and exploit. With this background, a study was made to illustrate the relation between the amounts of explorative and exploitative advanced projects with the aim of illuminating the balance between the categories and to create debate within Saab what a sound balance should look like. The result was an overrepresentation of exploitative projects, 60%, which was attributed to the tough financial situation and consequently, the focus was on daily business. Furthermore, the difficulties of embracing explorative projects were revealed to be a reason why these types of projects received less priority in the organization. They represented low legitimacy because they were perceived as not contributing to the bottom line, were organized too far down in the hierarchy and because there was a lack of a follow-up management tool. Furthermore, the environment was claimed to be lean, with scarce resources.

With regard to balancing everyday engineering activity with innovative exploration activities, there must be a better understanding of how to position product development efforts, to invest in long-term opportunities without risking short-term growth. The literature talks about the importance of a balance between explore and exploit projects. However, there seem to be a limited number of empirical studies showing what a sound balance should look like. These circumstances raised questions about the situation in other companies, and a study was subsequently performed at Volvo Cars. The results showed a substantive overrepresentation of exploitative projects (90%) versus only 10% of explorative projects. However, due to an increased focus on environmental projects, these types of projects ended up 80% exploit and 20% explore. Compared to Saab’s 60% exploit and 40% explore, the result is markedly different. Reasons mentioned were difficulties embracing radical innovation, reluctance to leave the comfort zone due to high investments in the infrastructure, a strong implementation focus and cultural differences between the companies.

Decision making in gates

To understand why new technologies are not implemented in products it was important to investigate what happened at decision meetings. New technologies already included in the program were cancelled in connection with gates due to such factors as time, cost and insufficient technology readiness, and they were not implemented if they were not



supported by the corporate strategies. Furthermore, decisions were made with some gut feeling, especially in the early phases of a project. An aggravating circumstance disclosed in the material and from experience was that decisions were made in front of the gates, meaning that when entering a gate the decision of the future of the technology had already been decided. From investigating gate criteria it seems they do not jeopardize new technologies since they are used in a flexible manner and are adapted to each project. However, a more positive form of gate criteria “measuring” the potential of the technology project could be assumed to highlight more radical projects.

The SÅNätt project

As a way of addressing some of the hindrances to radical innovation, the SÅNätt-project showed that while Saab focused on radical development of new concepts by supporting independent and innovative thinking aimed at building a supplier structure for collaboration, Volvo’s focus was on incremental development, developing technical solutions to be implemented in a shorter time horizon. Furthermore, Volvo had a strong implementation focus and was more deeply committed to its infrastructure for body manufacturing, thus hindering more radical changes. Additionally, it was revealed that Saab was missing long-term innovation strategies while they existed at Volvo. The project showed that although some hindrances were substantial, it was possible to challenge them.

Dominant paradigm

An effort was made to highlight the dominant paradigm that hinders more radical changes in the automotive industry. The paradigm is based on several inertias, including market, legislative, design, safety, investment, organizational and competitor inertia identified by experience working in the automotive industry for many years. In SÅNätt the participants worked actively to challenge the paradigm through different actions such as formulating three different objectives supporting long-term and short-term goals, dividing the vehicle into zones instead of subdivision partitioning, establishing self-organizing teams to define their own goals, boundaries and interfaces and providing supportive management that identified overall vehicle objectives without interfering in the solutions.

5.1 Delivery to FFI-goals

The project was performed as an industrial PhD project during the first years (until Saab’s bankruptcy in 2011) with purpose to enhance the competence of one employee becoming a doctor in line with one of FFI goals including a competence enhancement.

The project was driven by a need to enhance the possibilities for implementation of new technologies in the products. The studies (workshops and interviews) meant that many other persons within the company took part of made research within this area. Furthermore the result of the studies was presented in seminars encouraging discussions



of the result. All this together ensured that new knowledge was generated and implemented, and that existing knowledge was implemented in industrial applications as one of the goals by FFI. Unfortunately this could not fully be realized within the same company since Saab went broken before the project was finalized.

However the attendance in the SåNätt project the last years made it possible to increase the data collection and discuss and implement the result in a broader context. The cooperation with many different stakeholders in the automotive industry, involving both suppliers as other Universities in Sweden strengthened the collaboration between the automotive industry and government agencies, universities, colleges and research institutes, another goal by FFI.

Since the area of problem is general an application of the result to other industries is possible to do.

6. Dissemination and publications

6.1 Knowledge and results dissemination

The result of the studies in the project has been presented in different seminars with stakeholders in the automotive industry as suppliers, FKG and the two Swedish car manufacturers Saab and Volvo and lately NEVS. Furthermore it has been presented as a dissertation.

6.2 Publications

Kastensson, Å., Larsson, A., Ericson, Å. (2010) Embracing risk to pursue product innovation. Proceedings of the 17th International Product Development Management Conference, June 14-15, Murcia, Spain.

Ericson, Å., Kastensson, Å. (2011) Exploit and Explore: Two ways of categorizing innovation projects. Proceedings of the 18th International Conference on Engineering Design, August 15-18, Copenhagen, Denmark. Full paper, peer-reviewed.

Kastensson, Å., Johansson, C. (2011) Decision making in gates: based on formal basis or gut feeling? International Journal of Technology Intelligence and Planning, 7(2), 140-152.

Kastensson, Å. (2011). Managing innovation projects a perspective of explore and exploit. Luleå University of Technology.

Kastensson, Å. (2014) Developing lightweight concepts in the automotive industry: taking on the environmental challenge in the case of SÅNätt. Journal of Cleaner Production 66, 337-346.

Kastensson, Å., Claesson, A., Gustafsson, B. (2014) Innovation in a dominant Paradigm. Submitted to: International Journal of Automotive Technology and Management.

Kastensson, Å. (2014). Managing Product Innovation in the Automotive Industry in light of the environmental challenge. Luleå University of Technology.

7. Conclusions and future research

For existing automotive companies the environmental demands will require new and radical ideas and approaches and an implementation focus to realize innovations and to dare challenge the paradigm. This will be a delicate balance for the car industry.

The studies showed that Saab was stuck by all the inertias constituting the paradigm, which became more pervasive when they were integrated in GM. They were, however, not that tied to body manufacturing as Volvo since the infrastructure around it was minor. Nevertheless, through significant interest in technology and a more informal way of working, they managed to bypass several inertias in the paradigm. Additionally, they chose to run the lightweight project with a strong intention to break the paradigm from the start.

Based on the empirical material and analyses, Volvo was stuck in the paradigm implying difficulties to proceed particularly investment inertia. The infrastructure of body manufacturing is large, inhibiting radical ideas affecting investment inertia. Furthermore, Volvo was managing the projects through a formal process governed by strategic plans and a strong implementation focus.

Some interesting ideas for future research have emerged during the process:

- From the studies it emerged that decisions are made in many constellations and in

different kinds of meeting before the gates. To better understand the possibilities for innovations to be introduced in future products it is important to describe how the decision-process in practice looks like and in which different kind of constellations decisions are made.

- To understand why new technologies are cancelled in decision-meetings it is important to enhance the apprehension of evaluation criteria. Current criteria seems to be a more quantitative way of evaluating projects, including factors such as spending, timing, risk, and impact on manufacturing system, which might seem like a “negative” way of measuring projects as the focus is on the business case instead of on the potential of new technology. An interesting future approach would be to study how a more positive form of criteria could be designed to enhance the possibilities for developing companies to estimate the potential for new technologies which also include the environmental potential.
- From the empirical studies made in two companies it appeared that their different cultures seemed to have an influence of how they approached new ideas. How does the culture of a company influence its ability to develop radical innovations? The knowledge is valuable to better understand which corporate cultural features are important when aiming for new solutions which are more environmental friendly but also to identify who will manage to make the transition. Each firm in the automotive industry is heterogeneous, though acting in a homogenous industry, and everyone have to find their own way in regard to their culture but they could also learn from each other and thereby adapt to new surrounding circumstances.

8. Participating parties and contact person

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