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How the pressure for sustainability has influenced the innovation process in the automotive industry?

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ABSTRACT

This paper aims to highlight the changes that there have been in the innovation process due to sustainability pressure. The reference industry is the automotive sector, which for different reasons has always been centre of interest for policymakers and several scholars. Starting from an accurate analysis of the past literature and research we are going to make a multidisciplinary analysis that will touch several fields of study: eco-innovation management, supply chain management, management of sustainability, automotive industry. Through a research method based on interviews we are going to underline quite some dimensions and factors which play a key role in the eco-innovation process. We are going to try to verify the likelihood that a green-business, requesting eco-innovations development, can build a competitive advantage for the company. From this point we will see in what activities companies are focusing to develop eco-innovations, and what are the reasons that push companies to be green embracers, as well as who are the actors that put more pressure to automotive industry sustainability. Understood the research contest we will analyse in depth the two mains changes happen in the innovation process to develop in a efficient and effective way eco-innovations: cooperation and integration between economic goals and environmental goals. Part of these modification are due to specific features of eco-innovation that will be retaken several times in more points. We will enter in the green supply chain and organization for cooperation field, listing all the mains method and tools that companies usually use. The analysis will conclude trying to understand what typologies of eco-innovations are more developed from the players of the automotive industry. Thank to this last part we are going to discover the importance of the organizational eco-innovation. Implications display in the research's conclusion are going to converge in the idea to supply useful information to policymakers and automotive industry actors.

Cette recherche vise à mettre en évidence les changements qu'y ont été dans le processus d'innovation en raison de la pression vers la durabilité. L'industrie considérée est celle de la voiture, laquelle pour plusieurs raisons a été toujours au centre de l'intérêt de nombreux chercheurs et policymakers. A' partir d'une analyse minutieuse de la littérature et des recherches passées on effectuera une analyse multidisciplinaire qui va toucher différents domaines de recherche: éco-innovation, gestion de la chaîne d'approvisionnement, gestion de la durabilité, et industrie automobile. Grâce à une méthode de recherche basée sur l'entretien, on va mettre en évidence plusieurs dimensions et différents facteurs qui jouent un rôle fondamental dans le processus d'éco-innovation. On va essayer de vérifier la possibilité d'avoir un avantage compétitif grâce au développement des activités vertes, attentives aux questions environnementales, donc à travers le développement des éco-innovations. On va voir sur quelles activités les entreprises de l'industrie de l'automobile ont mit plus, quelles sont les raisons qui les poussent à être respectueuses de l'environnement, ainsi qui sont les acteurs que mettent plus pression pour réduire l'impact environnemental des produits et des processus. Compris le contexte de recherche, on va analyser en profondeur les deux principaux changements que il y a eu dans le processus d'innovation afin de développer efficacement les eco-innovations: la coopération et l'inclusion des objectifs environnementaux dans les plans économiques et des développement. Une partie de ce changement est dû aux caractéristiques spécifiques de l'éco-innovation qui seront prises et évaluées plusieurs fois. Ensuite, on entrera dans le domaine de la Green supply chain et dans le domaine de l'organisation de la coopération, et on ira énumérer les principales méthodes que les entreprises utilisent. L'analyse prendra fin en essayant de comprendre quelles sont les types d'éco-innovation les plus développés dans l'industrie automobile, en découvrant l'importance qui a l'éco-innovation organisationnelle. Les implications qui seront exposées lors de la conclusion de la recherche convergeront tous dans l'idée de fournir des

informations utiles pour les décideurs politiques et les acteurs de la chaîne d'approvisionnement.

Questa ricerca ha l'obiettivo di evidenziare le modifiche che ci sono state nel processo di innovazione a causa della pressione verso la sostenibilità. Il settore preso in considerazione è quello dell'automobile che per vari motivi è sempre stato al centro del interesse dei policymakers e di numerosi studiosi. Partendo da un attenta analisi della letteratura e delle ricerche passate si andrà ad effettuare un'analisi multidisciplinare che toccherà vari campi di ricerca: eco-innovation, supply chain management, management della sostenibilità, settore auto. Attraverso un metodo di ricerca basato sull'intervista si andranno ad evidenziare diverse dimensioni e diversi fattori che giocano un ruolo fondamentale nel processo di eco-innovation. Si cercherà di verificare la possibilità di avere un vantaggio competitivo grazie allo sviluppo di un business sostenibile e attento alle questioni ambientali, e quindi attraverso lo sviluppo di eco-innovation. In questo si andranno a vedere su quali attività si focalizza l'attenzione delle aziende del settore automotive, quali sono i motivi che le spingono ad essere eco-sostenibili, nonché quali sono gli attori che principalmente mettono pressione per un minor impatto ambientale dei prodotti e dei processi. Compreso il contesto di lavoro si analizzerà in modo approfondito le due principali modifiche che ci sono state nel processo di innovazione per poter sviluppare in modo efficiente ed efficace eco-innovation: cooperazione e inserimento di obiettivi ambientali al pari di quelli economici. Parte di tale modifica è dovuta alle specifiche caratteristiche delle eco-innovation che saranno riprese e valutate in più punti. Si entrerà quindi nel ambito della green supply chain e nel campo dell' organizzazione della cooperazione elencando anche i principali metodi che le imprese stesse utilizzano in modo operativo e abitudinale. L'analisi si

concluderà cercando di capire quali sono state le tipologie di eco-innovation più sviluppate nel settore dell'auto, scoprendo l'importanza che sta avendo l'eco-innovation organizzativa. Le implicazioni che verranno esposte a conclusione della ricerca convergeranno tutte nel idea di fornire utili informazioni per i policymakers e gli attori della supply chain.

KEYWORDS

Eco-innovation

Determinants of eco-innovation

Barriers of eco-innovation

Innovation Process

Sustainable development

Environmental issue

Environmental burden

Green supply chain management

Cooperation Management

Cooperative practices

Automotive Industry

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INTRODUCTION

Automotive industry assumes still today a primary place in the economics of many countries. Its importance, thanks to the direct and satellite businesses, has brought regulators to use it as tools for economics and development policies. Nowadays, the automotive industry is entered in the different regulators agendas even because of the environmental issues (Berns M. - Townend A. - Khayat Z. - Balagopal B. - Reeves M. - Hopkins M.S. - Krushwitz N. ,2009; European Union , 2000). Actors that ask to decrease the environmental burden to the automotive players are more and more. There are companies that have seen this pressure and issue as an opportunity and companies that in reverse is seeing that as a threat. Anyway no region and no country is immune to the environmental burden of cars and car industry (González P. - Sarkis J. - Adenso-Diaz B. , 2008).

Comparing automotive with others industries (figure 1), it can be noticed very well that automotive companies are not doing enough to increase sustainability in the sector. Many industries with a big environmental impact are making a lot of efforts and are investing hugely in sustainability. For some reasons automotive players are under the average.

Indifferently form the companies' visions, even if it will be possible to see that it will influence the company's approach, there is an increasingly need to innovate. Innovations that allow the growth of well-being in all the direction (OECD , 2009). One of this direction is the reduction of environmental impact, so the need to develop of eco-innovations.

Knowing how the innovation process has been modified by the environmental pressure, and therefore the need to develop efficiency and

effectiveness eco-innovations, is absolutely important for all the actors involved in these issues: from clients to regulators passing from supply chain actors.

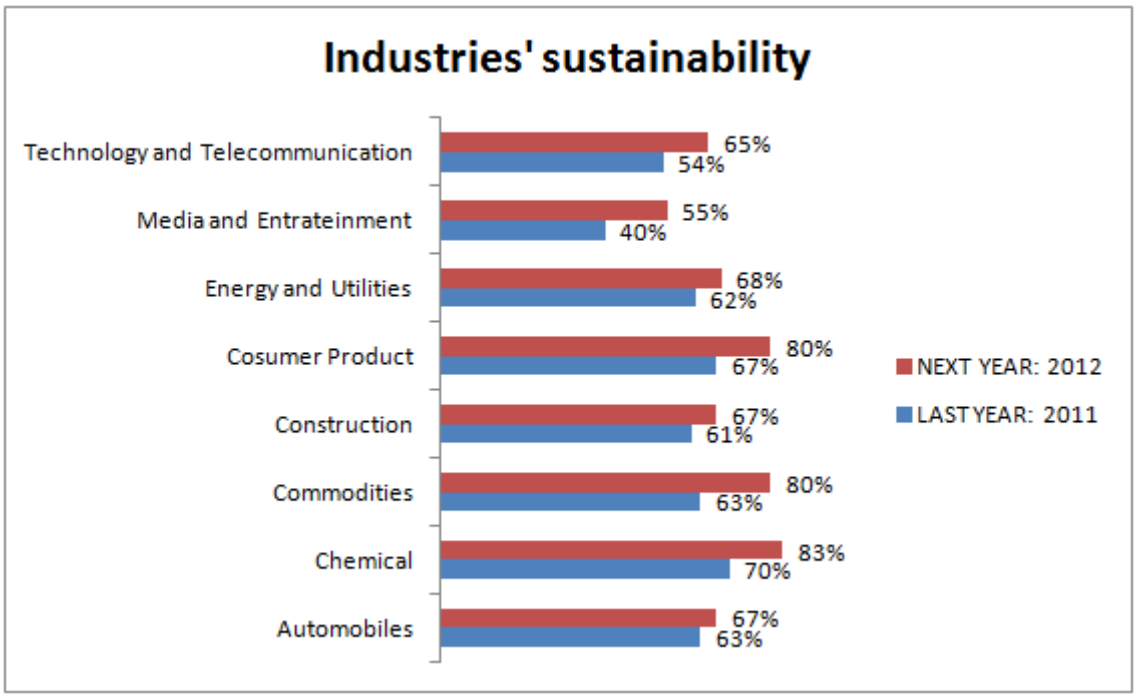

Figure 1: Industries' sustainability (Source: Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011).

In a managerial and scientific point of view cooperation in the supply chain, even in the automotive industry, has been already well studied. This paper tries to underline the most intensity and integration between all the actors that eco-innovations need differently from other innovations. Car makers, supply chain actors and management researcher might be interested this research because it is going to highlight the positive relationship between sustainability and so eco-innovations and competitive advantage. On the other for regulators this research and future more deep researches in this field become fundamental to understand how works the process and the collaboration, and what are the barriers, in a way to implement tools and rules to facilitate and push it

in order to make more sustainable and competitive all the country. Environmental issue in the automobile manufacturing field becomes more and more a critical management issue (Geffen C.A. - Rothenberg S. , 2000).

Nowadays it is not possible anymore to have industries with high environmental burden. Because of both economic reasons like costs, and environmental reasons like pollution. Industries that pursue this kind of development, that it is not sustainable, are destined to descend. Failing these industries, as automotive, that are an important part of the country richness (like in France, Italy, Germany etc.), can bring some negative impact in all the country system and in the country well-being.

To understand all the dynamics and factors, this work will start from a review of the past literature which concerns studies and researches in these themes. Later, it will pass understanding what is eco-innovation and its mains differences from a regular innovations, evaluating the barriers and the reasons that push companies to develop them. In the last part of the literature review it will be analysed in depth the link between sustainability, eco-innovations and competitive advantage putting emphasis to the different perspectives. Only at the end, the different innovation process/approach that eco-innovation needs will be analysed. Strict collaboration is part of this change and the research tries to understand why and how companies have to collaborate with the relative advantages. The collaboration approach will be part of the Green supply chain management field of studies influencing even the diffusion of eco-innovations as the analysis will put in evidence.

Before starting the analysis there will be a little overview of automotive industries and especially about interviewed companies stressing its supply chain position, size and relationship with clients and suppliers.

The previous work scheme will be maintained for the analysis exposition in order to facilitate the comparison between the effectuated study and the

past literature. The first step will try to explain the positive relationship between sustainability, eco-innovations and competitive advantage for the automotive players stressing why exist this link, focussing in which activities companies are developing eco-innovations. Passing in the eco-innovation barriers dimension and between actors that put pressure into automotive industry to become more sustainable. Thanks to these analysis, it will be better understood the work contest and the possible dimensions and variables which more are influencing the eco-innovation process.

Thanks to the second hypothesis, the research will develop a deeper knowledge about the transformation of the innovation process and about the innovation approach; passing from tools and methods that companies are using, arriving to list the most important eco-innovations that there are in the automotive industries, above all the organizational eco-innovations.

RESEARCH APPROACH

Research model

The work is started with the literature review, highlighting how rich and complex is the framework in the faced field. In the research there are four mains fields of analysis: automotive industry, innovation, environmental sustainability, supply chain. These themes have been and are some of the most studied sectors in the theoretical and practical point of view. It is not a news that the automotive sector is one of the most studied sectors in the world for its particularity, its appeal, and its impact in the society. Linked with the automotive sector a lot of studies has been done in its supply chain and in the relationship between suppliers. In the same way the innovation theme in the more technical/operational aspects or in the more organizational/management aspects is well studied and analysed. In the last decades another field is emerged: environmental sustainability. Green-economy, social-environmental sustainability, CSR, environmental impacts are only few of terms that help to remember how much is analysed this field.

In this complex framework situation, the most important contributes have been summarised following two criteria:

- The interest for and link with the research analysis that we are going to do;
- The importance of the contributes in the discipline;

A knowledge framework will be created behind the research question and the hypothesis.

In spite of the four fields have been deeply studied in a separate way; there are also some interdisciplinary studies. Innovation in the automotive sector, green-economy and automobiles, eco-innovation, green supply chain are only some of the interdisciplinary analysis. But the result of this first research (the literature review) is the lack of a comprehensive analysis that touch all the themes: innovation, automotive, supply chain, and environmental impact. One of this aspects is the evolution of the innovation process in the automotive industry. This evolution is concerning the actors relationship in the supply chain and the pressure for the sustainability. Understand how this process is evolved and how is evolving can develop the awareness in this field and help the actors (companies or regulators) that have the leverages to modify and improve sustainability.

From this first consideration, the following question was raised:" *How the sustainability pressure has influenced the innovation process in the automotive industry?*". Pressure for sustainability is a strength that directly or indirectly has influenced several companies and company functions, above all in the automotive industry. Is it true that this pressure has influenced even the innovation process? And if yes, why has it influenced the innovation process?. Especially, how the actors can incentivize the development of more eco-innovation to make the world more sustainable?

Innovation, in the broad sense of the word, for the company is the only way to remain competitive, and automotive industry is one of the big industry for a country (developed countries as France, Italy, Germany, USA etc) that concern: pollution dimension is huge and environmental impact is extraordinary; all this linked with the usage of the products and its pollution long all the life cycle. How these two issues (innovation and environmental issue) can be connected to have an useful outcome for everyone?

To analyse if it is effectively changed the innovation process because of the sustainability/environmental issue pressure and how it is changed, two mains hypothesis have been developed:

1. *In the automotive sector to be green allows companies to build a competitive advantage.*
2. *The pressure has changed the innovation process.*

The first hypothesis is necessary to understand if the eco-innovation allows the company to build competitive advantage. Without this link, it would be difficult for the supply chain automotive companies start to develop eco-innovations and maybe change the innovation process or approach to develop them. In this context the evaluation will concern:

- *1.a: In what activities is higher the pressure for the eco-innovation*
- *1.b: What are the barriers that the supply chain actors find*
- *1.c: From who arrive the eco-friendly request*

The previous issues are useful to understand the different eco-innovations peculiarities in the automotive industry in a way to insert the analysis in a practical context and not only into a theoretical one. And above all because of the need to understand if there are some linked with the eco-innovations specific features and the differences in the innovation process.

The second one is precisely focused on how the pressure for the sustainability has changed the innovation process. The issue is divided in two more points:

- *2.a: One of the most important aspect is collaboration. Developed eco-innovations need more collaboration between actors.* We are going to try to understand how they collaborate and how they implement collaborative programs.
- *2.b: The most of automotive industry's eco-innovation are: product innovations, Technological innovations, incremental innovations, and components innovations.* This verification is important to understand where the actors have done the major efforts, where there is more

improvement space; and what are the most important eco-innovation.

The scheme proposed is to better understand the logic behind the Research question and the hypothesises:

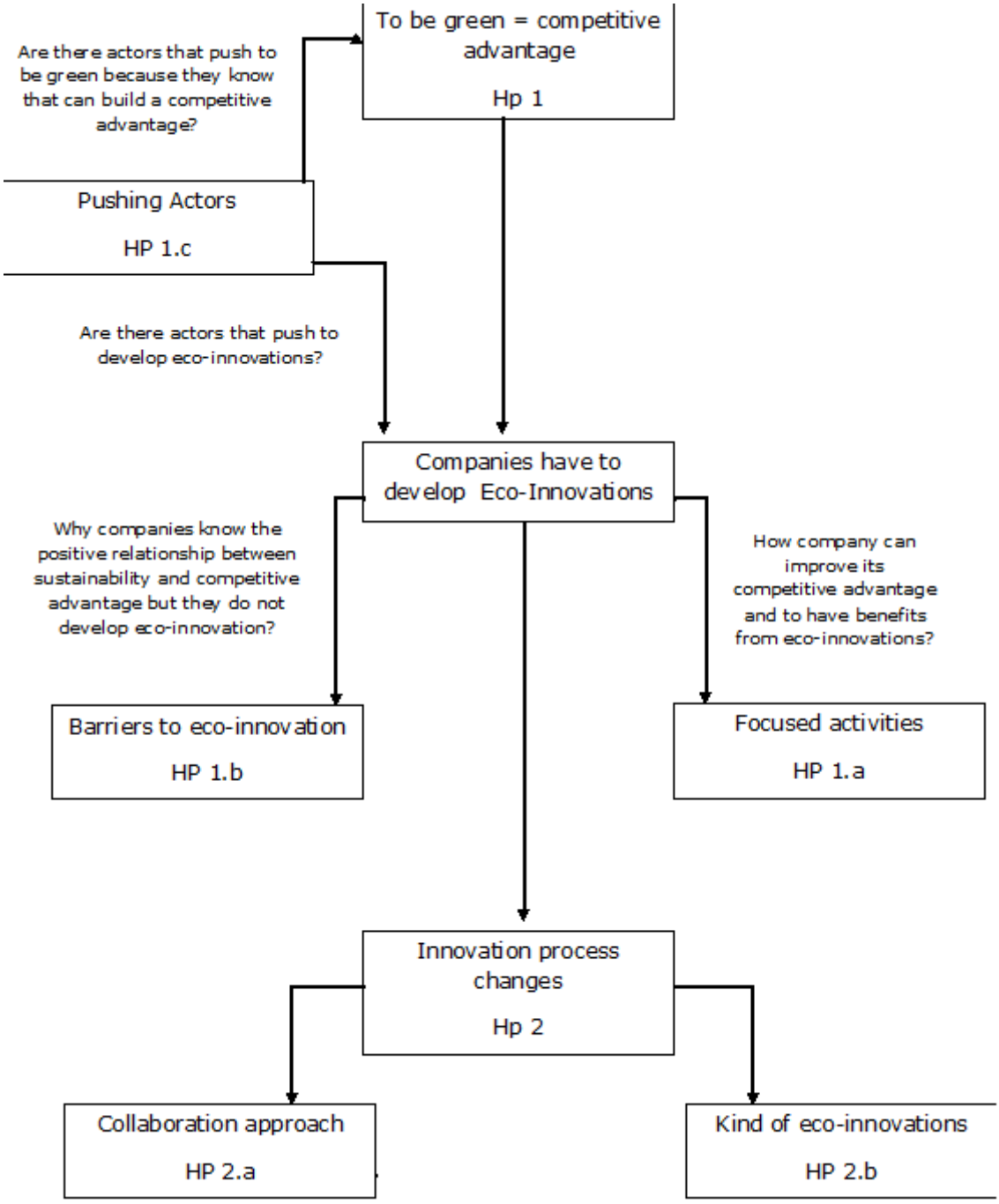

Figure 2: Research and hypothesises' scheme

Data collection and analysis

The case study methodology allows researchers to examine a subject in depth without separating the subject from its contextual environment (Yin R. K. , 2001). This Yin's affirmation is very important in this case, in fact would be very difficult if not useless separate this analysis from the contest given that is really the contest the main variable of the analysis.

The research method is entirely qualitative, using mainly primary sources. Secondary sources of information have been used only to have some more information about the company: the organization of the company and the most important policy in the environmental and innovation field. It has opted to use a qualitative research method because considered more appropriated to analyse these fields. This method is more suitable to investigate on: motivations, company background, cooperative relationship, actors pressures, innovation approach and diffusion.

The research tool was interview. Interviews have been done to 10 actors indifferently of the positions in the automotive supply chain, indifferently of its own dimension, and indifferently of the relationship that they have built with suppliers or clients. So, the managers interview were employees in big firms as little firms, more innovative company as non-innovative companies, car maker as rang-3 suppliers. The questionnaire was based on the research questions and the hypothesises. In this way the schema is very simple: it is possible to superimpose the literature review, the questions plan, and the analysis finding the same scheme and logic in a way to make comparisons very easily. After a dedicated lecture of the literature has been built the questionnaire following two criteria:

- the same logic in the research plan (RQ and HPs);
- Time issue: find the way to compact all the questions in the few time that managers grant you for the interview.

The finals interviews were 10, of which one has been done to a KPMG's consultant. This last interview has been done to an important advisor of several companies in the automotive industry in the innovation field. For several years he has worked in close contact with automotive industry's companies, and his expertise and knowledge was really important for the research. The interaction with this consultant was higher than with others managers, thanks to the partnership of the research with KPMG consultant group. In the interviews with managers the approach was to use them as a filter to understand and investigate companies as a whole. The focus was in the organization as a single institution and it was not focused on the specific manager.

Research limits

The mains limits and difficulties observed that have to be highlight are:

- Geographical limits: for a practical issue there is a real geographical limits. The headquarters of all companies are situated in the Italian or French Regions. Some of them have relationships with company in other countries (e.g. Germany, US, China), and some of them have subsidiaries in other countries (e.g. China, US), but their features are strictly linked with mother country. How written before, the case of study is a good method to stay embedded in the contest, this advantage become a limits to know and understand.
- Interviews limits: an analysis of this type would request an interview time longer than that allowed. Investigate in a deep way the different aspects and dimensions of the innovation process, of collaboration, of relationships etc. entail the need of long interview that unlikely are allowed. At the same time in some situations might be interviewed more than one manager; above all in a big company,

one manager is specialized only in a specific area, and for our research is needed to inspect deep not only one specific area but the company in general. Another limit in the interviews is the lack of possibility to make a re-interview. This is one of the most important limits to underline. To understand deeply the relationship between companies and all the variables embedded in this relationship, as even the dynamics of the collaboration, and how the pressure and the innovation pass from one company to another would have been suitable to have the opportunity to make more than one interview to the same manager. (e.g. we have interviewed before Valeo taking some information. Later we interviewed PSA, but with already some information about them thanks to Valeo interview, so we have had the opportunity to examine in depth some aspects having Valeo information as input. It was impossible come back to Valeo after the PSA interview and do the same thing). The approach uses managers as filters to understand company behaviours as a whole. This methodology is limited when the possibility of interview is only to one manager.

- Being innovation one of the most important and secrets elements for companies, and being the engine for its market victory, two important limits have been found:
  - some companies have given only a part of the information to respect the industrial secret.
  - some companies have required to do not put some information in a explicit way in the research. This kind of information will be useful as well to understand the different dynamics even if we can't use explicitly.
- A quantitative research could supported better the qualitative analysis done.

1. LITERATURE REVIEW

1.1. ECO-INNOVATION

The concept of eco-innovation appeared for the first time in the book "Driving Eco-Innovation: A Breakthrough Discipline for Innovation and Sustainability" (Fussler C. - James P. , 1996) defining it as *"new products and processes which provide customer and business value but significantly decrease environmental impacts".*

One of the most important definition of eco-innovation has been provided by the interdisciplinary project "Joint Project on Innovation impact of environmental Policy instruments" (FIU, 1998): *"eco-innovations are all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which: develop new ideas, behaviour, products and processes, apply or introduce them;* and *contribute to a reduction of environmental burdens or to ecologically specified sustainability target".*

In the same way even the "Competitiveness and Innovation Framework Program" defines eco-innovation as any form of innovation "*that allows to reduce environmental impact or that allows to use more responsiveness and more effectively natural resources"* (CIP, 2007 - 2013)[1].

It is easy to understand that eco-innovation covers all kinds of innovation that a company (better an organization) can develop regarding

[1] The CIP's aim is "*to contribute to the enhancement of competitiveness and innovation capacity in the EU, the advancement of the knowledge society, and sustainable based on balanced economic growth*". CIP, (2007 - 2013).

indifferently the product or the process. In the previous two definitions is not clarified why the innovation come out. So, an innovation to be defined eco-innovation does not require that one of its drivers is an environmental or sustainability objective. Any innovation, driven by other objectives such as cost reduction, technological advancement, or opening new trajectories that allows to have a reduction in environmental burdens or that allows to use more effectively and responsibly natural resources is a eco-innovation.

Similar definition of eco-innovation can be found in the eco-design field. Curtis and Walker (Curtis H. - Walker J. ,2001) defined eco-design (or design for sustainability) as "*the balance between social and environmental issue with economic factors within the product development process*"[2].

Eco-design considers all the environmental issues from the raw-material extraction to waste generation and final recycling (Borchardt M. - Poltosi L.A.C. - Sellito M.A. - Pereira G.M. , 2009). Eco-design do not cover only the product but also the process. This definition brings up the environmental issue. A product to be eco-designed should take into account an objective of environmental protection. Therefore, it shows a kind of co-objective: the first strictly economic and the second that concerns sustainable development. Such a position, even if similar to the previous, reveals an important issue: the will of the company to find a compromise between the two objectives. However Curtis and Walker (Curtis H. - Walker J. , 2001) do not analyze in depth such compromise, in the sense that it is not evaluated the possibility of a win-win game or of a trade-off game.

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[2] Another definition of eco-design can be*:" the process of integration of environmental aspects in the product development which aims to reduce the environmental impacts of products. This process is seen throughout the entire life cycle of products. The product concept includes goods, services and processes*". (Vallet F. - Messaadia M. - Eynard B.)

A depth-study of the types of eco-innovation that allows us to understand better the sense that this term has come from the work done by Zhu, Sarkis and Lai (Zhu Q. - Sarkis J. - Lai K. , 2012). In fact they divided eco-innovation in: soft technological innovation (e.g. increase collaboration in eco-design) and hard technological innovation (e.g. cleaner production equipment). This definition is not going to highlight what is truly an eco-innovation but underline the possibility to divide it into two large fields. A organizational field and a field closer to technological innovation that allows a progress toward a more sustainable economy.

In order to enter more deeply into the operational eco-innovation subject seems appropriate to mention the researches of Fiksel (Fiksel , 1996) and Venzke (Venzke , 2002). They have listed the mains principles that an eco-innovation has to have. In the materials field, eco-innovation requests to choose materials with low environmental impact or that are recyclables, avoiding hazardous substances. In the product field they advice to design modular, simple and multifunctional products with a greater durability. Linked to product they push for a recover product packaging. Concerning energy field they prefer the reduction of energy requirements and the use of renewable energy. In the end, to prevent and to decrease the risk of environmental accidents has to be the rule.

After an overview to understand how an eco-innovation is defined in the literature, and understand that eco-innovation's domain can be more or less wide, with no clear and easily determined borders, it would seem appropriate to highlight the differences that may be found between an eco-innovation and a regular innovation (Bertens C. - Statema H. , 2011:

- Higher initial investment costs and lower using and maintenance costs.
- Information asymmetries because of low experience and less trust.

- "*Environmentally sound alternatives*" bring higher collective benefits *and* equal or lower private benefits than regular innovations.
- Eco-innovation needs higher involvement, higher efforts, and more information due to limited experiences.

These differences highlight the fact that in the big innovation basket there is a part that can differentiate itself from the regular innovation. Principal objective, or secondary objective, or the goal of compromising or the break of the trade-off are indifferent when there are the mains differences that distinguish eco-innovation from the others. The eco-innovation discriminating factors, from regular innovation, can be used to define it. To these features can be attributed one or more of the previous described points (e.g. better efficiency use of the resources).

Previous research also made several managers' interviews to understand what they thought of these statements. The issues evidenced by the experts were the following (Bertens C. - Statema H. , 2011):

- The most important different that managers found between regular innovation and eco-innovations is the externalities. Thanks to eco-innovations benefits are not only for the company but for a wide range of stakeholders.
- Putting environmental goals in the organizations and in the new product development companies have to face new challenge in some fields that they do not know (e.g new materials), so the risk is higher. But sometimes companies reach a smaller environmental impact without particular and specific sustainable objectives.
- They underline the difficulties to develop innovation that does not care about environmental. So, nowadays it is very difficult to develop new product or new process without develop eco-innovations.
- Eco-innovation influence a lot the quality perception of costumers in a positive way or in a negative way.

- In the case of eco-innovation the contest is more complex. Eco-innovations have to enter in the case of system innovation. Eco-innovation requires more players involved. Another important point of complexity is that at the end eco-innovation has to fit with the existing infrastructure and services.

For the experts the greater difference is who is going to take the benefits from the innovation. An eco-innovation brings benefits not only to the clients and to the users but to a larger range of subjects. Another important difference is why, so the reasons that push the company to eco-innovate. The most different reason that it is possible to find in eco-innovation is the values and idealism to be eco-friendly, that in the regular innovation we cannot find. Not all eco-innovations have a idealistic push, but they only reduce at the end the environmental impacts. The last, but not least, aspect emerged from the interviews is the risk. The need to enter in new markets and fields brings companies to have more entrepreneurial risk because of the modest knowledge of the new sectors.

It seems suitable analyze deeper the last point of the list. To develop eco-innovation companies need to be supported from other organization. The cooperation and the involvement of more actors is a pre-requisite to eco-innovate. This complexity is accentuated by the need to inset an eco-innovation in the common standards used in that moment.

So, to conclude one of the better definition of eco-innovation is described in Rennings (Rennings K. 2000):"*Eco innovation has been defined as the process of developing new ideas, behaviour, products and process that contribute to a reduction in environmental burdens or to ecologically specified sustainability targets",* putting in evidence that eco-innovation can have a specific environmental goal, or that can be a general innovation that allow a fewer environmental impact, so with no deliberate environmental objective (OECD, 2009).

1.2. DETERMINANTS OF ECO-INNOVATION

What motivates companies to be eco-innovators? The answer has been taken by many authors through a lot of qualitative and quantitative researches.

One of the best specification that is able to explain the company's motivations to become eco-innovator has been done by Statema (Statema H. , 2011). He lists under three big clusters the different reasons that push companies to be eco-innovator. Before entering in the factors details it is compulsory underline the interdependency and the simultaneously activity that exist between these factors. As it is impossible affirm that only one of them push the company to a more environmental intelligence. Easily, the causes are interdependent each other and some of them influence the company decisions with more or less strength.

Market pull factors (Statema H. , 2011):

The existence of potential customers is essential to have a long term eco-innovation approach. Demand plays a key role in the preferences, requests, and needs that customers show and that companies try to satisfy. The factors are: to increase market share, to be better of the competitors, enter in new market, the image transmit to all stakeholders (clients included), to satisfy the potential customers requests (implicit or explicit).

Technology push factors (Statema H. , 2011):

These factors are strictly linked with the technological progress: indifferently if it is a technological incremental innovation or a technological disruptive innovation, both bring the company to be eco-innovators. Effectively the drivers are: energy efficiency, product quality, material efficiency, product palette.

Regulatory push factors (Statema H. , 2011):

An important role is played by the government and regulators. Regulations, laws, and directives push companies to engage the eco-innovation issue. Not only the existing regulatory system is important, but also the future regulatory system, as well as the expected regulation. Standards compulsory regulations is one of the main way that the regulators use to increase the eco-innovation sensibility.

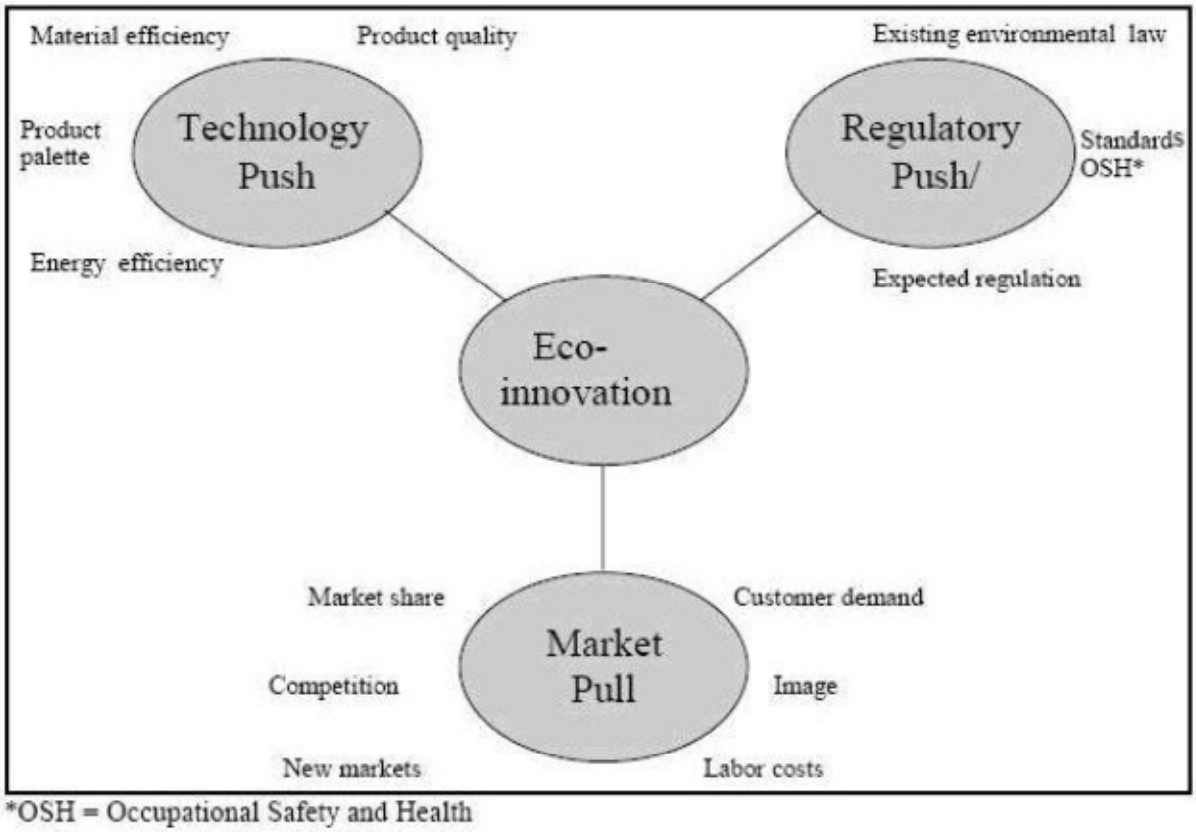

Figure 3: Eco-innovation drivers (Source: Reannings K. , 2000)

A further research highline five different drivers of eco-innovation: regulation called legal framework , demand from users, capturing new markets, cost reduction, and image in the positive way as well as to fear of reputation loss[3].

[3] Rennings K - Zwick T. , 2003 measuring eco innovation Bowen *et al.* 2006,

Haanaes, Balagopal, Arthur, Kong, Velken, Kruschwitz and Hopkins (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011) research is based on surveys done to managers (figure 2).

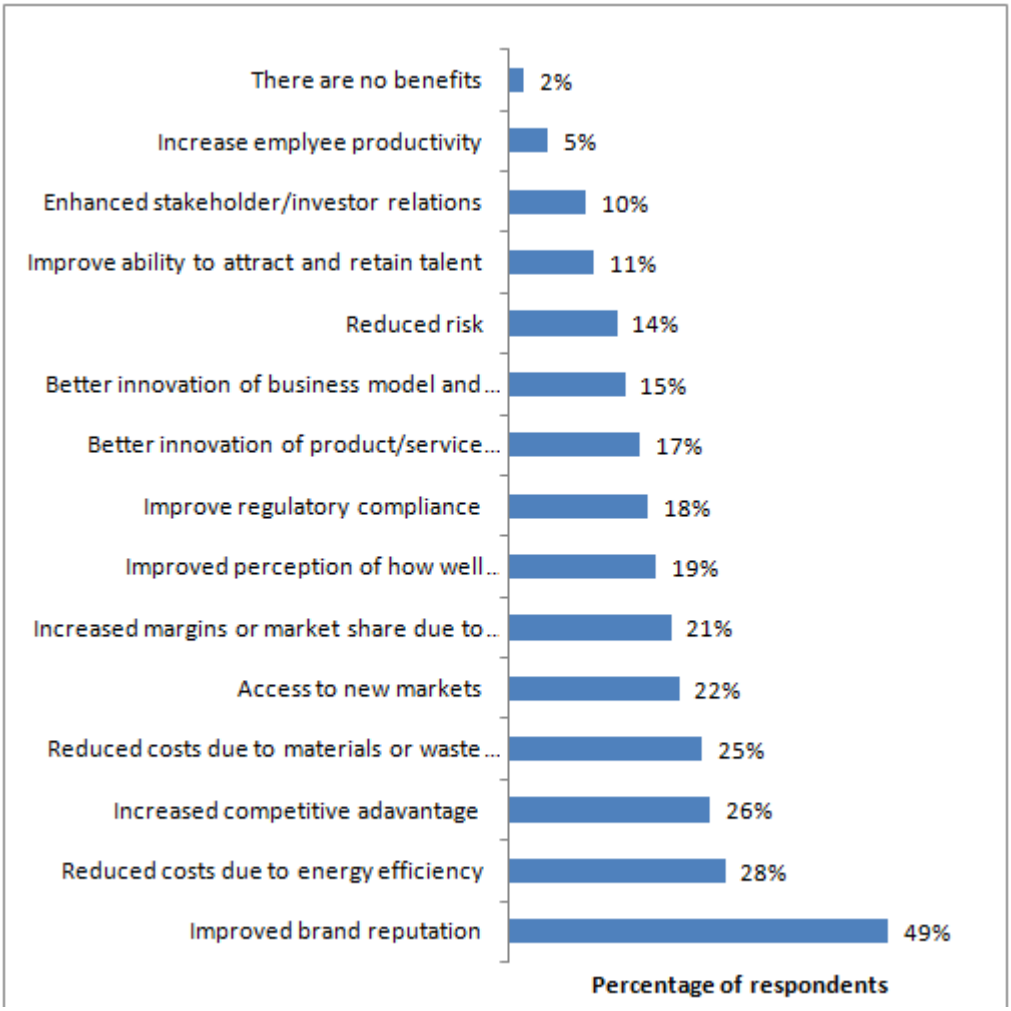

Figure 4: What are the greatest benefits to your organization in addressing sustainability? (Source: Haanaes K. et all , 2011; own re-elaborated version)

They directly asked what reasons push them to be eco-innovators. The research's overcomes are in line with the two previous analysis. In the first place there is brand reputation, and in the second one costs reduction.

Handfield *et al.* 1997, Preuss 2001, Sarkis 1999, 2006) carbone moatti

The image coming back, as explained in the analysis is not an end to itself but allows to: "*covering a diverse set of related benefits that go beyond the normal parameters of brand. For example companies with a good reputation have better chance of capturing several of other, lower-ranked benefits, such as successfully entering in new markets, increasing margins, or market share, improving their ability to attract and retain talent, and even to have potential financial benefits*".

Among the actors that can influence and push companies to be more eco-friendly the Second Annual Report (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011) puts, next to regulators, the line-leaders, the Advocacy Organizations and NGOs. Based on them power, these actors can, in a stronger or in a lighter way, influence the decisions of the companies.

In the same research the authors affirm: *" Company's senior leaders are the top driver of action and organizational attention , even if customer pressure is a close runner-up".* The intention is to highlight the great importance that top managers have as eco-innovation driver. The Senior managers' will is a key factor to focus the attention to the environmental issues, and to push all the organization and employees toward sustainability (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011).

Retaking the line leader concept as eco-innovation development driver, the relationship can be examine thanks to work "Towards greener supply chain: an institutional perspective" , done by Carbone and Moatti (Carbone V. - Moatti V. , 2011). In a green supply chain management field of study the two researchers highlight two kinds of relationships that there are among supply chain actors: institutional pressure and imitative behaviour. "*Isomorphism stems from the influence of three different types of institutional pressure* (Di Maggio P. - Powell W.W. , 1983)*. We have chosen to group these three pressures into two major types of influences*

that also echo Baron's typology (Baron D.P. , 1995) *of non-market versus market influences. The first type of pressure comes from formal institutions*[4]*, particularly regulations. The second type is the result of more informal social pressures initiated by leading or interconnected companies*[5]*. Such pressures are exerted by business partners (suppliers, customers or other allied firms) or competitors".*

1.3. BARRIERS OF ECO-INNOVATION

Going to analyze the supply chain in the automotive industry; barriers, as drivers, to eco-innovation are the same in the business to business market like in the business to costumers market (Statema H. , 2011).

The second step to do is clarify that there are a lots of barriers to innovation. Those already studied and depth analysed conventional innovation barriers can be translate directly to the eco-innovation field. Briefly, the paper is going to discuss only the barriers identified as specific barriers for eco-innovation, but keeping in mind that there are all the other regular barriers[6].

Before Porter and Van Der Linde (Porter M. - Van der Linde A. , 1995), later Crotty and Smith (Crotty J. - Smith M. , 2006) reinforcing the

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[4] coercive isomorphism for Di Maggio and Powell (Di Maggio P. - Powell W.W. , 1983).

[5] normative isomorphism and mimetic isomorphism for Di Maggio and Powell (Di Maggio P. - Powell W.W. , 1983)

[6] Many authors has defined regular innovation to differentiate them from the eco-innovation. So, we use the same logic to differentiate the barriers to regular innovation from the specific barriers to eco-innovation

intuition of the firsts two researchers explain that:" *firms are presented with many opportunities, but have limited information and resources, with the potential of selecting the wrong technological option. There is also the problem of technology 'lock-in', which may demand capital investment, thus incurring opportunity cost and potentially limiting future options. Third, and allied to the potential problem of 'lock-in', is the relationship with dominant technologies".* If it is true that the previous three barriers are some of the most difficult barriers in the regular innovations, they become even more higher in case of eco-innovation. Actually, as seen before in eco-innovation, companies have less information, expertise and experience than in regular innovations. The "lock-in" effect increase the complexity of eco-innovations that have to adapt to conventional standards, infrastructure and technologies without compromise the customer satisfaction.

Specifically for eco-innovation many authors (Kempton, W. , 1991; Jaffe - Stavins , 1994; Kaenzig - Wustenhagen , 2008) found: "*higher initial costs"* as *"one of the major barriers for eco innovation*". Hidde Statema (Statema H. , 2011) adds that: "*Together with information asymmetries this prevents the market diffusion of eco-innovations".* He went on underlining that it's true that usually eco-innovations are more expensive than regular innovation; but that there is the information asymmetries that influence the actors' perception, when happen the contrary, with: "*green and expensive versus brown and cheap*".

The ETAP (the European Commission's Environmental Technologies Action Plan)[7] has identifies five mains barriers typologies for the environmental technologies. That types are mostly linked to eco-innovation. The limits of this range is that it is specific for technologies eco-innovations, so for

[7]. Communication from the Commission to the Council and the European Parliament, 2004.

kinds of innovations that quite enough authors call hard innovation (Burgess, T. F. - Gules, H. K. , 1998)[8].

The barriers are the following:

- Economic barriers: starting from prices, passing through the cost of investment, arriving to the switching costs;
- Regulations and standards: they can also act as barriers to innovation when they are unclear or too detailed;
- Insufficient research efforts: this means weak investments in research, inappropriate research system and scarse information flow;
- Inadequate availability of risk capital;
- Lack of market demand from the public sector, as well as from consumers.

While ETAP highlights the barriers linked with the technological eco-innovation, and while Kepton (and others) and Statema underline the problems of the high initial costs and the information asymmetries, a more elaborated lists and complete analysis of eco-innovation barriers can be found in Ashford (Ashford N. , 2002):

1. *"Technological barriers":* these kinds of barrier are strictly linked with the technical and technological knowledge; in fact there is a real technical limit that research and studies are not able to overpass yet. Other limits under this dimension are: the performance capability of technologies under some economic restriction or process or product design standards. It is possible to

[8]. Burgess and Gules (Burgess, T. F. - Gules, H. K. , 1998) divided Hard Technology and Soft Technology. The first one is the traditional tech-innovation linked with hardware or software technologies. Te second one is based on organizational innovation: organizational culture innovation, policies innovation, practices innovation.

insert in this set of barriers even the uncertainty or the scepticism in performance that stop the investments.

2. *"Financial barriers":* In this list of barriers, it is possible to find several and different limits. Ashford underlines the importance of costs and of the initial investment. The first cost barrier is the R&D costs. But after there are a lot of others barriers linked with costs: the difficulties to evaluate future costs, and above all the difficulties to forecast a cost-benefit analysis. There are even all the costs linked with the customer acceptance of the new product. The idea that: investing in environmental issue, when others companies are not doing the same, can bring to have less competitiveness. There are other two important barriers for all the companies: the lower short-term profitability that eco-innovations can have; and the difficulties to understand what are really the operating costs linked with current technologies that are no-modifiable and what are only masked in operating costs. In this category there are other two barriers linked with specific contests:
   - Little companies: that can not reach economies of scale investing in eco-innovations
   - Old companies: that can find inefficient to invest in process modification

   Kempton, Jaffe, Stavins, Kaenzig and Wustenhagen's (Kempton, W. , 1991; Jaffe - Stavins , 1994; Kaenzig - Wustenhagen , 2008) higher initial costs can be insert in this category. Ashford has only explicated all the other sources of higher costs.
3. *"Labour force-related barriers":*There are two mains barriers in this class. The first one is the lack of managers in charge of eco-innovations or in charge of the environmental issues. The second one is the requirements that environmental issue requests to managers that can do not have or can do not able to manage an additional program. The perception of "green-expensive and brown-

cheap" (Statema H. , 2011) has to find a place here, but in part has to be put in the managerial barriers.

4. "*Regulatory barriers":* Regulators can be a strong barriers to develop eco-innovations. In fact he can put a incentives system that does not really subsidize eco-innovations development. They also can based is regulation to the conventional technologies removing the possibility to develop better eco-innovations. The last one is the too much complexity of regulation and the uncertainty about the future laws.
5. *"Consumer-related barriers":* The acceptance of the product is not easily predictable and not all consumers are available to pay more for a sustainable product. There are even another important barriers: the product typology called by Ashford "*tight product specification (e.g. military purposes)".*

6. *"Supplier-related barriers":* Suppliers play a key role in the product and process development. To have a eco-innovate process or product companies need suppliers support in many field e.g. expertise, process adjustments and so on. The lack of this support become a difficult barriers to face.
7. *"Managerial barriers":* These kind of barriers can strongly influence all the other barriers because of the perception of them. Lack of managers and top management commitment in the environmental issues, as the lack of expertise and knowledge about it are the two most important barriers in this set. These two can bring two more limits : the first one is linked with the lack of education, motivation and training of employees; the second one is "*the reluctance on principle to initiate change in the company",* the so called managers inertia. Internally, the lack of cooperation, formal with program or informal based on culture, can bring out a lot of problem to develop eco-innovations.

It is important don't forget that as the eco-innovation drivers are interrelated each other, also the barriers are interdependent and jointed each other.

1.4. TO BE GREEN AND THE COMPETITIVE ADVANTAGE

"*Historically, both researchers and practitioners have considered the firm's requirement to minimize its environmental impact as part of a firm's corporate social responsibility, and thus researchers theorized that firms had responsibility for the environment as ethical obligation* (Des Jardins J. , 1998; Zadek S. , 1998)*. Today there is growing recognition that there are explicit linkages between a firm's environmental practices and its overall business performance* (Klassen R. - Whybark S. , 1999; Zhu Q. - Sarkis J. , 2004; Reuter C. - Foerstl K. - Hartmann E. - Blome C. , 2010; Hollos D. - Blome C. - Foerstl K. , 2012) " (Tate L. W. - Ellram L. M. - Dooley K. J. , 2012). Starting the paragraph with this passage is important because it can explain very well the passage from the idea that sustainability is a mission linked with ethical obligation and the company will, to the becoming conscious of sustainability as a competitive drives.

The literature in the theme of sustainability and competitive advantage is very large and well developed. The most important contribute will be analyzed and compared them each other.

Motivations that push companies to look for eco-innovation are not only contain in environmental benefits. On the contrary, companies know that implementing eco-innovation allows them to have lots of economics vantages. Cost cutting, image improvement and law respect are some of the most important motivations to be green (Vercalsteren A. - 2001).

Murphy and Gouldson (Murphy J. - Gouldson A. , 2000), referring to the Ecological Modernization Theory (EMT), think that there is a possible solution to the conflict between industrial development and environmental protection. Hall (Hall J. , 2001) in the same way, saw the big opportunity

to gain competitiveness through environmental innovation thanks to Green Supply Chain Practice (GSCM).

An important contribute come from Christmann (Christmann P. , 2000) who found a justification for the relationship between sustainability and competitive advantage. He argued that: "*companies can develop complementary capabilities that flow from environmental management to other areas*". He showed: "*the possibility and the opportunity for the companies to increase its competitiveness transferring knowledge, skills, capability and expertise from the environmental area to the others functions*" (Vachon S. - Klassen R.D. , 2008). So, a proactive environmental management can develop innovative solution to face green challenges and at the same time discover innovative way in the other organization's operations (Russo M.V. - Fouts P.A. , 1997; Porter M. E. - Van der Linde C. , 1995).

Nidomolu, Prahalad and Rangaswami (Nidomolu R. - Prahalad C. K. - Rangaswami M.R. , 2009) followed the same path about competencies transferring. Putting in the primary goals sustainability, companies can " *develop competencies that rivals will be hard pressed to match*". For the author the logic is the following: putting as main objective sustainability, the organization has to put itself out of the balance, and push itself toward the eco-innovation development. The development of these eco-innovations builds new competencies and know-how. Being the company an early-adopter these capabilities will be difficult to imitate and will stress the other competitors to reach the same level and objectives.

A lot of other authors' studies underline and prove the positive link between the green sustainability practice and the economic performance. The overcomes of these researches are that: green practices allow to firms to have above all an improvement of productivity, competitiveness, business profitability, and green image (Zhu Q. - Sarkis J. , 2004; Simpson D. F. - Power D. J. - Samson, D., 2007; Zhu Q. - Sarkis J. - Geng

Y. , 2007; González-Torre P. - Pérez-Bustamante G. , 2006; González-Benito J. - González-Benito O. , 2005).

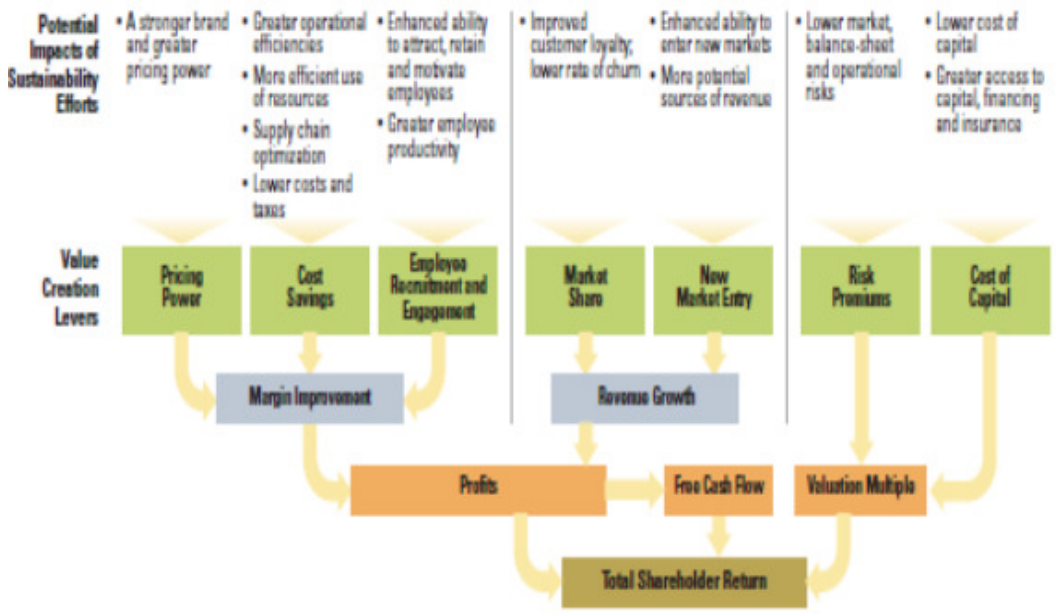

Figure 5: How sustainability affects value creation (Source: Berns M. , 2009)

The authors of "*Environmental Regulation an innovation Driving Ecological Design in the UK Automotive Industry*" (Smith M. - Crotty J. , 2008) summarizes everything with: " *doing more with less".* If it is mandatory to confirm this affirmation, seen previous researches, it is obligatory as well to highline that " do more with less" is not the entire link between eco-innovation and competitive advantage. To be green embracers means much more than find a efficiency solution, but it means to break the trade-off between economic performance and environmental performance through a win-win game long all the supply chain; starting from inserting sustainability targets in the most important and strategic goals of the company.

Researching to be eco-innovators, and therefore putting in practice the major sensibility for the environmental issues, allows the company to be better performer. The Analysis done in the "First look: The second Annual Sustainability & Innovation Survey (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011) brings out the positive relationship:" *Top performers are significantly stronger embracers of sustainable-driven strategy*".

Not less important, in the academic point of view, it is the work conducted by Arundel and Kemp (Arundel A. - Kemp R. , 2009) in the eco-innovation measuring field. In this research the author found that *"...faced with rising costs for producing goods and managing waste products, the competitiveness of firms, countries and even regions is increasingly linked to their ability to 'eco-innovate*". To eco-innovate, it is not only referred to increase the competitiveness of one company, but becomes a key factor for the development of regions and/or countries. Developing eco-innovations there will be environmental benefits for the country and the region where the company is set up; but there will be also competitiveness benefits for them.

Seeing the different analysis, researches, and theories; they seem to confirm the relationship between sustainability and competitiveness. To be embracer adds competitive advantage to the organization. Logically, these affirmations do not want to delete the barriers and limits that companies can find in the path to become eco-innovators. But this means to give to companies and to the top managers the theoretical background to push themselves toward the eco-innovation strategy.

A position a little bit different, but not contrary, from those described above is that of Orsato. Orsato, in his famous research "*Competitive Environmental Strategies: When Does It Pay To Be Green?*" (Orsato R.J. , 2006), explains that there are not only the possibility that investing in green-friendly activities company will have competitive advantages. He

underlines the fact that there are a lot of variables that can bring the company to have not a competitive advantage investing in the environmental issue. In line with Porter (Porter M. , 1985) to have the probability to transform environmental investments into source of competitive advantage, companies need:"*the creation of unique and valuable position, involving a different set of activities".* Profit generation and the competitive position of the company from green issue embracing depends on several variables:" ranging from internal capabilities to the structure of the industry" (Orsato R.J. , 2006).

1.5. THE COLLABORATION'S ROLE IN THE ECO-INNOVATION PROCESS

In a complex good as the automobile, collaboration in the innovation process is an activity that exists from years. This section will allow to discover how collaboration is so important in the eco-innovation development. The main point is the link between complexity and collaboration. More complexity asks for more collaboration; so the goal is to understand the past theoretical framework, under the idea that eco-innovation activity is a more complex activity than regular innovation, adding to the already complexity of vehicles (Zirpoli F. , 2008; Zirpoli F. - Becker M. C. , 2011).

One of the most important analysis on eco-innovation has been done in "Business models of eco-innovation" (Bertens C. - Statema H. , 2011). In this work is possible to find an important theoretical and practical basis to analyse the role of collaboration. Bertens and Statema (Bertens C. - Statema H. , 2011) declare: "*Within the value network of an eco-innovation cooperation between parties involved seems to be more and more important*" Authors went on analyzing deeper this affirmation and underline that it is absolutely compulsory an intensive cooperation between actors in the value chain "*in order to be able to deliver a total solution".* Of the same mind González, Sarkis and Adenso-Diaz (González P. - Sarkis J. - Adenso-Diaz B. , 2008) explain that to develop and implement environmental practice, and the base of new environmental practice are eco-innovations, companies need to interact and collaborate with suppliers. The several done interviews bring out the beliefs of embracers manager that the cooperation and the good partner relationships are a critical factor in the green business model.

The importance of supply chain partnerships is going up in order to maximise the value and to overcame externalities optimally. Previous

researchers wrote: "*By identifying value adding moments in the chain and ensure a better fit and collaboration between partners in the chain, it is expected to ensure higher gains for the supply chain as a whole and thereby for its individual partners*". The supply chain collaboration become a managers leverage to use intensely and to push organization until the highest limit.

With the similar idea, Hart (Hart S. L. , 1997) puts in evidence the importance of the collaboration in the environmental strategy. Without explicited connection with eco-innovation he wrote: to have a "*integrated environmental strategy*" company must to build relationship with customers, suppliers and other companies. He inserted into the strong network to build policymakers and all the stakeholders as well. But it seems logic that implicitly we can refer this idea to eco-innovation. To implement a new strategy there is the need to innovate, and in this case to eco-innovate.

In the Green supply chain studies, Srivastava (Srivastava S.K. , 2007) confirmed the need of collaboration: "*green supply chain management is a integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life*" (Carbone V. - Moatti V. , 2011).The "integrating environmental thinking" can easily place side by side with the "*integrated environmental strategy*". With these two authors it is easy to understand that talking about environmental strategy, that imply the eco-innovations development, it is compulsory to build strong relationship in a vertical way and in a horizontal way. Vachon and Klassen (Vachon S. - Klassen R. D. , 2008) add that to have a major environmental collaboration actors need to share commons objectives and policies. That can be seen as a pre-requisite to build a "integrated environmental strategy" or an "integrated environmental thinking".

Previous affirmation can be summarised thanks to others authors, confirming the theory that to have un effective green supply chain is necessary to have: inter-organisational collaboration, internal and external supply chain integration, and information sharing (de Brito M. - Carbone V. - Meunier C. , 2008; Vachon S. - Klassen R.D. , 2008; Young R. , 2000).

The logic behind previous affirmation and the innovation process is not too difficult. To have always a low environmental impact, companies need to eco-innovate. To make possible a green supply chain, and so a green impact toward external environment, is necessary that all the actors of the supply chain make his own effort. The activity of one actors will influence the activities and results of another linked partner, also in the sustainability field. It is easily possible to understand how important is the collaboration to reach a eco-innovation and to allow its diffusion.

Lied to these evaluations, several actors expound that: "*The environmental performance of the supplier has become a decisive criterion in selection processes for many companies*" (Lawrence L., Andrews D., Ralph B. - France C. , 2002), in fact this trend shows better companies awareness about the necessity of cooperation and the interdependency of the performances. To merge borders means not only exchange information and objectives but *"include the development of diffusion mechanisms for environmental experiences, knowledge and practices*" (Cousins P.D. - Lamming R.C. - Bowen F. , 2004; Klassen R. - Vachon, S. , 2003; Sarkis J. , 2006; Simpson D.F. - Power D.J. - Samson D. , 2007; Simpson, D.F. - Power D.J. , 2005).

Johansson (Johansson G. , 2002), Keldmann and Olesen (Keldmann, T. - Olesen J. , 1994) affirm:" *This partnering has included product development, which in turn permits the incorporation of more environmentally friendly materials and components from the early stages of the development of new products*" (González P. - Sarkis J. - Adenso-

Diaz B. , 2008). The focus is on the products partnerships to include more environmental respectful materials and components. This relationship can be enlarged to the other product environmental activities and to the process development. It is clear that a downstream companies that want to reach a competitive advantage facing the environmental issue has to start the environmental standards respect at the beginning of the supply chain and so outside its borders. At the same time, it is expected that to develop eco-innovation, there is not only a need of integration between supply chain actors to have a green product from the beginning. But even sharing knowledge, expertise and capability.

The most detailed and thorough explanation about collaboration is: " *Environmental collaboration can be defined as the direct involvement of an organization with its supplier and customers in planning jointly for environmental management and environmental solutions. Within a rich collaborative context, suppliers and customers plan together the reduction of environmental impact from production processes and products. Environmental collaboration includes the exchange of technical information and requires a mutual willingness to learn about each other's operations in order to plan and set goals for environmental improvement. It also implies cooperation to reduce the environmental impact associated with material flows in the supply chain*" (Bowen F. E. - Cousins P. D. - Lamming R. C. - Faruk A. C. , 2001; Carter C.R. - Carter J.R. , 1998).

It is not an error starting to consider cooperation as a prerequisite for the eco-innovation development, diffusion and implementation. "*Environmental collaboration comprises a good understanding of each other's responsibilities and capabilities in regard to environmental management.*" (Vachon S. - Klassen R. D. , 2008)[9]. This affirmation adds to the previous ones the high importance of responsibilities. While the capabilities issue has already been treated before, the responsibility issue

[9] A good example by GEMI (GEMI , 2001) is the electronic industry.

is now a new element. Appointed responsibilities is one of the most important pre-requisite to develop a trusty cooperation, to incentive suppliers or clients, and to understand better each other and the capabilities that each one has.

To be green, that require environmental collaboration to develop eco-innovations creates competitive advantage in three way:

"*Collaboration includes knowledge integration and cooperation between organizations, which are recognized as resources that might generate competitive advantage*" (Grant R. M. , 1996). In fact, thanks to cooperation one company can use resources, expertise, knowledge and capabilities of an other companies in order to improve its competences and develop eco-innovations. It can have information about other fields or themes where it is not specialized. In this way it can exploit the specialization of others companies assimilating with owns. This strictly interaction and relationship can develop in a company "*organizational capabilities* (Lorenzoni G. - Lipparini A. , 1999) *which can be expected to translate not only into improved environmental performance, but also into other dimensions, such as cost and quality* (Hart S. L. , 1997)". (Vachon S. - Klassen R. D. , 2008).

"*Second, environmental collaboration is directly associated with a proactive environmental management orientation* (Bowen F. E. - Cousins P. D. - Lamming R. C. - Faruk A. C. , 2001). *Such an orientation is recognized as leading to the development of capabilities in the sense of the NRBV* (Russo, M. V. - Fouts P. A. , 1997)*, and it is often associated with positive environmental performance* (Aragon-Correa , 1998; Porter M. - Van der Linde A. , 1995). *The findings indicate that environmental collaboration with primary suppliers and major customers, defined as encompassing joint environmental planning activities and cooperation in finding solutions to environmental challenges, can have a significant*

positive impact on both manufacturing and environmental performance" (Vachon S. - Klassen R. D. , 2008).

There is a third advantage that can be added at the previous couple. In fact, having closer relationships with clients and suppliers, companies can increased levels of innovation (Tyre, M. - Von Hippel E. , 1997; Von Hippel E. , 1988). So, a tight collaboration allows companies to have an higher capacity of innovate in the sense of time, faster time to market; as well as in the number, major number of eco-innovation; and in the sense of efficiency and effectiveness, less costs for the single company and higher performance.

1.5.1. Push suppliers and clients

From the previous extracted, it is possible to understand that companies would find convenient to insert the environmental dimension into its goals. The main reasons are: minimizing the environmental footprint, and gain more competitiveness. To reach a good outcome in both areas the company's borders are not the limits where push itself. Companies have to cross its own border integrating a supply chain common vision and policies (Carbone V. - Moatti V. , 2011). The pre-requisite to do this is the so called:"*Green attitude at the strategic level*" (González P. - Sarkis J. - Adenso-Diaz B. , 2008). It means the awareness of top management about the green opportunity and the environmental issue integration at the high strategic level. This is a necessary requirement before the internal and with supply chain actors operational action (González P. - Sarkis J. - Adenso-Diaz B. , 2008).

To know how the embracers try to push in the entire supply chain this vision, it is useful Rogers' (Rogers, E. M. , 1995) academic work. To answer at the question how they do, the two researchers write: "*One of the most important theory that can help us to understand this issue is the DOL Theory. This theory underlines the stages that an organization has to*

pass to adopt a new practice or a new behaviour: knowledge, persuasion, decision, adoption and confirmation" (Carbone V. - Moatti V. , 2011). DOL Theory brings out the different step that an embracers has to facilitate for the adoption of the new innovation by the other supply chain's actors.

Adding the Hall's (Hall J. , 2001) vision of the DOL Theory in the supply chain management, it can be used to understand how important is the green supply chain management practices and cooperation for the building, diffusion and adoption of soft or hard eco-innovation. Above all cooperation allows to accelerate all the DOL Theory steps, make faster the adoption of and the adaptation to an eco-innovation. Even in the eco-design area of studies has been studied the innovation diffusion phenomena and the green embracer practices. These analysis confirm the previous theories (Borchardt M. - Poltosi L. A. C. - Sellito M. A. - Pereira G. M. , 2009).

A different, but linked, prospective comes from McFarland et al. (McFarland, R. G. - Bloodgood, J. M. - Payan, J. M. , 2008)[10]. He highlights that the supply chain practices are influenced by institutional pressure. "*Based on the Institutional Theory* (Di Maggio P. - Powell W. W. , 1983; Galaskiewicz J. - Wasserman S. , 1989; Haunschild P. R. 1993)*, firms tend to adopt the same behaviour as those they have inter-organisational ties with supply chain acts as a catalyst for the diffusion of innovation"* (Carbone V. - Moatti V. , 2011).

These last observations play a fundamental role in the client-supplier relationship along the supply chain. In the this research specific case between OEM-supplier and supplier-supplier in the innovation process and in the innovation diffusion.

[10] They called this situation "*Supply chain contagion*" (McFarland, R. G. - Bloodgood, J. M. - Payan, J. M. , 2008)

1.5.2. The link between competitive advantage and the eco-innovation diffusion

The relationship between eco-innovation and competitive advantage does not to be seen only in the single company perspective. An important connotation of this link is the diffusion of the eco-innovation. Without the diffusion of the eco-innovation the competitive advantage is much lower than with the diffusion in the supply chain. So, it is possible to affirm that the diffusion in the supply chain of the eco-innovation works as leverage for the competitive advantage. The link between innovation diffusion and competitive advantage enter in the first mover advantages[11]. In line with the DOL and EMT theories the early adopters of eco-innovation may establish larger performance gains (Zhu Q. - Sarkis J. - Lai K. , 2012; Waddock A. S. - Bodwell C. , 2002 - 2004).

[11] To have more information about the limits and the advantages of the first mover see Lieberman M. B. - Montgomery D.B.(1988); Shilling, M. A. (2005) Christmann P. (2000).

1.6. IMPORTANT CONCEPTS IN THE RESEARCH

At this point of the research it is expedient to highlight some of the most important concepts that has been used or will be used in all the analysis long.

1.6.1. Product innovation and process innovation:

Product innovation concerns innovation on the output as goods or services. Process innovation are innovation that concern the way that an organization manage its business, so the producing technique and marketing goods/services.

It is logical to consider that very often product innovation and process innovation are very tied each other; e.g. a product innovation for a company could be a process innovation for its company client. So generally the consequences of a product innovation cross the company's borders to enter in another organization and vice versa (Shilling M. A. , 2005).

1.6.2. Radical innovation and incremental innovation:

We can think about the change from the existing practises thanks to innovation as a continuum where the two extremes points are radical and incremental innovation. The two most important dimension for the radicalness are: newness and differentness (Shilling M. A. , 2005).

1.6.3. Competence-enhancing innovation and competence-destroying innovation

A competence enhancing innovation is built on the firm's existing knowledge and does not destroy the knowledge base. A competence

destroying innovation there is if this innovation make obsolete previous competence (Shilling M. A. , 2005).

1.6.4. Architectural innovation and component innovation

A modular innovation is an innovation to one or more components that does not significantly affect the overall configuration of the system.

The architectural innovation changes the design of the system and/or the way that components interact with each other.

These are two very important definitions to understand the importance of the knowledge that an organization has to have about the entire system and the relationship between the components or the knowledge about only the component. In this two theoretical definitions we find the different knowledge need by OEM or by suppliers (Shilling M. A. , 2005).

1.6.5. Technological innovation, organizational innovation and presentational innovation

Technological innovations are innovation specifically linked with the technology both hard or soft. Organizational innovations are related to "*innovative ways of organizing work*" or innovative ways to do business. We can insert in this category business model innovation. Presentational innovations are based on marketing innovation (Kemp R. - Foxon T. , 2007).

1.7. AUTOMOTIVE OVERVIEW [12]

If automotive industry was a country, it would be the sixth powerful country in the world. And its power is going on to increase, given that in the 1960 people with cars were less than 4% of the world population, in the 1980 were 9%, and now the quota is 12%. Taking into account the growth of the emerging countries, by 2020 the 15% of the world population will have a car. Because statistically the number of people is increasing, reaching in 15 years 7.5 billions, the number of cars will be around 1.1billion (Crea N. , 2010).

This dimension has not only a big impact in an economic point of view for the world and for all the countries that have a big part of their economy based on car industry, but also a huge impact even in the environmental dimension for both: cars production process and use of vehicles.

Carmakers and their suppliers have already developed a lot of process and product innovations that have allowed to reduce the environmental impact (e.g. now the car engine emits from 30% to 50% CO2 less than the twenty-years-old engine)[13], but the efforts have been partially limited by sales growth of cars in the markets and to the growth of the cars use[14]. To Carmakers are requested to produce products and services that satisfy human needs and preferences, increasing the quality of life at competitive

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[12] The chapter has been done using: KPMG (2012), KPMG (2011), KPMG(2013)

[13] Car makers and their suppliers have already take several measures to decrease the CO2 emissions and to decrease their environmental impact. They have tried to improve the energy efficiency and efficacy. This has been done even with some collaborations with actors outside the supply chain, e.g. government to develop the city mobility and transports. Inside the classical borders' industry, several actors have developed eco-innovation like: injection technologies improvement, low inertia tires, optimisation printing, etc.

[14] Car use is increased about 40% in the last 15 years (Crea N. , 2010).

price; gradually reducing environmental impacts reaching the earth's carrying capacity (Dobers P. - Wolff R. , 1999).

To understand better the situation of the automotive industry, we can use the Paul Ehrlich and Barry Commoner's formula (Hart S. L. , 1997). The environmental impact[15] created by human activities using and producing cars is a function of: population, consumption and technology[16]. The result of this multiplication is the total amount of environmental burden. Reaching sustainability means reducing the environmental impact/burden, and it can be done with a reduction of the population, or with a reduction of consumptions, or at the end with the improvement of technology. It is compulsory to agree with the facts that the first two variables are impossible to decrease. It is not possible to hide that the trend of population growth, and the trend of consumption growth above all in the developing countries, also the consumption of cars.

The last option that it is possible to use is technology. Improving technology in a broad sense of the word allow to car industry to become more and more sustainable. This simplification of the contest fit perfectly with the reality. Even consumers consciously or unconsciously know it, and it is for this reason that day by day they are going to increase the pressure on the automotive industry to become more sustainable.

The improvement possibility, reaching a zero environmental impact, or at least reaching a real reduction of the impact, passes from the capacity of all supply chain actors to be green to have a positive total performance. The problem is the complexity of the automotive supply chain mainly for three reasons. The first one is the number of the suppliers: each car, on the average, is composed from 8000 to 12000 parts (Crea N. , 2010). During the 80s and 90s there was an explosion of two phenomena: outsourcing and decentralization, which will bring the suppliers to play a

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[15] environmental burden (EB) for Ehrlich and Commoner

[16] population (P); affluence (A), which is a proxy for consumption; and technology (T).

crucial role in the industrial sector (González P. - Sarkis J. - Adenso-Diaz B. , 2008).

The second problem is the past history and culture in the automotive supply chain relationship in Europe, based on, above all, in the hierarchical approach, even after the lean production development. The third one is the presence in the components and parts supply of huge multinational and at the same time of little/micro enterprises. In this difficult environment it is necessary to add the recent crisis that affected Europe, particularly in the the automotive industry. Carmakers compete each other to offer cars with higher performance, with more optional, more technological advances, with an appealing innovative design. But consumers expect also a safer car, with more energy saving, that need less maintenance, that is less polluting, and logically cheaper.

The automotive industry is one of the industries that have suffered and is still suffering a strong and pressing demand for higher environmental performance (Bennett D. - Nunes B). This is because of its great dependence on fossil fuels, large consumption of raw material[17] (Bennett D. - Nunes B), and the increasing awareness of environmental issues by society.

Being in a very tough competition, cars are facing a deep renovation process both in the technical and technological point of view and in the marketing point of view.

Carmakers and suppliers are reorganizing themselves and their relationships to are ready to tackle the new challenges in terms of competitiveness, regulations and environment. It is possible to notice a big concentration between Carmakers and new alliances with the closer

[17] E.g. to produce one car is used 15 tons of raw materials and 40000 liters of water. During its life car consume fuel and lubricates most of them produced by nonrenewable fossil resources. Vehicles emit several air pollutants like carbon dioxide and sulphur dioxide. At the end of life cars, automotive palyers find a lot of difficulties to recycle their components (Borchardt M. - Poltosi L.A.C. - Sellito M.A. - Pereira G.M. , 2009)

suppliers; but to really reach a good performance the need is to involve all the supply chain suppliers in the re-organization (Rolfo S. - Vitali G. , 2001).

Carmakers and the automotive supply chain have not only to face the market challenge that is in continues developing, but even the transport system transformation, both linked to a higher environmental pressure in a context where new actors (outside the Automotive industry e.g. Insurances companies, Digital companies) always exercise more power.

2.OVERVIEW OF THE COMPANIES

The analysis scheme used to verify the hypothesises is based on the descriptive and confrontation methods. This allows to evaluate differences and similarities between companies and simultaneously comparing them with the existing literature input discussed in the previous chapters.

Before starting the analysis and the verification, It is considered appropriate to make a brief overview of the interviewed companies, just to understand better the working context. Three variables in this background, that could be important to understand some different results in the companies' answers(see graphic), will be highlighted. Therefore, in the list below is written the name of the company and the variables: position in the automotive supply chain; main products; size of the company.

Interviewed companies are:

- Ap Tech: rang 1; forged wheels; little size.
- Cosberg: rang 1 and 2; automatic solution in the component manufacturing process; little size.
- Valeo: Rang 1 and final market; power train system, thermal system, driving system, visibility system; big size.
- Timken: Rang 1 and 2; bearings, alloy steel, power transmission, lubrication, seal, motion control system; big size.
- Novatec Spinoff: Rang 3; mechanical and mechatronics design service concerning products, production machinery, industrial plants; micro size.
- Bimal: Rang 2 and 3; design and build test stands; little size.

- Proplast: Rang 2 and 3; plastic innovation pole (process/packaging/product engineering); little size.
- Lisi automotive: Rang 1 and 2; fastening and assembly solution for automobiles; big size.
- PSA: car maker; big size.

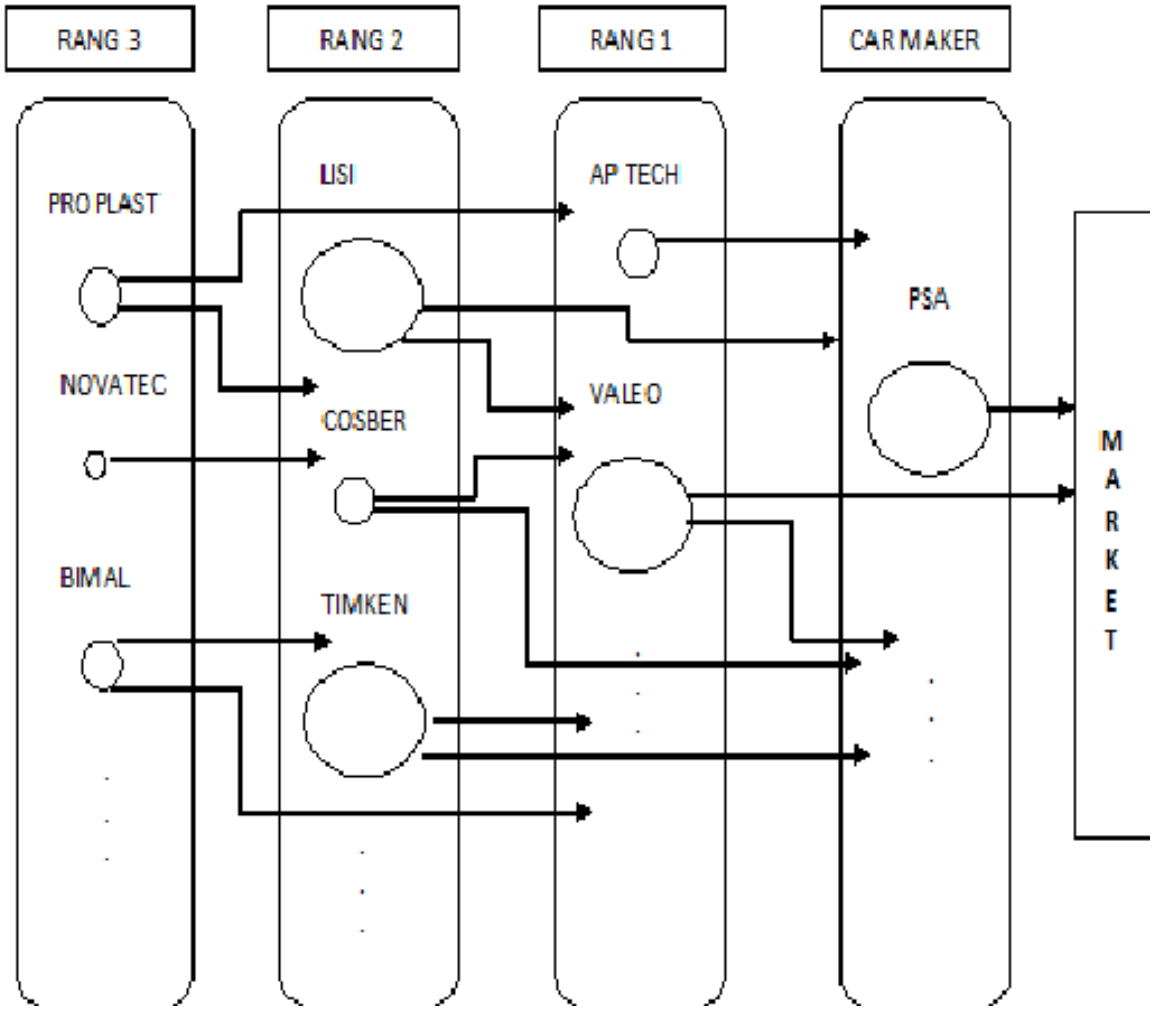

Figura 6: Companies' overview

It is expected that0 size and position variables sometimes influence the truthfulness of the hypothesises as appeared in the interviews.

3.IN THE AUTOMOTIVE SECTOR TO BE GREEN BUILD A COMPETITIVE ADVANTAGE:

Thanks to interviews it is possible to say, from a general point of view, that companies believe that being an eco-innovator, so develop eco-innovations, allows them to build a competitive advantage. Not only, companies know that in some cases without eco-innovate they would fail. This part is going to see if hypothesis 1 is confirmed or not, but above all it will be seen all the different dimension linked with the hypothesis that companies have brought out.

On this score, such company awareness does not differ among different between company sizes or company positions. But, it is possible to highlight three different affirmations:

- One company underline the fashion effect. This means that there is an effect that touch more than one company which bring them to have a similar behaviour because of fashion. Timken's manager compare this green fashion effect with the bio fashion effect in the food industry.
- More actors bring out the less important issue of eco-innovations to build competitive advantages. More and more, being an eco-innovators who creates more sustainable products with more sustainable process (both environmentally and socially) is becoming a suppliers' selection parameter . A lot of companies are obliged to start to eco-innovate if they want to maintain the commission with some clients, and this does not build a competitive advantage but it is only a minimum limit to stay in the market. The described contest

counts only for some clients or some markets (e.g. most of Germany Market).

- Lisi Automotive is the only company affirming that being an eco-innovators does not allow to have a competitive advantage. Using the single affirmation alone seems that Lisi Automotive does not find a positive relationship between eco-innovation and competitive advantage. But after examining in depth all the interviews, it is easy to understand that even for them eco-innovation activities are sources of competitive advantage. The misfit is supposed to steam from the definition of eco-innovation: Lisi interpreted eco-innovation as innovation with only a environmental objective; but eco-innovation, as written in the literature review, and indifferently from the first goals of the innovation.

To better understand the positive relationship between eco-innovation and competitive advantage, it is useful to analyse the reasons that push companies to develop eco-innovations. The most important motives are:

- decreasing costs: 6 companies
- performance car improvement: 4 companies
- differentiation: 4 companies
- regulations respect: 3 companies
- energy consumption as client selection criteria: 1 company
- ecological company sensitivity: 1 company

Costs are still today one of the most important aspects in the automotive industry. It is a critical factor to remain competitive in the market, and only for luxury segments supply chain costs are less important as underlined by App Tech. According to interviewees, costs reduction is divided in two big factors: lower costs that some eco-innovations can bring in the components or parts productions, allowing them to ask a lesser price to clients; lower costs of the clients car use, so eco-

innovations that allow a lower costs for the final car user in the vehicle use.

These reasons work interdependently and more than one push company to develop eco-innovations as highlight by Statema (Statema H. , 2011).

Comparing the abovementioned with the literature review it is possible to note that companies are in line with her in the several reasons that push organizations to be eco-innovators (Statema H. , 2011; Rennings, K. , 2000; Rennings K - Zwick T. , 2003; Haanaes K. - Balagopal B. - Arthur D. - Kong M. T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011). But it is brought out also some differences. The major contrast is with the Haanaes, Balagopal, Arthur, Kong, Velken, Kruschwitz and Hopkins' research (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011). As already said, in the automotive industry, costs reduction maintain the highest importance and in the second position there is differentiation. It is easily interpretable differentiation as brand reputation in the previous mentioned research. In that research the first reason to be eco-innovators for companies were brand reputation and not cost reduction that was in the second position. To underline the importance of this results is necessary. Brand reputation is linked with several advantages, mentioned in the research, that even companies in the automotive sector could have. Putting brand reputation (differentiation for our interviewers) in the second position, focusing above all on costs reduction, can highlight the lack of linked advantages awareness; and the lost of these benefits.

An interesting relationship found between the reasons that push companies to be eco-innovative and the size and position of the company will be as soon as possible explained. If there is not relevant relationship between costs reduction and the position of the company in the supply chain and its size. The relevant one is between differentiation/brand reputation and the size of the company, not the position. App Tech,

Novatec, and Proplast are little enterprises that are more sensitive to differentiation than other big companies exception done for Valeo.

3.1. IN WHAT ACTITIVITIES COMPANIES ARE FOCUSING DEVELOPPING ECO-INNOVATION?

Knowing that companies recognise the possibility to create competitive advantage against competitors by developing eco-innovations; and knowing that one of the mains reasons is cost reduction, it has been tried to identify in what activities companies are focused and where they put more efforts. It is interesting to discover in the specific contest of automotive industry how companies exploit the potentiality of eco-innovations focusing in some activities that they find essential to improve. The analysis has done to develop the 1.a hypothesis.

There is the need to consider that each company is in a particular sector of the supply chain depending on the particular products sold and this will influence in the operative activity where the company is focused.

In spite of this particularity, interviews clearly highlighted two important issues: 1) materials focus, and 2) energy saving focus. Focus on materials means all the different eco-innovations that allow using less material to build the same part than before with the same (or higher) quality. A part of this set is the research of new materials, above all alloys, that allow a mass lightening. Energy saving suggest that: energy saving linked to the components production; energy saving linked with the car use. These two focus are interlinked. In fact, one of the way to reduce energy consumption using car is rightly having a lighter vehicle. The other

motivations are: cleaner development technologies, saving distance transport, recycling and restoring products, branding and culture.

It is important to notice that only one company puts brand and culture building as activity where organization is focused. How it will be seen later in the analysis, this element, even if there is no operating eco-innovation, is one of the most important factors to develop eco-innovation and, in the negative way is the most important barriers to eco-innovation. KPMG advisor put a lot of emphasis in this point. Some of the most important companies in the automotive supply chain are working in this field. Change the culture and the companies approach to become more collaborative is not easy and take a lot of time, but organisations like Michelin are worked hard to have a significant improvement.

There is another important activity where companies are working on: ecological services. This field of activity is really wide, but the trends that we have seen with the interviews are companies that more and more are developing services for clients which improve the environmental awareness and decrease the environmental impacts. It is possible to use for example the case of Michelin. Michelin has developed a program called Safety Driving, where the goal is to supply to clients the right way to drive a car to be more safety. Doing this, logically, there are some marketing and communication objectives for the brand, but there are ecological targets as well. Thank to a better drive you can decrease the tyres usury and the fuel consumption, so at the end to have a lower environmental impact.

Using the Rennnings' scheme model (Rennings, K. , 2000), operating activities, where companies are more focused, will be inserted into the cluster defined "Technology push factors", in-between the factors of the model, see the graph, with the two most important factors: "*energy efficiency*" and "*materials efficiency*".

3.2. WHAT ARE THE MOST IMPORTANT BARRIERS TO ECO-INNOVATE FOR THE AUTOMOTIVE ACTORS?

Results that it is possible to extrapolate from the interviews regarding innovation barriers are plenty and very various. For this, the different barriers, that actors have found, will be gathered in some homogenized groups, in a way to simplify the analysis. Even in this case it is easy to understand that barriers can be more or less representative, depending on company peculiarity. 1.b hypothesis is essential to understand the limits of companies to eco-innovate; in fact if companies know that to be green and eco-innovate can build a competitive advantage; there would be no reasons to do not eco-innovate. But in this contest enter many, more or less insurmountable, barriers. In general, the results found are:

- Social awareness: this group means all the barriers that are linked with the organization culture and people conceptions about eco-innovations and eco-sustainability. There are seven companies that named this factor as the main barrier to eco-innovate. Social awareness concerns people inside organization, top and middle management, clients. In the interviews it was possible to understand very well this problem when the different actors say: "*Eco-innovation is seen more as cost than an opportunity"; "there is a management culture linked with the past, and we are waiting for a generational change"; "there is the need to have a different vision of the business model where the environmental sustainability is the key factor"; "the most important barrier is the lack of clients awareness that s our first input".*
- Cost of this kind of innovation: three companies brought the eco-innovation costs as one of the most important barriers. In fact, they have underline that most of times the costs or investment for eco-innovation is higher than regular innovation, causing the

abandonment of the project. Collaboration approach is suggested to overtake cost barrier thanks to costs and risks sharing.

- Others: from the others factors included in the eco-innovation barriers there is: the difficulty to evaluate the future savings; the difficulty to find the wastes to transform them in savings; communication; lack of ecological plan; the difficult to forecast who is going to take the value created. There is a natural barrier, that is the technical and technological barrier, that is a limit that for now researcher can not pass. Regulation is another barrier emerge in the interview. In one side regulation push companies to be more sustainable and therefore to develop eco-innovation. In the other side they push companies really slowly, becoming a barrier. To explain this contest is really long, complicates and not fully pertinent with this research, but it is expexted that there are a lot of actors that put pressure to regulators to do not change or change very slowly the rules (e.g. oil companies, car makers etc).

Before comparing interviews' results with the literature's results, there is a need to understand better the communication barrier and the lack of ecological plan barrier. Communication barrier, mention by PSA, is linked above all with regulations. In this case regulations can be an important barrier for companies as PSA told. Only experts can understand complicated regulations from standards, and this make the internal and external communication for the organizations more and more difficult. In the case of lack of ecological plan barrier it is suitable to think that is only a consequence and not the cause. The real cause is the lack of managerial awareness about eco-innovation, entering in the first group barrier.

While Kempton (Kempton, W. , 1991) underlined that the most important barrier of eco-innovations is the cost, interviews bring out that costs are only the second important barrier in the automotive industry, and that the most important is the so called social awareness. Logically, also in the automotive industry costs is an important barriers but it is supposed that

sometimes even the perception of the higher cost depends on the social awareness*: " people think most of the initial cost than to the later savings"; " eco-innovation are perceived more as a cost than an opportunity".*

Using Ashford's scheme (Ashford N. , 2002) it is possible to put partially social awareness barriers into the "managerial barriers'" area. Managers' opinions as *"Culture inertia"; "generation inertia"; "see the initial investment and not the future saving"; "do not see eco-sustainability as the key factor"; "lack of sustainability culture"; "perceived as a cost and not as a opportunity";* fit perfectly with the Ashford managerial barriers' list. Even Statema (Statema H. , 2011) affirming:" *the general impression of green and expensive versus brown and cheap"* get the problem of managers perception and company's culture. In the articles "*Green Supply Chain Management innovation diffusion and its relationship to organizational improvement: an ecological modernization perspective"* Zhu, Sarkis and Lai (Zhu Q. - Sarkis J. - Lai K. , 2012) assents with this logic writing:"*...the need for corporate management to recognize ecological issues as a mean of enhancing competitiveness".* This barrier is called "*social barrier"* by KPMG advisor. He means the lack of collaboration culture that you can find in most of French companies. The lack of collaboration culture brings company to be not able to develop eco-innovations, because this will influence all the other barriers raising them. For example: collaboration allow to share risks and costs decreasing the cost barriers; collaboration allow to share knowledge and know how decreasing the technical and technological barriers.

The other part of social awareness has not been found in any articles analyzed for the literature review. This part of social awareness is not referred to company or to managers but to clients, the final clients, and in a wider way to the society in general. Managers told us: "*at the end are the consumers that decide what they want"; "clients see the initial investment and not future savings"; "clients are our most important input*

to eco-innovate". All what is possible to do is to note this gap between the literature and the automotive industry managers' evaluation referring to clients and society culture and perceptions.

3.3. FROM WHO ARRIVE THE ECO-FRINDLY REQUEST?

Pressure to be sustainable; to decrease the environmental impact, and so to develop eco-innovations comes from several actors. There is not only one pressure that pushes company to be "green", but there are more than one that work simultaneously and interdependently, as from Statema (Statema H. , 2011) point of view it will be noticed also in the interviews. Hypothesis 1.c has been divided into two directions. Actors that push automotive supply chain players to be more green because this affects their competitive advantage and their performance; both economically and environmentally. And Actors that for different reasons put pressure to supply chain players to develop eco-innovations.

Actors can be divided in four main groups:

1. Costumers: interpreted as final client. Costumer exercises pressure through his requests and his preferences on the carmakers, which in turn address this pressure to the supply chain. Costumers have another important role: they can pressure government or regulators to take more strictly standards. The first influence, that to carmakers, is the pressure that Rennings (Rennings K. , 2000) call Market Pull Factors.

2. Regulators: They have three main ways to put pressure on the automotive supply chain. The first one is to regulate the carmaker activity, which in turn transmits this pressure to the supply chain. The second one is to regulate directly the activities of the suppliers, or to the entire industry, or to more than one industry. The third one addressing product regulations. Talking about innovation it is understandable that the most part of the pressure does not come from the present laws but from the future and expected ones. Rennings (Rennings K. , 2000) defines these as Regulatory push factors.

3. Car makers: They can influence a lot the others supply chain actors. How seen before they can put pressure to suppliers because of regulatory factors or market factors. But even for all the previous reasons that link eco-innovations to the competitive advantage.

4. Company awareness: some of the interviewed companies have highlighted an autonomous pressure to be eco-innovators. This self-pressure come from the company awareness. Awareness about the environmental issue and so the sensitivity for this problem. Awareness about the competitive advantage that eco-innovators can have.

The point four needs to be analyzed in-depth. It has been seen that social awareness is the most important barriers to eco-innovation. A part of social awareness, barrier is the culture and the mentality of the managers. The same manager can be the most important driver to put pressure to the organization and make it a eco-innovator, in fact in the Second Annual Report (Haanaes K. - Balagopal B. - Arthur D. - Kong M. T. - Velken I. - Kruschwitz N. - Hopkins M. S. , 2011) they write:" *Company's senior leaders are the top driver of action and organizational attention".* In the end, company's top managers are the driver to build the organization culture, to build awareness, and to address organization attention on

some issues with a lot of tools, and so to transform the barrier in opportunities.

Always in the Second Annual Report (Haanaes K. - Balagopal B. - Arthur D. - Kong M. T. - Velken I. - Kruschwitz N. - Hopkins M. S. , 2011) the authors underline other important actors that can pressure the automotive supply chain for the green issue. One of the actors, relevant to this research, are the line-leaders, which for many reasons manage and lead the supply chain. It is possible to use this thought to understand the importance of the line-leaders in the automotive supply chain as well. Nowadays, in the automotive supply chain the line leaders are still the carmakers, and so their actions will influence a lot all the supply chain players. But, they are not alone. In the present days is taking more and more relevance other actors in the supply chain that are becoming line-leaders (e.g Valeo). This analysis will allow to understand how the *informal social pressure* (Carbone V. - Moatti V. , 2011) plays a fundamental role in the automotive supply chain. Conducted pressure by leaders of the supply chain become an important element that influence the behaviour of the others actors. This informal social pressure allows to the environmental pressure to rise the supply chain until the upstream suppliers (Carbone V. - Moatti V. , 2011), and to diffuse it in the horizontal way too.

4. PRESSURE FOR ECO-INNOVATION DOES IT CHANGE THE INNOVATION PROCESS?

A fundamental part of the research is based on the hypothesis number 2. Is it true or not that the previous described pressure that brings companies to develop eco-innovations has changed the innovation process?

Analysing interviews, it is possible to understand two important changes in the innovation process for eco-innovations:

1. The need for more collaboration between the supply chain actors but also with actors outside the supply chain.
2. The insertion and integration as primary goals of environmental objectives of the eco-innovation process. One similar opinion can be found in "Adopting ecodesign practices: Case study of a midsized automotive supplier" where they explain that environmental issue has to be a integral part of the process and product development (Borchardt M. - Poltosi L.A.C. - Sellito M.A. - Pereira G.M. , 2009).

Most of the interviewed companies have expressed the big need of collaboration to develop eco-innovation. On the one hand, collaboration in the automotive industry has been done for many years, on the other, as underlined in the interviews, eco-innovations' development-diffusion-implementation requires more collaboration than before because of its particularities. Collaboration has to be implemented in both ways: upstream with the suppliers and downstream with clients.

To have explicit and clear environmental goals is a fact really important for two reasons. Firstly, it is important to put in evidence the management culture and sensitivity, and so address the developers and organization attention to these issues. Secondly, using these objective internally and externally helps to develop: 1) a clear and common vision among the actors; 2) the environmental issue awareness, and the social pressure[18]. This is in clear contrast with most of literature review that do not allude to environmental objectives to call an innovation eco-innovation. It is important underline that it is true that does not put environmental goals among the top objectives does not mean to have not developed an eco-innovation. But it is similarly true that putting the environmental goals as primary targets helps people and companies to develop better eco-innovation.

The previous two points allow to confirm the truthfulness of the second hypothesis. The transformation is going on and for most of the companies is only in the firsts steps.

Thanks to interviews, it is possible to highlight others interesting points.

Novatec company brings out two elements linked to collaboration. Collaboration has to be done with others actors in the supply chain, above all clients and suppliers, but also with actors outside the automotive supply chain. They underline that this two collaboration vectors are for regular innovation but especially to find innovation economically favourable with a lower environmental impact. The second element is the concept of open-innovation[19] that is developing itself between the

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[18] normative isomorphism and mimetic isomorphism for Di Maggio and Powell.(Di Maggio P. - Powell W.W. , 1983).

[19] Open Innovation as defined by Chesbrough (Chesbrough H. W. , 2003) is: " *Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market. As the firms look to advance their technology. Open innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model. The business model utilizes both external and internal ideas to create value, while defining*

automotive supply chain actors (vertical cooperation) and between actors from the automotive supply chain and actors outside the supply chain (horizontal cooperation).

Another important dimension are costs. Eco-innovation process costs are changed from regular innovation. App Tech underlines that costs linked with eco-innovation development are higher than costs linked with regular innovation development because of the more complexity of the innovation process, the final product, and the variables to consider. Deeper request for collaboration, higher need for specific competences to put together, and need of deep knowledge, also taking into account a lots of different variables and dimensions, lead to a costs explosion.

Only two companies do not perfectly fit into the previous hypothesis: Lisi Automotive and Timken.

Timken has changed the process putting as objectives some environmental goals increasing the attention to the environmental issue. But as they said these targets are only secondary respect to the economic ones:" "...goals environmental is entered in the process but only as secondary objectives because of the first one is always cost reduction".

Lisi Automotive has a similar opinion, even more retreated, where there are no goals but only minimum standards dictated by law.

At the end, it is important to talk about the change at PSA. In this particular case, the modification had been happened with the insertion of new actors in the innovation process. They created the "excellence team" for several reasons around ten years ago, and during these years the team took increasingly the role of eco-innovation driver and supervisor.

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internal mechanisms to claim some portion of that market through external channels, outside the current businesses of the firm, to generate additional value".

Comparing these outcomes with the literature, the result is a good fit between them. Several authors have explained that eco-innovations need more collaboration, and one of the first step to collaborate is putting as first objectives common visions and environmental goals. Through this it is proved that there is a transformation of the innovation process.

4.1. ONE OF THE MOST IMPORTANT ASPECTS IS COLLABORATION, COMPULSORY TO DEVELOP ECO-INNOVATION

One of the most important aspect is collaboration. Developed eco-innovations need more collaboration between actors. If all interviewed actors know that eco-innovations development require more collaboration; this awareness is not always put in practice in the automotive industry. Next analysis is going to put in evidence these aspects in a way to understand if it is possible to consider the hypothesis number 2.a confirmed or not.

Introduction of collaboration in the eco-innovation process is one of the most important changes. It is advantageous reiterate that cooperation between actors in the automotive industry was already implemented and in some cases was very well developed. What the paragraph is going to underline is that eco-innovation process require more and more collaboration compared to a regular innovation, "*achieve environmental performance improvements while maintaining production quality and cost goal...is through unique partnership with suppliers*" (Geffen C.A. - Rothenberg S. , 2000). This part is done to understand closer the kinds of cooperation that companies use to develop eco-innovations. Thanks to the previous part, it is already possible to say that also this sub-hypothesis is confirmed.

4.1.1. Collaborative practices in the interviewed companies

App Tech establishes a strong relationship with its suppliers based on constant flow of information. Existing real collaboration is focalized in two specific fields: materials improvement and machineries improvement. Raw materials' suppliers are implicated in new materials development to have a better quality, a better resistance, but lighter weight. Suppliers of process machineries study with App Tech new method to produce the product but with less material waste and with more energy savings.

The relationship with several clients, in this case OEMs, is also really collaborative, working with a lot of interaction and common decisions. The team where is concentrated this interaction is the engineering team for developing products. For example one eco-innovation was the better design of the wheel to allow less air inertia during the driving allowing fuel saving.

Cosberg does not have a developed cooperation with its clients. If it is true that there is a strong interaction between Cosberg and clients, in the other side most of this interaction descend from the customization of the product. Cosberg's manager told*:"...we put in the project the minimum standards, higher standards only on customers demand*". So, there is not real collaboration with common goals in this direction. Thing that changes are the horizontal relationships. Cosberg joins several innovation and research poles, open-innovation consortiums, and eco-innovation project as Itallimech and PowerSave.

Valeo is one of the most innovative companies, with one of the highest eco-innovation inclination. And to confirm previous hypothesis is one of the most collaborative companies interviewed. With his suppliers it has a harmonization policy, and a real supplier management policy. Collaborative relationship has done with the company's strategic suppliers. Collaboration and trust is used to develop eco-innovations, to have a

higher performance, besides leveraging specifics capabilities and as a external innovation process control tool. Some examples of instruments are inter-company teams, combined/integrated information systems, and permanent control process. With its clients, so the OEMs, the relationship and collaboration become day by day always more intense and dynamic. The reasons for this relationship enhancing, passing from a hierarchical one to a collaborative one, are: the carmakers' externalization of competencies and capabilities and therefore of some R&D functions, the green pressure, 2007/2008 crisis which bring car makers to commit themselves in a more collaborative approach. Logically, still existing compulsory requests from carmakers, like Valeo can suggest innovations, but always more frequently there is a integrated work between them.

Timken rests as one of the less collaborative, above all for the eco-innovation development. There is no collaboration with the suppliers, and with the OEM the relationship is more developed, but always in market logic. Even Lisi has the same approach.

Novatec supplies engineering services and so the interaction and collaboration with clients is very high. Working for some of the most important rang 1 and rang 2 suppliers, which are embedded in the collaborative eco-innovation process with the OEM, its activities are embedded as well in this collaboration area. It collaborates vertically and horizontally thanks to: research project, innovation centres, research consortiums.

In spite of the great awareness of Bimal on the importance of collaboration in the eco-innovation process and the awareness about the link between eco-innovation and competitive advantage, the relationship with clients and suppliers is not well developed. Test table production is only a peripheral activity in the value chain of the automotive industry.

Proplast works with Rang 1 and 2 suppliers. The relationship that it has with its clients is based mainly on the hierarchic approach. They explain that the principal reason is the size of the company. Little and middle size companies are obliged to follow the car makers directives without a real

collaboration au pair. They know very well that nowadays to develop, diffuse and implement eco-innovation it is necessary to collaborate; but that this situation happens only in few and limited cases. Not wrongly they develop a strong collaboration in some innovation poles and clusters.
PSA divides all suppliers in two categories: most important ones and others. With the most important, PSA sets up a collaboration relationship with common research projects and inter-company development projects; instead with the others PSA has a hierarchical relationships.
It is possible to perceive that the analysis background is really varied and difficult to insert into a perfect scheme with clear borders. There are companies with more collaborative inclination, and companies instead that have a really low collaborative propensity. Thanks to interviews, building a scheme is impossible, but it is useful to highlight some collaboration contest aspects in the automotive supply chain:

- Companies size: Interviewees underline that the dimension of the company is not an important variable in the collaboration inclination. What it is possible to see is that some little and medium companies have collaboration programs, vertically and/or horizontally, more developed than some big company. Size is easier that influences the possibility of negotiation in the business with clients and suppliers, but this aspect is not interesting in the eco-innovation point of view. This point is demonstrated even from other studies outside the automotive industry. These researches underline that there is no relation between environmental practice and organization size.

- The product: product typology and specifications influenced a lot the kind of collaboration and the inclination toward it. A more complex product, that influences a car system or that is important for the consumer evaluation, or that has high costs, bring companies to be more inclined to collaborate. This situation becomes more a pre-requisite than an inclination to have a high overall car performance. It has notice one different case. Lisi Automotive even having a

complex and important product for the automotive is not too much willing to collaborate.

- Rang 1: rang 1 companies, like Valeo and App Tech, enter in the big collaboration sphere with the OEM. Relationship between Car Makers and Rang 1 companies are more intensive than relationship between companies upstream. Partly, this collaboration influence the upstream suppliers for having more collaboration but this influence dissolves little by little.

- Vertical cooperation and horizontal cooperation: if vertical cooperation is defined as the cooperation done with clients and suppliers, and horizontal cooperation as the cooperation done with actors outside of the automotive supply chain, it is possible to underline that: from the OEM to the far away companies, gradually the collaboration is transformed from vertical collaboration to horizontal collaboration.

- Car Makers: although the more strength of the Rang 1 players, OEMs maintain the supply chain fundamental role in the relationships management. This position is critical to put pressure and influence all the supply chain on the collaboration approach. Without forget the financial potentiality of the OEM.
- Operational tools: companies to collaborate use different tools and methods. Some of the most important are: combined research project, innovation and research poles participation, research consortiums participation, project or research teams, integrated information systems.

In the end, the hypothesis partially has been confirmed. On the one hand, companies are really aware about the need of cooperation for: the development, diffusion and implementation of eco-innovation; and to have a total solution and not only partial solutions (Bertens C. - Statema H. , 2011). On the other hand, a real barrier exists has been noticed. In fact,

not all the companies have developed collaboration program with suppliers, clients or horizontal relationships; despite they well know the importance of collaboration to develop eco-innovation and so to build a competitive advantage. As Hart (Hart S. L. , 1997)wrote the environmental integrated strategy between actors in the supply chain and its implementation and practice would allow to have results and benefits much more high than the sum of each single actors result.

This analysis has absolutely to be integrated into the green supply chain studies and does not stop at the eco-innovation management aspect. Inter-organisational collaboration, internal and external supply chain integration, and improved information sharing is considered the most important prerequisite (de Brito M. - Carbone V. - Meunier C. , 2008*;* Vachon S. - Klassen R. D. , 2008); Young R. , 2000) to develop eco-innovations and to have a green supply chain (figure 7)[20].

[20] LCA (Life cycle assessment) is a method used to evaluate and account the environmental impact of a product (or service) from inception to end-of-life. The stages are: material extraction, material processing, manufacturing, product delivery, consumer use, end of life.

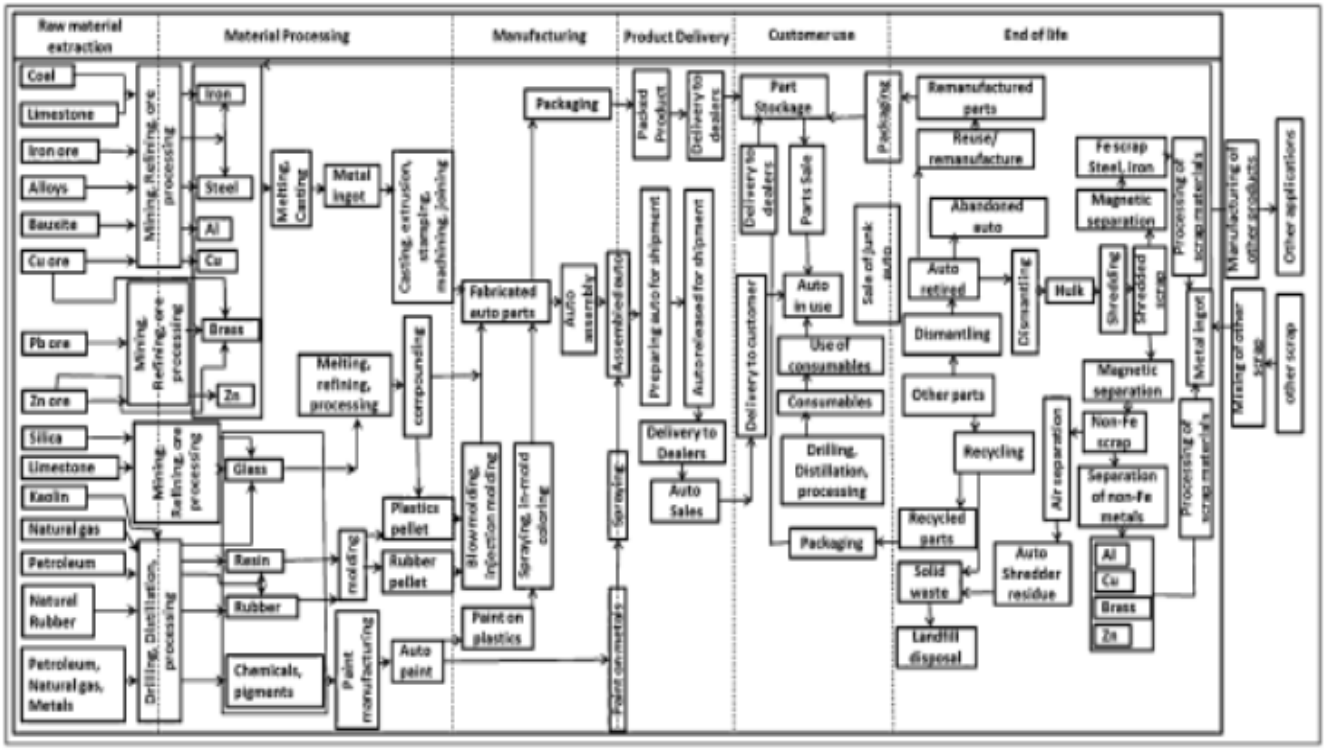

Figure 7: LCA, understanding the supply chain connections (Mayyas A. - Qattawi A. - Omar M. - Dongri S. , 2012).

In these aspects the automotive supply chain has to do a lot of progresses. It is not surprising; for the majority of the organizations, included countries, GSCM is still relatively novel (Lam J. - Hills S. - Welford R. , 2005; Lin C. Y. - Ho Y. H. , 2008; Sarkis J. , 2006; Seuring S. - Muller M. , 2008; Seuring S. - Sarkis, J. - Muller M. - Rao P. , 2008; Vachon S. - Mao Z. , 2008). If in the first Rang with the OEMs the vertical collaboration is well developed, there is a lack of the horizontal one. The contrary is the rang far away from the market. Additionally, there are still companies that have not developed cooperation in both ways.

Collaboration and its practical instruments, as used by some interviewed companies, allow the exchange and the integration of knowledge. Resources, capabilities, information, knowledge, know-how can be

transferred from supplier to client or vice versa, building an inter-companies knowledge. This allows the transformation of this knowledge to better environmental performances to happen, which in turn improves economic performances as quality and costs (Grant, R. M. , 1996; Vachon S. - Klassen R. D. , 2008; Hart S. L. , 1997; Porter M. - Van der Linde A. , 1995). Logically, collaboration, and above all environmental collaboration is strictly linked with:" *proactive environmental management orientation" (*Bowen F. E. - Cousins P. D. - Lamming R. C. - Faruk A. C. , 2001), which can be an advantage if the managers have it, or can be a barrier if managers do not it. To reach a good outcome in both economic and environmental areas, company's borders are not the limits to reach. Companies have to cross their border integrating a supply chain common vision and policies (Carbone V. - Moatti V. , 2011). Supplier management became one of the most important key factors in the environmental-collaboration issues (Noci G. , 2000; Chen C. C. 2005; Simpson D. F. - Power D. J. , 2005).

Using DOL Theory, it is more easily to understand even the diffusion of the eco-innovation. Collaboration between two or more companies speeds up the steps knowledge-persuasion-decision-adoption-confirmation. And through Institutional theory (Di Maggio P. - Powell W.W. (1983). ; Galaskiewicz, J. and Wasserman, S., 1989), it is possible to explain that " *firms tend to adopt the same behaviour as those they have inter-organisational ties*" (Carbone V. - Moatti V. , 2011), cooperation would increase this possibility thanks to higher trust and higher interactions.

4.2. TYPOLOGIES OF ECO-INNOVATION IN THE AUTOMOTIVE INDUSTRY

The most of automotive industry's eco-innovation are: product innovations, Technological innovations, incremental innovations, and components innovations. 2.b hypothesis has an ulterior motive. This passage has tried to understand if there is a link between eco-innovations and the development of specific kind of innovations.

Even this hypothesis has been verified only in part. As already repeated several times, eco-innovation choices depends a lot of the good produced. Anyway the main noticed tendencies are:

- Actors have focused and are focusing in the product eco-innovation more than process eco-innovation. But it is compulsory to consider that a lot of products are going to build the process of a client company, e.g. machineries' supplier focusing on his product will improve the environmental impact of the client's process plant. Some automotive supply chain actors is putting more and more interest in the process eco-innovation but most of them are only in the firsts steps. The environmental impact generated during the use of the car is quite big, but even the impact of the automobile manufacturing process is significant (Keoleian, G. - Kar K. - Manion M. - Bulkley J. , 1997; Graedel, T. - Allenby B. , 1997). The trends are: recycling, re-engineering, packaging, energy consuming, restoring.

  Instead the organizational innovation (Ayerbe , 2003; Mathieu A. - Chandon J. - Reynaud E.) is always with more attention in the environmental field. These eco-innovations are based on: dedicated team building, support team building, modification of the layout based on environmental criteria, collaborative structure building, environmental goals inserting; that are one of the most important

eco-innovation if, as seen, the big barrier is the company/managers culture; because these eco-innovation can push to be eco-innovative in both previous direction: products and processes.

- Only two companies have brought out marketing eco-innovation: PSA for the communication and Cosberg for the new brand linked with energy saving.
- Most of the eco-innovations are done in the incremental way. The only field where exists some real radical eco-innovation is in the new alloys field. This trend is backward to which of Huesemann. He wrote that to reach the environmental goals, companies need to develop radical innovation because improving existing technologies gradually is not enough.
- The most important eco-innovations are in the components and not in the system as a whole. But, underlining that some of components eco-innovation have influenced a lot the entire system because of the several and strong interdependences and interconnections between cars components and parts.

5.CONCLUSION AND MANAGERIAL IMPLICATION

5.1. Overview of hypothesis verification

Passing from a dense and various literature review about the debated fields, until to arrive to the analysis of the interviews to verify the hypothesises, it is possible to understand that the research contest is very broad and complex. To be able to exhibit some conclusion, it seems suitable to briefly revise the implication that the interviews' answers have had on the pre-formulated hypothesis.

For the first hypothesis (HP 1: In the automotive sector to be green allows companies to build a competitive advantage), most of the companies, indifferently from size and supply chain position, find that being a green-embracer is a driver to build a competitive advantage. This driver is linked, above all, with the possibility to decrease the costs of using cars and producing cars thanks to eco-innovations. A second important element to know is the differentiation. One of the possibility that green embracers have is to differentiate themselves from competitors; little and medium companies give more importance to this element than big companies.

To make effective the previous visions companies is focusing above all in material efficiency and energy efficiency developing eco-innovations. Hypothesis 1.a depends a lot of the product produced, in fact depending on produced goods, companies focus on different operational activities that at the end can be gather in those two sets. A clear step forward has been done in the clients services. Automotive companies are developing

costumers services that can be useful to improve car sustainability and the ecological visibility of the brands.

If in one side there is the great possibility to gain competitive advantage with eco-innovations, thanks to the improvement of efficiency and effectiveness; in the other side there are a lot of barriers to eco-innovation (Hp 1.b). The most important barrier listed by companies is the social awareness. Social awareness means the culture, perceptions and knowledge that stop people to be eco-friendly. It is expected to find this barrier internally the companies as management culture, internally the supply chain as the problem of no-cooperation philosophy, or externally the automotive industry in the consumers or society in general. The real importance of this barrier become from its possibility to increase all the other barriers.

Thanks to the 1.c hypothesis, the actors that put pressure to be green and its implications have been analysed. This issue have a secondary objective because can help to understand how the eco-innovations are diffused long the supply chain. Actors that mainly influence supply chain automotive companies are: Clients, Regulators, car Makers, and the company itself with its awareness (or the awareness of its managers recalling the previous paragraph).

Quickly going through the analysis's results of hypothesis 2, it is possible to underline that there are some modification of the innovation process. If in one hand managers pointed out that the operative tools and methods have not had modifications, in the other hand it is essential to highlight two important change in the innovation process. Eco-innovation process needs a different approach to the innovation. It requests a collaborative approach and process, and it requires to put in the primary goals level the environmental objectives. Logically these things bring to adapt to them tools and methods. Cooperation has done in a vertical way (with clients and suppliers) and in a horizontal way (with actors outside the supply

chain). There is a trend linked with this two way to cooperate: suppliers more far away from car Makers cooperate more in a horizontal way, instead suppliers closer to car Makers cooperate more in a vertical way. The most important companies in the Rang 1 with car Makers, for many reasons, set up a grey zone where borders between them are not well defined. Underlining these things aim to highlight the current limitations of the automotive supply chain cooperation. To reach a green supply chain, a sustainable industry and a well performed eco-innovation cooperation has to have done in a vertical and horizontal way by all the actors of the supply chain. The need of vertical cooperation comes from the necessity to have a integrated supply chain to really gain sustainability, to develop and to exploit at most eco-innovations. Horizontal cooperation allows companies to access and use resources and knowledge from other companies to develop and implement eco-innovations. Cooperation have an important role in the diffusion of eco-innovations as well, facilitates it and makes it faster.

The last sub-analysis of the second hypothesis concerns the most developed typologies of eco-innovations. The 2.b hypothesis is confirmed by interviews where the most important eco-innovation indicated are: product innovation, technological innovation, incremental innovation and components innovation. The second goal of the hypothesis, that tries to evaluate if there is a relationship eco-innovation - kind of innovations, has been reach with one important aspect brought out from the analysis: more and more companies are going to develop organizational eco-innovation. This last aspects will be used ahead.

After the brief conclusion of interviews, it is important to understand what implications these conclusions have for the managerial field and what are the most important trend for the future.. These implication are partly brought out comparing the theoretical framework and interviews. Partly from the experience of KPMG's advisor.

It will be proposed again the hypothesis scheme to quickly understand the work and the logical thread behind analysis. This little summary has inside only a little part of all the results that have been found, but can be very useful to understand the logic and the dynamics of the research.

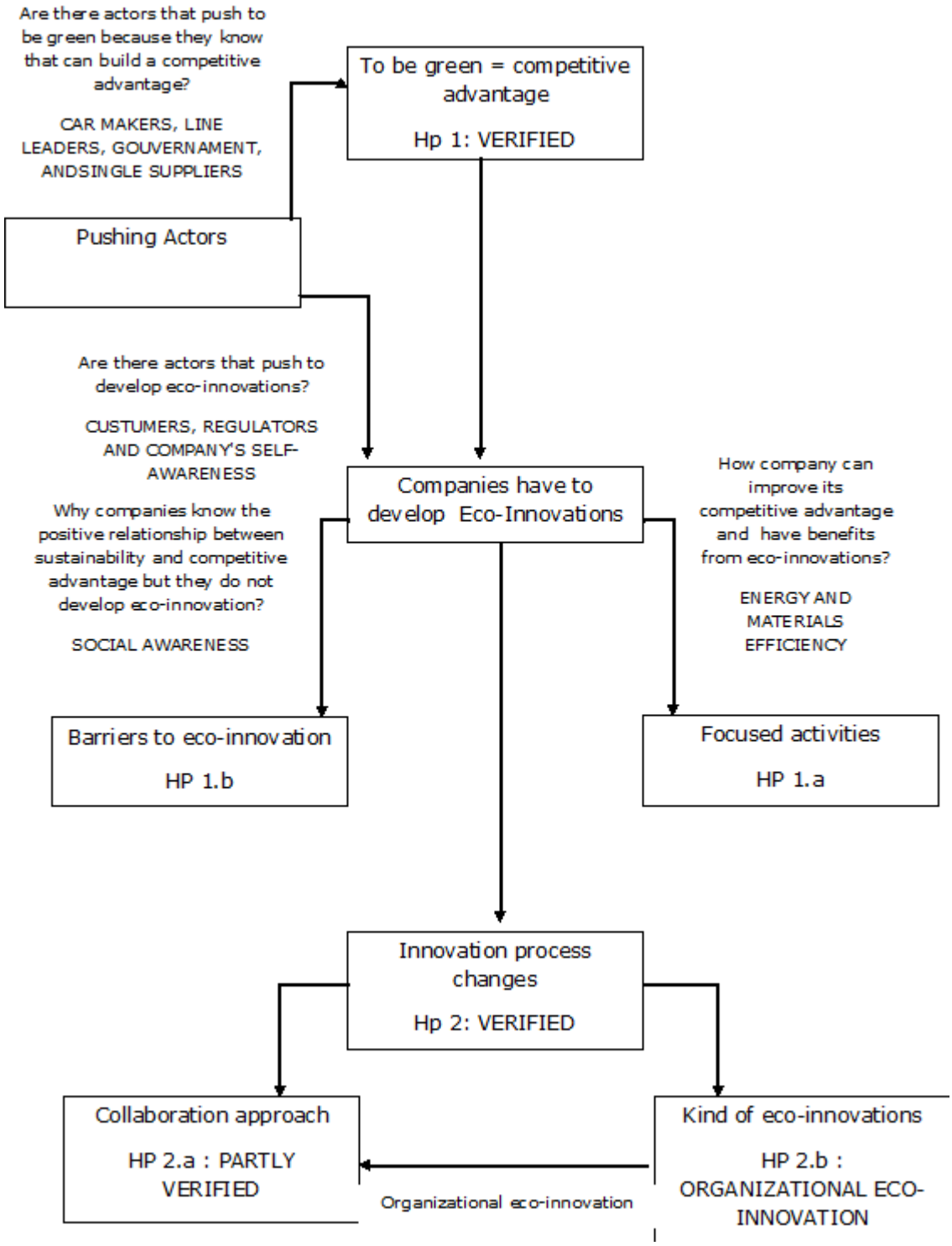

Figure 8: Research and hypothesis summary

5.2. Implications

Even in this paragraph, it will be followed the same scheme of the literature review and the analysis travelling again through the hypothesis model.

Managers' answers put in evidence good companies awareness about being green-competitive advantage's positive relationship. Companies also know that to become green-embracers have to develop eco-innovations. The real problem is the implementation in the reality of this vision. From seeing the linked and declare it to put in practice all the behaviours needs there is a great difference. Automotive companies are very obsoletes in this dimension, and this could be a serious limit in the next years, above all in the Italian and French contests. In fact, the link between eco-innovation and competitive advantage seems to become less intense, not because of the link is not proved but because eco-innovations and higher environmental standards are becoming one of the criteria to select suppliers. Therefore, more and more to be sustainable become a pre-requisite and no more a source of competitive advantage. Briefly, increasingly companies have to develop eco-innovations not to have competitive advantage comparing with competitors but to survive in the market. This trend change of intensity and power from country to country (e.g. France and Germany), but in a logic where companies can not stop to see the own country borders this trend is going to influence more and more organizations.

Referring to the Hp 1.a, it is possible to conclude as well, that automotive companies are obsolete in the activities where pressure to be green is higher. It is true that the produced good specification influence where put the attention; but from the literature and from others researches it is necessary to see that brand image have to be the manly focus for

companies. Far away from the idea that costs focus is not important, it is compulsory to underline the lack of awareness in the brand image field and in all the advantages that its improvements can bring (Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. , 2011).

Eco-innovation have to find different economic reasons to be develop and not only the costs decreasing. Brand reputation, access to new markets, quality, reducing risk are only few thing that build a eco-innovation culture can develop or improve. In brand reputation dimension surely enter one of the brought out barrier analysed in the 1.b hypothesis. The present regulated analysis system for automotive companies become one of the largest barriers. If it is true that is a push to be more sustainable, its complexity bring a objectify difficulty to become a communication tool. So, everyone knows very well the link between communication and brand reputation,, and the complexity of the system, understandable only by experts, becomes a real barriers for companies. Stakeholders are not facilitate by the regulated system and this influence even the communication which will influence brand image and recognition.

Going on with the Hp1.b it seems opportune underline once again the importance of social awareness. If in one side social awareness can be a push to companies, it is easier to find it as a barriers. In the consumer point of view, companies told that more and more consumers are aware about green issues, but at the same time, this awareness is not still decisive in the purchasing choice. Focusing in the single company, social awareness can be translate into managerial awareness. Managers' culture, believes and knowledge act like limit in developing eco-innovations. Managers and top managers can influence the focus and the vision of the organization. Managers that do not believe in eco-innovations, that do not have an eco-friendly culture, that do not accept the link between sustainability and competitive advantage are a barrier for all the enterprise. In the implication of the 1.b hypothesis it is needed to

underline one important method that governments or local institutions can use do decrease some barriers. Statema (Statema H. , 2011) studying into Netherland contest, he found a lot of programs where Country's institutions became eco-innovations early adopters in order to accelerate their diffusion (knowledge, persuasion, decision, adoption and confirmation).

Passing to the 1.c analysis, it has to be concluded that there are a lot of actors that put pressure all long the supply chain players: costumers, regulators, carmakers and the company itself. This different actors influence in a different way the suppliers and carmakers. This dimension is an important element to understand the dynamics of the eco-innovation in the supply chain, above all for the link with cooperation. At the same time it is possible to notice that there are actors that put pressure to become embracers and actors that try to influence as a inertia strength. Sometime are the same actors that in one way put pressure that become an obstacle to eco-innovations (Regulators, consumers, car makers). Trying to understand the automotive system as a whole it is supposed to do not still think about the automotive supply chain like in the old versions. The actors involved in the car offering with interest in the automotive industry are more than the strictly definition of automotive supply chain; and this actors (e.g. insurance companies, oil and fuel distribution company), that sometime are really powerful (in the economic sense), can influence a lot the automotive actors. Stressing the OECD's opinion, regulators and government have to press more companies, and to put in practice an adequate prices and incentives system to stimulate the development and the diffusion of eco-innovations thank to make easier passing barriers OECD (2009).

The pressure from many actors and companies awareness about eco-sustainability have changed the companies innovation process; or at least companies know that the eco-innovation process has to change. The two main changes are: in the approach that request a strong collaboration in

all directions; and in putting the environmental goals at the top level of the development plan. In spite of these progress it is possible to see that the implementation level of this changes are different from company to company. Two important inclinations in the automotive supply chain have been noticed: the first one is the vertical collaboration in the downstream companies (Car Makers with the most important Rang 1 suppliers) building a sort of grey zone where borders are not well defined; the second one is the tendency to cooperate horizontally by upstream suppliers. So, there is a lack of vertical cooperation upstream and a lack of horizontal cooperation downstream. This situation does not allow a perfect development of eco-innovations, and does not allow an enhancement of the eco-innovations performances.

Thanks to KPMG's advisor partnership it is possible to confirm this situation and add new implication. In France as in Italy, in general, vertical and horizontal collaboration in the automotive supply chain is very few developed, there are only few exceptions. Car makers and some of the most important suppliers still act with the idea of a hierarchical supply chain where their suppliers are not important in the value creation. Compared with e.g. Germany's automotive industry there is a huge difference of approach. The limit just explained is linked with the Hp1.b social awareness. Thanks to companies interview, it has been noticed that the big barrier to collaboration is the companies culture and the managers believes; and this has influenced and is influencing the possibility to establish a cooperative solution to develop eco-innovations. Entering in the green supply chain management field an integrated and more collaborative supply chain is necessary to have a real sustainability and to have the development and diffusion of eco-innovation in a efficiency and effectiveness way. Taking the national innovation system perspective that emphasizes the interactive process to generate innovations[21], it is possible

[21] Interactive learning between companies and between companies and other actors (Kemp R. , 2000).

to well understand how important is the regulator and government action to incentivize collaboration and interaction between companies but above all between companies and other actors (Kemp R. - Foxon T. , 2007).

The last hypothesis implications are very important, especially because linked with the culture and way of thinking. Organizational eco-innovations brought out from interviews are used by companies to develop or improve a cooperative culture and to direct the organization's attention to environmental issues.

As seen, the eco-innovation process needs a different approach from the regular innovation process. Even if in the car industry collaboration was already developed partly, environmental embracers need to be more and more collaborative in a way to discover new green-solutions. To make this real, companies are starting to develop organizational eco-innovations that allow them to focus the organization attention in collaboration and in environmental issues. A lot of actors put pressure into automotive supply chain to develop a sustainable vehicle but a key role is still played by carmakers. Carmakers have the power, the position, and the resources to influence all the supply chain actors with the objective to reach a green supply chain. In this match there are other important actors that are becoming more and more important.

The situation in the Italian contest and in France is not rosy in the eco-innovations development (even in the general automotive industry). No collaborative and no environmental culture, believes and awareness are the fatal mix for the eco-innovation development. Companies is still fixed with the old business model when there is a huge need of new business model able to develop eco-innovations and to take value from them.

5.3. Future research

The analysed elements give a lot of new starting point from where begin new research. The possibility to study the best practice in this field is one of the most important research that has to be done in the future. Collaboration's best practice can improve the awareness of others important actors and can be a starting point to develop new solution for the no-collaborative actors.

To examine in depth the tools and methods used to collaborate in a vertical way and in a horizontal way, above all understand how and how much they influence the company and the supply chain performance. This has to be a qualitative and a quantitative research, in a way to clearly highlight the relathionship.

Comparing the different country situations each other. It has been studied only few companies in the Italian and French contest. There is a need to enlarge this analysis to other important countries (US, Germany, Pacific Asia etc.) and with more companies.

Another important future research has to be developed with a different supply chain point of view. In our paper we have use the classical concept of supply chain; but, actually, the real world is more complex. Nowadays the car is not only a good. Car is becoming more and more a set of mobility services linked each others. Actors that are putting interested in car industry are more than supply chain actors. These actors have an important influence in all the vehicles system. So, it is possible to use a enlarged point of view to understand better the dynamics of eco-innovations and green embracers in the automotive industry. In this contest could be appropriate to analyse better how the eco-innovations re diffused.

References

Aragon-Correa (1998), "Strategic proactivity and firm approach to the natural environment", *Academy of Management Journal* Vol.41 Issue5 p556–567.

Arundel A. - Kemp R. (2009), "Measuring eco-innovation", Working Paper, *United Nations University-Maastricht Economic and social Research and training centre on Innovation and Technology* .

Ashby M. (2009), *Materials and the environment,* 1st ed. Elsevier; 2009

Ashford N., (2002), "Government and environmental innovation in Europe and North America", *The American Behavioral Scientist* Vol.45 Issue9 p1417–1434.

Ayerbe (2003), "Innovation technologique et organisationnelle au sein de PME innovantes: complémentarité des processus, analyse comparative des mécanismes de diffusion", *XIIème Conférence Internationale de Management Stratégique*, Tunis.

Baron D.P. (1995), "Integrated strategy: market and non market components", *California Management Review* Vol.37 Issue2 p47–65.

Becker C.M. - Zirpoli F. (2011), "The limits of design and engineering outsourcing: performance integration and the unfulfilled promises of modularity", *R&D Management* Jan2011 Vol.41 Issue1 pp21-43.

Bennett D. - Nunes B. (2010), "Green operations initiatives in the automotive industry: An environmental reports analysis and benchmarking stuy", *Benchmarking: An international Journal"* Vol.17 Issue3 p396-420.

Bennett D. - Nunes B. , "Green Innovation Management in the Automotive Industry"*, Managing Innovation* Aston University UK.

Berns M. - Townend A. - Khayat Z. - Balagopal B. - Reeves M. - Hopkins M.S. - Krushwitz N. (2009), "Sustainability and Competitive Advantage", *MIT Sloan Management Review* Fall2009 Vol.51 Issue1 p19-20.

Bertens C. - Statema H. (2011), "Business models of eco-innovation: an explorative study into the value network of business models of eco-innovations and some Dutch case studies", Commissioned by Dutch Ministry of Infrastructure and Evironment and by Agentshap NL, Dec2011.

Borchardt M. - Poltosi L.A.C. - Sellito M.A. - Pereira G.M. (2009), "Adopting ecodesign practices: Case study of a midsized automotive supplier", *Environmental Quality Management* Aut2009 Vol.19 Issue1 p7-22.

Bowen F.E. - Cousins P.D. - Lamming R.C. - Faruk A.C. (2001), "The role of supply management capabilities in green supply", *Production and Operations Management* Vol.10 Issue2 p174–189.

Bower L.J. - Christensen M.C. (1996), "Customer power, strategic investment, and the failure of leading firms", *Strategic Management Journal* Vol.17 No.3 pp197-218.

Brabec M. (2010) , *Business model vert : L'économie durable comme stratégie gagnante*, Dunod, Paris.

Burgess, T.F., Gules, H.K., (1998), "Buyer–supplier relationships in firms adopting advanced manufacturing technology: an empirical analysis of the implementation of hard and soft technologies", Vol.15 Issue 2–3 p127–152.

Carbone V. - Moatti V. (2011), "Towards greener supply chains: an istitutional perspective", *International Journal of Logistics: Research & Applications*, Jun2011 Vol.14 Issue3 p179-197.

Carter C.R. - Carter J.R. (1998), "Interorganizational determinants of environmental purchasing: Initial evidence from the consumer products industries", *Decision Sciences* Vol.29 Issue3 p659–684.

Charter M. - Clark T. (2007), "Sustainable Innovation: Key conclusions from Sustainable Innovation Conferences 2003-2006 organised by The Centre for Sustainable Design", *The Centre for Sustainable Design*, University College for Creative Arts.

Chen, C.C., 2005, "Incorporating green purchasing into the frame of ISO 14000", *Journal of Cleaner Production* Vol.13 Issue 9 p927–933.

Chesbrough H. W. (2003), "Open Innovation: the new imperative for creating and profiting from technology", *Harvard Business School Press*.

Christmann P. (2000), "Effect of 'best practices' of environmental management on cost advantage: The role of complementary assets", *Academy of Management Journal* Vol.43 Issue4 p663–680.

CIP, Competitiveness and Innovation Framework Program. (2007 - 2013). The entrepreneurship and Innovation Programme. European Commission.

Clark K.B. - Henderson R.M. (1990), "Architectural Innovation: The reconfiguration of existing product technologies and the failure of established firms", *Administrative science Quarterly* Mar1990 Vol.35 No.1 p9-30.

Cornaert J. (2010), *L'Avenir de l'automobile*, Armand Colin, Paris

Cohen W. M. - Levinthal D. A. (1990), "Absorptive Capacity: A new Perspective on Learning and Innovation", *Administrative Science Quarterly*, Mar1990 Vol. 35 No.1 Special issue p128-152.

Cousins P.D. - Lamming R.C. - Bowen F. (2004), "The role of risk in environment-related supplier initiatives", *International Journal of Operations & Production Management* Vol. 24 Issue6 p554-65.

Curtis H. - Walker J. (2001), "Design council European survey of manufacturing comanies' attitudes towards design fos sustainability", *Design Council*, London 2001.

Crea N. (2010), "L'innovazione dell'automobile!, *XXI Secolo.*

Crotty J. - Smith M. (2006), "Strategic responses to environmental regulation in the UK Automotive Sector: the EU End of Life Vehicle Directive and the Porter Hypothesis", *Journal of Industrial Ecology* Oct2006 Vol.10 Issue4 p9-111.

Dobers P. - Wolff R. (1999), "Eco-efficiency and dematerialization: scenarios for new industrial logics in recycling industries, automobile and household appliances", *Business Strategy and the Environment* Vol.8 p31–45.

de Brito M. - Carbone V. - Meunier C. (2008), "Towards a sustainable fashion retail supply chain in Europe: organisation and performance", *International Journal of Production and Economics* Vol.114 p534–553.

DesJardins J. (1998), "Corporate environmental responsibility", *Journal of Business Ethics* Vol.17 Issue8 p825–838.

Di Maggio P. - Powell W.W. (1983), "The iron cage revisited: institutional isomorphism and collective rationality in organizational fields", *American Sociological Review* Vol.48 Issue2 p147–160.

Dooley K.J. - Ellram M.L. - Tate W.L. (2012), "Environmental purchaising and supplier management (EPSM): Theory and practice", *Journal of Purchaising & Supply Management* Vol.18 p173-188.

Eccles R. (2012), "Get Ready: Mandated Integrated Reporting Is The Future of Corporate Reporting", *MIT Sloan Management Review* March2012.

ETAP (2004) 38 final, Communication from the Commission to the Council and the European Parliament. "Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union".

European commison (2012), "Competitive Automotive Regulatory System for the 21st century: CARS 21".

European Commission (2012), Communication from the commission to the European Parliament, the council, the European Economic and Social Committee and the Commitee of the Regions: "Innovation for Sustainable Growth: A Bioeconomy for Europe", Bruxelles.

European Union (2000), Directive 2000/53/CE, "End of life Vehicles".

Eynard B. - Messaadia M. - Vallet F. (2010), "Sustainability requirements deplyment in product-process eco-design", *Summer school on Sustainable Manufacturing* Dec2010 p143-158.

Fiksel J. R. (1996), *Design for environment: Creating eco-efficent products and process*, McGraw-Hill, New York.

Fingar P. (2012), "The Innovation Process", Adapted from the book: *Business Innovation in the Cloud: Executing on Innovation with Cloud Computing*, June 2012.

FIU (1998) - Forschungsverbund innovative Wirkungen umweltpolitischer Instrumente (Joint Project on Innovation Impacts of Environmental Policy Instruments), 1998. Innovation Impacts of Environmental Policy Instruments.

Flash Eurobarometer 315 (2011), Attitudes of European entrepreneurs towards eco-innovation: Analytical report Synthesis Report of a project commissioned by the German Ministry of Research and Technology (BMBF), Volume III. Analytica-Verlag, Berlin.

Fussler C. - James P. , (1996), *Driving Eco-Innovation: A Breakthrough Discipline for Innovation and Sustainability*, Pitman Publishing: London.

Galaskiewicz J. - Wasserman S. (1989), "Mimetic processes within an interorganizational field: an empirical test", *Administrative Science Quarterly* Vol.34 Issue3 p454–479.

Geffen C.A. - Rothenberg S. (2000), "Suppliers and environmental innovation: The automotive paint process", *International Journal of Operations & Production Management* Vol.20 Issue2 p166-186.

GEMI (2001), *New Path to Business Value*.

Gilbert J.T. - Birnbaum-More P.H. (1996), "Innovation timing advantages: from economic theory to strategic application", *Journal of Engineering and Technology Management* Vol.12 p245–266.

González-Benito J. - González-Benito O. (2005), "An analysis of the relationship between environmental motivations and ISO 14001 certification", *British Journal of Management* Vol.16 No.2 pp. 133- 48.

González P. - Sarkis J. - Adenso-Diaz B. (2008), "Environmental management system certification and its influence on corporate practices: evidence from the automotive industry", *International Journal of Operations & Production Management* Vol.28 Issue11 p1021-1041.

González-Torre P. - Pérez-Bustamante G. (2006), "Technological innovation and environmental practices in the auxiliary automotive

industry", *International Journal of Business Environment* Vol.1 No.2 pp. 177-89.

Graedel T. - Allenby B. (1997), *Industrial Ecology and the Automobile*, Prentice Hall, Upper Saddle River, New Jersey.

Grant R.M. (1996), "Prospering in dynamically-competitive environments: Organizational capability as knowledge integration", *Organization Science* Vol.7 Issue4 p375–387.

Haanaes K. - Balagopal B. - Arthur D. - Kong M.T. - Velken I. - Kruschwitz N. - Hopkins M.S. (2011), "First look: The second Annual Sustainability & Innovation Survey", *MIT Sloan Management Review* Win2011 Vol.52 Issue2 p77-83.

Haanaes K. - Arthur D. - Balagopal B. - Kong T.M. - Reeves M. - Velken I. - Hopkins M. S. - Kruschwitz N. (2011), "Sustainability: The "Embracers" Seize Advantage", *MIT Sloan Management Review* Spr2011 Vol.52 Issue3 p23-35. MIT Sloan Management Review, Reserch Report in collaboration with BCG, winter2011.

Hall J. (2001), "Environmental supply-chain innovation", *Greener Management International* Vol.9 Issue3 p105–119.

Hart S. L. (1997), "Beyond Greening: Strategies for a Sustainable World", *Harvard Business Review* Jan/Feb1997 Vol.95 Issue1 p66-76.

Haunschild P.R. (1993), "Interorganizational imitation: the impact of interlocks on corporate acquisition activity", *Administrative Science Quarterly* Vol.38 Issue4 p564–592.

Hellstrom T. (2007), "Dimension of Environmentlly Sustainable innovation: structure of eco-innovation concept", *Sustainable Development* May2007 Vol. 15 Issue3 p148-159.

Higgins S. - Kauffled R. - Malhotra A. (2009), "Going for green: a capabilities-driven approach to environmental opportunity", *Booz&Co*. Nov2009.

Hollos D. - Blome C. - Foerstl K. (2012), "Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line", *International Journal of Production Research* Vol.50 Issue11 p2968–2986.

Ingham M. (2011), *Vers l'innovation responsable : pour une vraie responsabilité sociétale*, De Boeck, Bruxelles.

Jaffe, A.B. - Stavins, R.N. (1994), "The Energy Paradox and the Diffusion of Conservation Technology", *Resource and Energy Economics, Elsevier Science B.V.*

Johansson, G. (2002), "Success factors for integration of ecodesign in product development. A review of state-of-the-art", *Environmental Management &Health* Vol.13 No.1 pp. 98-107.

Kaenzig J. - Wüstenhagen R. (2008), "Understanding the Green Energy Consumer", *Marketing Review St.Gallen* Vol.4 p12-16.

Keldmann T. - Olesen J. (1994), "Conditions for handling the environmental issue as a business issue in product development", *Journal of Environmentally Conscious Design & Manufacturing* Vol.3 No.1 pp. 35-44.

Klassen R. - Vachon S. (2003), "Collaboration and evaluation in the supply chain: the impact on plantlevel environmental investment", *Production and Operations Management* Vol.12 No.3 p336-52.

Klassen R.D. - Whybark D.C. (1999), "The impact of environmental technologies on manufacturing performance", *Academy of Management Journal* Vol.42 Issue6 p599–615.

Kemp R. (2000), "Technology and Environmental Policy-Innovation effects of past policies and suggestions for improvement", *OECD proceedings Innovation and the Environment* OECD p35-61.

Kemp R. - Foxon T. (2007), "Eco-innovation from an innovation dynamics perspective", *MEI projects: measuring eco-innovation*. Project No: 044513

Kempton W. (1991), "Lay Perspectives on Global Climate Change", *Global Enviromental Change*.

Keoleian G. - Kar K. - Manion M. - Bulkley J. (1997), *Industrial Ecology of the Automobile: A Life Cycle Perspective*, SAE, International, Warrendale, Pennsylvania.

Lam J. - Hills S. - Welford R. (2005), "Ecological modernisation, environmental innovation and competitiveness: the case of public transport in Hong Kong", *International Journal of Innovation and Sustainable Development* Vol.1 Issue1–2 p103–126.

Lawrence L. - Andrews D. - Ralph B. - France C. (2002), "Identifying and assessing environmental impacts: investigating ISO 14001 approaches", *The TQM Magazine* Vol.14 No.1 p43-50.

Lieberman M.B. - Montgomery D.B. (1988), "First-mover advantages" *Strategic Management Journal* Vol.9 p41–58.

Lin C.Y. - Ho Y.-H. (2008), "An empirical study on logistics service providers' intention to adopt green innovations", *Journal of Technology Management and Innovation* Vol.3 Issue1 p17–26.

Loew T. - Clausen J. - Hall M. - Loft L. - Braum S. (2009), "Case Studies on CSR and Innovation: Company Cases from Germany and USA", PDF-Download at www.4sustainability.org and www.future-ev.de, Berlin.

Lorenzoni G. - Lipparini A. (1999), "The leveraging of interfirm relationships as a distinctive organizational capability: A longitudinal study", *Strategic Management Journal* Vol.20 Issue4 p317–338.

Mathieu A. - Chandon J. - Reynaud E. "Le developpement durable en actions: approche par l'eco innovation".

Mayyas A. - Qattawi A. - Omar M. - Dongri S. (2012), "Design for sustainability in automotive industry: A comprehensive review", *Renewable & Sustainable Energy Reviews* May2012 Vol.16 Issue4 p1845-1862.

McFarland R.G. - Bloodgood J.M. - Payan J.M. (2008), "Supply chain contagion", *Journal of Marketing* Vol.72 Issue2 p63–79.

Midler C. - Maniak R. - Beaume R. (2012), *Réenchanter l'industrie par l'innovation : l'expérience des constructeurs automobiles*, Dunop, Paris

Mildenberger U. - Khare A. (2000), "Planning for an environment-friendly car", *Technovation* Vol.20 p205–14.

Murphy J. - Gouldson A. (2000), Environmental policy and industrial innovation: integrating environmental and economy through ecological modernization, Geoforum 31 p33–44.

Nidomolu R. - Prahalad C.K. - Rangaswami M.R. (2009) , "Why Sustainability Is Now the Key Driver of Innovation", *Harward Business Review* Sep2009 Vol.8 Issue9 p56-64.

Nishisato S. (1980), "Analysis of categorical data: dual scaling and its applications", *University of Toronto Press*, Ontario, Canada.

Noci G. (2000), "Environmental reporting in Italy: current practices and future developments", *Business Strategy and the Environment* Vol.9 Issue4 p211–223.

OECD (2009), "La Production durable et l'éco-innovation au service d'une économie verte", *OECD L'Observateur.*

Orsato R.J. (2006), "Competitive Environmental Strategies: When Does It Pay To Be Green?", *California Management Review* Win2006 Vol.48 Issue2 p127-143.

Patris C. - Valenduc G. - Warrant F. (2010), "Technological innovation fostering sustainable development", *Work and Technology Research Centre Fondation Travail-Université.*

Pennington D.W. - Potting J. - Finnveden G. - Lindeijer E. - Jolliet O. - Rydberg T. (2004), "Life cycle assessment", *Environment International* Vol.30 p721–39.

Porter M. (1985), "Competitive Advantage: Creating and Sustaining Superior Performance" , *London: Free Press* p120.

Porter M. - Van der Linde A. (1995), "Towards a new conception of environment - competitiveness relationship". *Journal of Economic Perspective* Vol.9 Issue4 p97-118.

Porter M. - van der Linde C. (1995), "Green and competitive: Ending the stalemate", *Harvard Business Review* Vol.73 Issue5 p120–133.

Rennings K. (2000), "Redefining Innovation — Eco-Innovation Research and the Contribution from Ecological Economics", *Ecological Economics* Vol.32 p319-332.

Rennings K. - Zwick T. (2003), "Emplyment Imacts of cleaner production", ZEW economic Studies. Bd. 21, Heidelberg.

Reuter C. - Foerstl K. - Hartmann E. - Blome C. (2010), "Sustainable global supplier management: the role of dynamic capabilities in achieving competitive advantage", *Journal of Supply Chain Management* Vol.46 Issue2 p45–63.

Rolfo S. - Vitali G. (2001), *Dinamiche competitive e innovazione nel settore della componentistica auto,* FrancoAngeli Editore.

Rogers E.M. (1995), *Diffusion of Innovation*, 3rd ed. Free Press, New York.

Russo M.V. - Fouts P.A. (1997), "A resource-based perspective on corporate environmental performance and profitability", *Academy of Management Journal* Vol.40 Issue3 p534–559.

Sarkis J. (2006), *Greening the Supply Chain*, Springer, London.

Seuring S. - Muller M. (2008), "From a literature review to a conceptual framework for sustainable supply chain management", *Journal of Cleaner Production* Vol.16 Issue15 p1699–1710.

Seuring S. - Sarkis J. - Muller M. - Rao P. (2008), "Sustainability and supply chain management" , *Journal of Cleaner Production* Vol.16 Issue15 p1545–1551.

Shilling M.A. (2005), *Strategic Management of Technological Innovation,* McGraw-Hill International Edition.

Simpson D.F. - Power D.J. (2005), "Use the supply relationship to develop lean and green suppliers", *Supply Chain Management* Vol.10 No.1 p60-80.

Simpson D.F. - Power D.J. - Samson D. (2007), "Greening the automotive supply chain: a relationship perspective", *International Journal of Operations &Production Management* Vol.27 No.1 p28-48.

Smith M. - Crotty J. (2008), "Environmental Regulation an Unnovation Driving Ecological Design in the UK Automotive Industry", *Business strategy and the Environment* Vol.17 p341-349.

Srivastava S.K. (2007), "Green supply-chain management: a state-of-the-art literature review", *International Journal of Management Reviews* Vol.9 Issue1 p53–80.

Statema H. (2011), "Business models in Eco-Innovation: An explorative study", Master Thesis Departement of Business Economics, Erasmus Universiteit Rotterdam, Coach: Hofstra N.A. Co-reader: Kloosterman L.P.F.

Sundin E. (2004), "Product and process design for successful remanufacturing." Linköping studies in science and technology. Dissertation No. 906, Department of Mechanical Engineering, Linköping University.

Tate L. W. - Ellram L. M. - Dooley K. J. (2012), "Environmental purchaising and supplier managemnt (EPSM): Theory and practice", *Journal of Purchaising & Supply management* Jul2012 Vol.18 p173-188.

Tyre M. - von Hippel E. (1997), "The situated nature of adaptive learning in organizations", *Organization Science* Vol.8 No.1 p71-83.

Vachon S. - Klassen R.D. (2006), "Extending green practices across the supply chain: The impact of upstream and downstream integration", *International Journal of Operations and Production Management* Vol.26 Issue7.

Vachon S. - Mao Z. (2008), "Linking supply chain strength to sustainable development: a country-level analysis", *Journal of Cleaner Production* Vol.16 Issue15 p1552–1560.

Vachon S. - Klassen R.D. (2008), "Environmental management and manufacturing performance: The role of collaboration in the supply chain", *International journal of Production Economics* Feb2008 Vol.111 Issue2 p299-315.

Venzke C. (2002), "A situação do ecodesign em empresas moveleiras da Região de Bento Gonçalves—RS: Análise dasposturas e práticas ambientais", Dissertation submitted to the Federal University of Rio Grande do Sul for a master's degree in administration.

Vercalsteren A. (2001), "Integrating the ecodesign concept in small and medium-size enterprises: Experiences in the Flemish region of Belgium", *Environmental Management and Health* Vol.12 p347–355.

Von Hippel E. (1988), "The Sources of Innovation", *Oxford University Pres,.* New York.

Young R. (2000), "Managing residual disposition: achieving economy, environmental responsibility and competitive advantage using the supply chain framework", *Journal of Supply Chain Management* Vol.36 Issue1 p57–66.

Yin R. K. (2001), *Estudo de caso: Planejamento e método*, Porto Alegre: Bookman.

Waddock S. A. - Bodwell C. - Graves B. S. (2002), "Responsibility: The New Business Imperative," *Academy of Management Executive* p132-148.

Waddock S. A. - Bodwell C. (2004), "Managing Responsibility: What Can Be Leamed from the Quality Movement?" *California Management Review*, Fall2004 p25-37.

Zadek S. (1998), "Balancing performance, ethics, and accountability". *Journal of Business Ethics* Vol.17 Issue13 p1421–1442.

Zhu Q. - Sarkis J. (2004), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprise", *Journal of Operations Management* Vol.22 Issue3 p265–289.

Zhu Q. - Sarkis J. - Geng Y. (2007), "Green supply chain management in China: pressures, practices and performance", *International Journal of Operations &Production Management* Vol.25 No.5 p449-68.

Zhu Q. - Sarkis J. - Lai K. (2012), "Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective", *Journal of Engineering & Technology Management* Jan2012 Vol.29 Issue1 p168-185.

Zirpoli F. (2008), "Il ruolo dell'organizzazione nella gestione strategica dell'innovazione", *e&m Economia & Management* Vol.1 p53-68.

Zirpoli F. - Becker M. C. (2011), "What happens when you outsource too much?", *MIT Sloan Management Review* Win2011 Vol.52 Issue2 p59-6.

Sitography

http://www.apptech.it/

http://www.cosberg.com/site/it/home.htm

http://www.valeo.com/

http://www.timken.com

http://www.novatecspinoff.com/

http://www.bimal.com

http://www.proplast.it/

http://www.lisi-automotive.com/

http://www.psa-peugeot-citroen.com/

http://www.kpmg.com/fr/fr/pages/default.aspx

APPENDX 1 : QUESTIONS PLAN

1. What is your name and your position in the company? In what consist your job?
2. In what position is the company related to the automotive supply chain?
3. What kind of relationship has the company with the suppliers, the clients and the OEM in the automotive industry?
4. How the company see the eco-innovation? For the company is a competitive advantage factor?
5. What push the company, in a operative way, to be more a eco-innovator? What are the reasons? The reasons have any linked with the other actors?
6. In what activities the attention for eco-innovation is higher? Why?
7. What are the most barriers for the eco-innovation? Are there different from the classical innovation barriers?
8. To be eco-friendly is required by suppliers, OEM, clients? Or is it a autonomous choice? How this request/influence works?
9. How the actors adopt/absorb the different eco-innovations? The eco-innovations are diffuse in a coercive or collaborative or imitative way? (As input or output, both upstream , downstream and same level company)
10. So, there is a real pressure to be green? Is it a pressure that become more from the internal actors of the SC or from outside ? Who are the most important actors that express this pressure?
11. This pressure have induced the company to modified the innovation process? How? (there is more collaboration? And how the collaboration work?)
12. What are the more common eco-innovation? (process/product/organizational, technological/ not technological, soft/hard, radical/incremental, of components/ architectural)

APPENDIX 2: ANSWERS SCHEME

COMPANY	AP TECH	COSBERG
PERSON - POSITION	De Boni Francesca - General manager and sales	Mauro Viscardi
MAIN PRODUCT	Forged wheels	Automatic solution in the component manufacturing process (e.g. brakes assembly machine)
COMPANY'S POSITION IN THE AUTOMOTIVE SUPPLY CHAIN	Rang 1 (luxury cars)	Rang 2 - supplier of machines' process for rang 1/2 companies
COMPANY SIZE	Little	Little - 90 employees
SUPPLIERS' RELATHIONSHIP	The relationship with the supplier is very strong. We have a constant flow of information between us.	
CUSTOMERS' RELATHIONSHIP	With the OEM there is a big collaboration. In fact our product it's a really important part in the clients satisfaction, so the relationship with the car makers has to be very close	Very interactive because of the big customization of our product. We put in the project the minimum standards respect, and we use higher standards on customers demand.
ECO-INNOVATION BUILD A COMPETITIVE ADVANTAGE	The factor that push us to be eco-innovators is the competitiveness	Yes, it's a driver to be more competitive in some products; Above all in the energy saving.
REASONS TO BE ECO-INNOVATORS	The first factor is the competitiveness. Now the differences in the cars (luxury cars) are linked with the technology innovation, and so in the performance. With forged wheels we can save a lot of weight: higher cars performances, and differentiation	• competitive advantage against competitors • More and more clients use the energy consumption as a choice criteria • Ecological company sensibility • continue innovation
MAIN ACTIVITIES	Materials and working	The main activity is the

	technologies to have more and more light wheels but robust	energy saving. So the product that allow a big energy saving using innovative technologies. The second one is the material used in building the machine.
BARRIERS OF ECO-INNOVATION	• Mainly linked with the social awareness. Social awareness is referred above all to the customers, that they are the most important input to start to be eco-innovative. • The costs of this kinds of innovations. • The low are very precise but do not well understood and applied.	• Energy saving is not seen in all the automotive sector as a key factor. • There is a concrete difficulty of evaluate the savings • Difficulty to discover wastes to transform after in saving
WHO PUTS PRESSURE TO BE ECO-INNOVATIVE	It's a choice that has to start from the customers. From the customers pass to car makers and then will climb into all SC actors	• External input: clients that ask for higher standard • Endogenous input: company awareness
DIFFUSION OF ECO-INNOVATION	From many years car makers incentivize the collaboration to have more sensibility to the social awareness, and to build this awareness even into the SC's organizations. (ex Ferrari)	Collaboration and diffusion. Concrete programs of open-innovation. Building collaborations through common research programs (Itellimech, PowerSave)
PROCESS INNOVATION MODIFICATION	In the point of view of the costs and collaboration	More collaboration with customers and suppliers. There is a common vision in the technologies development in the companies that are members at the different innovation centres. The most important modification after the collaboration is a common and explicit goals setting, both for external relationship and for internal process and

		routines.
WHEN THE MODIFICATION	8-10 years	
COLLABORATION FOR ECO-INNOVATION	Yes, much more than before	Yes. Open innovation has the objective to diffuse the eco-innovation. But it is easy to find organizations that see the eco-innovation as cost and not as opportunity.
HOW COLLABORTE	• With SUPPLIERs: to our suppliers we ask for innovations that allow to have machines with less energy consuming, less waste production (above all special waste e.g. emulsion oil) that have higher removal costs and removal problems. For the raw materials suppliers our request is to develop more and more eco-innovation to have lighter goods respecting eco-friendly process. • OEM: intensive collaboration with a lot of interaction between the engineering team to develop a perfect product that fit his needs, the need of the customers, our needs with the idea of environmental respect keep in mind. Not only for our component, but for the car as a whole (e.g. aerodynamics in the wheels < inertia)	Collaboration and diffusion. Concrete programs of open-innovation. Building collaborations through common research programs (Itellimech, PowerSave)
TYPOLOGIES OF ECO-INNOVATION	Product, process (press), organizational (logistics lay-out)	Product that for our customers is a process innovation: eco design,

		re-setting machine, new brand linked with energy saving. Process: guidelines for our process, energy consuming monitoring,
OTHERS	With a more pressing marketing activity in the green field we can have a future more eco-friendly. The Government is not doing enough for these issues. Crisis bring people to use money to give salaries more than invest in the green.	

COMPANY	VALEO	TIMKEN
PERSON - POSITION	Jean-Luc di Paola Gannoli - sustainable development and communications director Jeremie Blas - sustainable development team	Bertrand Kromperaker - General Manager Supply chain Europe
MAIN PRODUCT	Power train system, Thermal systems, Comfort and Driving Systems, Visibility systems	Bearings, alloy steel, power transmission, lubrication, Seal, motion control system
COMPANY'S POSITION IN THE AUTOMOTIVE SUPPLY CHAIN	Rang 1	Rang 1 or Rang 2
COMPANY SIZE	Big	Big
SUPPLIERS' RELATHIONSHIP	Harmonize strategic suppliers. Privilege those have a strategic importance. These ones help us in the innovations. We are one of the leader in the innovation but we recognize that innovation has done internally and externally (collaboration with universities and suppliers): we can not control the exterior innovation process as the internal one; so it's	Not relationship very important. Most of our suppliers come from Chine and Indie, and as you now, the standards are very different. The law is much more weak.

	important to establish trust and cooperation: we are establishing some external controlling process too (>quality <errors). E.g. Permanent control into their plants.	
CUSTOMERS' RELATHIONSHIP	From some years the relationship with OEM are more and more strong. Before the relationship was quite hierarchical (OEM ordered and I accomplished). After the crisis (2007) the relationship is still more intensive. Trust and balance are the two words. Now we propose a lot of innovation to the car makers. This is due because the big externalization in the past decades (Part of R&D transferred to suppliers). And car makers is transforming the production system in big platforms. So they need to have more trust in their supplier, they need more harmonization. And the crisis has reduced the numbers of supplier keeping alive only the stronger and the best. Permanent control into their plants. We impose the material standards respect, and a logistic procedure to follow. For our suppliers that suffer more the crisis we are available to help them (innovation, finance etc)	With the OEM the relationship is bidirectional. Usually car makers ask us how they want the product or the component. We have the engineering sector (application engineers team) that is in charge to develop the product.
ECO-INNOVATION BUILD A COMPETITIVE ADVANTAGE	Yeas absolutely	Yes, but it is a fashion phenomena as well (as bio in the food). But it is important to pay attention above all for the sales development.

REASONS TO BE ECO-INNOVATORS	Sustainability is in the group's dna. Why eco-innovation is in the dna? Before the environmental laws and directives (e.g. on CO2), Car makers asked to Valeo always lighter and more compact components to improve the cars performance and to decrease costs. These brought Valeo to be at the same time more sustainable. So the link with sustainability and innovation in Valeo is embedded, and it is seen as an economic indicator. When in the 90s (1997 above all) and in the new millennium legislation strengthened the environmental standards, Valeo used his eco-friendly culture of innovation to develop new product. In each kind of research there was/is a obsessive research for the best material to use, the weight reduction, energy saving. All of this maintaining high quality because of cars components production plays in the huge numbers. Costs, differentiation law present and future. To exceed the law standards is more a branding marketing culture.	The main reasons is for the development of the sales. The main goal is costs reducing. That means reduction of the consume using the car. So decrease the consume of the car. The second way to reduce costs is using less materials
MAIN ACTIVITIES	The starting platform is the law. After is the future laws (feasible target)	Propulsion, fuel efficient driving as example for the energy saving. And the other important driver is costs reduction
BARRIERS OF ECO-INNOVATION	At the end is the customer that decide what wants and not wants	

	There is even a a culture inertia, generational inertia. And even the problem of the familly businesses that didn't become familiar with the sustainability culture.	
WHO PUTS PRESSURE TO BE ECO-INNOVATIVE		Car makers
DIFFUSION OF ECO-INNOVATION		
PROCESS INNOVATION MODIFICATION		It is the same, as goal the environmental issue is entered in the process but only as secondary objectives because the first one is always the costs reduction
WHEN THE MODIFICATION		
COLLABORATION FOR ECO-INNOVATION	Even before was collaborative. But is increasing to develop the relationship with the supplier.	There is not too much collaboration
HOW COLLABORTE	Supplier are always less and we keep the more strategically important. Deeper relation, better know each other. There is a permanent process of collaboration thanks to culture of quality and audit. We develop collaboration thanks to the VIP program. Vip suppliers are the best suppliers that we have and with them we develop a really close program. Actually the directive depart from us, but we work in contact with the supplier to the development. Some supplier are so close, and so good that are able to anticipate our needs. Bidirectional. We are open and we appreciate, even with the VIP	Clients ask us to respect some standards and we develop a product respecting them. There is a little interaction between the engineering teams

	program, the suppliers suggestions. There are even some requests that are compulsory for our customers, as for us when they come from the OEM.	
TYPOLOGIES OF ECO-INNOVATION	Product, process: packaging, remanufactoring, recycling,	Our most important innovation are in the product. There are some eco-innovation in the processes, and why not organizational bringing more attention to the environmental issues.
OTHERS	We don't have the economist luxury to ask to ourselves where we do innovation; we do that's all.	

COMPANY	NOVATEC SPINOFF	BIMAL
PERSON - POSITION	Pierluigi Beomonte Zobel - President	Renzo Bigi - Technical Manager
MAIN PRODUCT	Mechanical and mechatronics design service concerning products, production machinery, industrial plants	Design and build test stands
COMPANY'S POSITION IN THE AUTOMOTIVE SUPPLY CHAIN	Rang 3	Rang 2 - Rang 3
COMPANY SIZE	Micro	little
SUPPLIERS' RELATHIONSHIP		
CUSTOMERS' RELATHIONSHIP	We work with some of the most important player in the rang 2 or 1 in the automotive industries. We provide them a engineering service, so the interaction between the two teams are very high and frequent	
ECO-INNOVATION FOR THE COMPANY		

ECO-INNOVATION BUILD A COMPETITIVE ADVANTAGE	Yes	yes
REASONS TO BE ECO-INNOVATORS	The most important that we find when we provide our services is the energy saving that can really shoot down costs. It is different from a mass market and the more luxury markets. In the mass market the most important thing is the cost. So everything is focused in the costs. maintaining a good quality. In the other market cost reduction is important but not fundamental. Eco innovation here can bring an higher performance and a differentiation from other competitors	Decrease the using costs. But it is something more logic than a real choice
MAIN ACTIVITIES	Saving energy in the process and in the usage of the car	Saving energy (electric, mechanic and hydraulic saving energy). Get back energy system.
BARRIERS OF ECO-INNOVATION	The problem that we have seen after the crisis and that we live nowadays is that: the car makers business model in the developed countries is not sustainable yet. So, the main problem is to find a winning business model where inset the eco-sustainability as key factor. (so the eco-innovations)	Clients see the initial investment and not the future saving.
WHO PUTS PRESSURE TO BE ECO-INNOVATIVE	Market requests. Markets are always more sensitive. The second one is the legislation directly to the supplier. Legislation that influenced car makers that transmit this to suppliers	Clients and a little bit our philosophy . But it's not a real pressure as for the direct actors in the automotive supply chain. There is stronger and more complex
DIFFUSION OF ECO-		

INNOVATION		
PROCESS INNOVATION MODIFICATION	Yes. The model is linked with the open-innovation concept. The net of innovation and collaboration with different actors perfectly specialized. But more with other industries (NASA - Fiat) or with universities.	Each machine is projected ad hoc. So there is a great cooperation between our clients and us. We try to find the best solution economically and technically.
WHEN THE MODIFICATION		
COLLABORATION FOR ECO-INNOVATION	The collaboration is very difficult. Actually the relation is coercive starting from OEM. Only few players (e.g. Brembo) can propose some innovation and move him-self in an autonomy way. It's different basing on the bargaining power	
HOW COLLABORTE	But the rang 1 supplier are embedded in the process of innovation and eco-innovation. Actually the rang 1 supplier are the most important for their competences and expertises. The rang one suppliers are going to have always more importance in the innovation process. Collaboration and active participation. Research's consortiums, innovation poles, research projects.	
TYPOLOGIES OF ECO-INNOVATION	One important trend is a focus into recycling the components. The trend is to retake the end-life components restore them and reuse. Most incremental innovation, sometimes radical but only in the components not as a system.	Incremental
OTHERS		

COMPANY	PROPLAST	LISI AUTOMOTIVE
PERSON - POSITION	Gianluca Capra - Key account and training Manager	David Pacaud - Production control manager, industrial and logistics direction.
MAIN PRODUCT	Plastic innovation pole: process/packaging/product engineering	Fastening and assembly solutions for automobiles (power train and gearbox, steering, suspension...)
COMPANY'S POSITION IN THE AUTOMOTIVE SUPPLY CHAIN	Rang 2 - Rang 3	Rang 1 (60%) - Rang 2 (40%)
COMPANY SIZE	Little	big
SUPPLIERS' RELATHIONSHIP	We supply rang 1 or 2 actors. The difference in the automotive supply chain is that suppliers (above all the little-medium enterprises) follow the car makers. In other industries, as electronic or packaging, suppliers are really more active suggesting innovations	
CUSTOMERS' RELATHIONSHIP		
ECO-INNOVATION BUILD A COMPETITIVE ADVANTAGE	Nowadays for some car makers or for some important suppliers to be eco-innovators is very important. To win the supply contract you must be sustainable and so sustainability is become a discriminating factor to chose the supplier (above all in Germany). Instead for the other actors is still an activity to build competitive advantage	Really not too much. In the automotive industries the important thing is only the price, and so the cost.
REASONS TO BE ECO-INNOVATORS	Brand image and marketing is the most important. Costs saving and cars lightening (an important key driver now more than before)	It's true that a consequence of the price pressure is savings. Savings materials, savings energy, savings distance transports that

		are environmental-friendly activity. But the real reason it is costs reduction. AN other reason is laws respecting .
MAIN ACTIVITIES	Saving materials and lightening to have less consumes. Recycling and restoring parts and components after the life-cycle.	Savings materials, savings energy, savings distance transports
BARRIERS OF ECO-INNOVATION	The lack of environmental/sustainability culture. The second one is the costs of these kind of innovations.	
WHO PUTS PRESSURE TO BE ECO-INNOVATIVE	Above all the car makers. It's not perfectly bidirectional. Actually is very easy that the relationship is only from car maker to suppliers. It is more coercive.	Clients to car makers that pass this pressure in the supply chain.
DIFFUSION OF ECO-INNOVATION		
PROCESS INNOVATION MODIFICATION	Operationally on the process point of view is not changed. The real difference is in the insertion of sustainability goals in the project. And together with the culture, that is changing in favour of sustainability, teams pay more attention to respect environmental standards. They need to pay more attention at some aspects/factors/dimensions that before were not in the process.	There is no modification. The evaluation of green impacts is used only to respect the law imposed standards.
WHEN THE MODIFICATION		
COLLABORATION FOR ECO-INNOVATION	Theoretical might be very high. But often suppliers suffer the car makers decisions.	
HOW COLLABORTE	There was even before collaboration. The previous collaboration had a lot of reasons to exist (e.g time	There is not too much collaboration. Car makers or our clients ask us a specific

	to market reducing, components integration, lean production, complexity etc). The approach is not really changed; the thing that has to change is the background. But, we know that to discover and implement eco-innovation might be more collaboration in all the supply chain to reach a good degree of sustainability.	products and we develop it. There are some protocols to respect, as in the transport or in the packaging. (logistics protocol). Some of them are compulsory for the law, the other ones are imposed from clients.
TYPOLOGIES OF ECO-INNOVATION	In the process there are a lot of possible development. The eco-innovation in the process is still in the first steps. New technologies and new materials are the two most important fields. There is a lot of incremental innovation. Radical above all in the metal replacement (new alloys). Logically more in the components that architectural.	
OTHERS		

COMPANY	PSA
PERSON - POSITION	Pierre - Alexandre Phelipot - ex. Supply chain manager , excellence department manager
MAIN PRODUCT	Car maker
COMPANY'S POSITION IN THE AUTOMOTIVE SUPPLY CHAIN	Car maker
COMPANY SIZE	Big
SUPPLIERS' RELATHIONSHIP	There are cooperative relationships with the most important rang 1 suppliers. With the other the relationship is more coercive or more a market

	relationship
CUSTOMERS' RELATHIONSHIP	
ECO-INNOVATION BUILD A COMPETITIVE ADVANTAGE	Yes, but in PSA it is very developed in the product side and much less in the process side.
REASONS TO BE ECO-INNOVATORS	
MAIN ACTIVITIES	The most important eco-innovation are in the product.
BARRIERS OF ECO-INNOVATION	Communication. PSA in the product environmental impact is very well developed, but our lack and difficulty is the communication. The second barrier is the lack of a ecological plan. It is perceived as a cost more than an opportunity. Often the regulation system is too much complicated, above all for the further internal and external communication. (does not allow to have a good visibility)
WHO PUTS PRESSURE TO BE ECO-INNOVATIVE	Regulations are the first input to be eco-innovators. The second one is the managers mentality and willing. In PSA the last two elements are not so developed. It is like if we are waiting for a generational change. We put pressure to our suppliers asking them the respect of some standards. Clients put a lot of pressure nowadays.
DIFFUSION OF ECO-INNOVATION	
PROCESS INNOVATION MODIFICATION	The process is changed with more collaboration with the suppliers and trying to make aware them. The process is change in a organizational

	point of view with the creation of a "equipe exellence". The team has in charge the excellence even in the sustainability point of view. The problem is that still now the culture of the company is linked with the costs past culture. The team has not too much power of decision in the innovation process, it is only like advisor or influencer.
WHEN THE MODIFICATION	Excellence team 10y
COLLABORATION FOR ECO-INNOVATION	There is collaboration only with the most important suppliers. The interaction with them are frequent and dynamic. But we have trust in the expertise of our supplier, so, if we need a wheel with more inertia we ask Michelin to innovate it.
HOW COLLABORTE	
TYPOLOGIES OF ECO-INNOVATION	Product
OTHERS	Need of law simplification; where every common person can understand without the need of an expert or specialist.

Michel Paolucci (KPMG partner) interviews:

In what position do you work? In what mission mainly linked with the automotive industry?

I work in some missions those concern innovation management for Michelin Worrld, Peugeut France, Renault France mainly. After I'm in charge of other mission as advisor in the government field linked with automotive industries.

What kind or relationship has the company with suppliers and clients?

We have to differentiate the focusing country. Because it's really different the relationship between actors in different countries. Like in France the relationships is set in a way, in US and in Germany in another way.

Ok, we can talk about France that is where is focused most of your missions.

There is no collaboration in France. This is really different from Germany and US where the collaboration between car makers and suppliers is really developed. This thing even in the innovation point of view. Collaboration in France is really infrequent. French culture is more based on hierarchy, and this influences the relationships. In Germany for example they have developed innovation and collaborative clusters. But it was the big car makers group to build or push for this kind of cooperation model. The idea in France is "I need something, I buy it at the lower price, from the best offerer, and that's all". The situation is the same for the car makers, but even for all the other big automotive groups in the supply chain. Logically there is some exception, but only in the most innovative companies in the supply chain. We have to remember in all the discussion that automotive is the first industry in the world.

So, the relationship is hierarchical? And not cooperative? Even in the innovation point of view?

Yes, in France is really difficult to find a collaborative relationship, above all from car makers and other supply chain actors. They communicate to

be collaborative, but if we see really the facts there is not a well developed collaboration.

We are going to talk about eco-innovation. How companies see eco-innovations? And they think that eco-innovations can build a competitive advantage?

Logically they think that eco-innovation can build a competitive advantages, and as well they know that without innovation and now eco-innovation they are dead. The problem is that nowadays, innovation and above all eco-innovation need a cooperative approach and they do not have this approach. It is not in the French culture. They have like a "engineering culture", so they think to are able to make everything alone without cooperation. They do not accept to stay in the same level of others important players of the supply chain.

What push company to be more eco-innovator? what are the reasons? The reasons have any linked with the others actors?

As Michelin as example. Michelin believe in eco-innovations. They have found a lot of eco-innovation. The problem is that they have developed these eco-innovation only internally. Developing eco-innovation only internally they have a expertise, know how, knowledge, capabilities limits that you can not have if you collaborate. Now, Michelin is changing is policies and starting to develop products in collaboration with other companies and markets.

In what activities the attention for eco-innovation is higher? Why?

There are three main activities:

- Product: the focus of the car makers and then that they push along the supply chain is on the eco-innovation product.
- Services: a lot of companies is developing more and more services for clients. From car makers to others suppliers. Services linked to the product in a ecological way. For example the program of "safety driving" from Michelin. In

this program there is logically the will to transmit the idea that using Michelin you driving is more safety. But there is also the ecological side. If you drive your car in a good way you can save the usury of your wheel, and save fuel too.

- Culture: Michelin for example is developing a collaboration culture inside the company. They are trying to develop a culture of people based on collaboration. Michelin is not the only one, but is one of the most performed in this field in France. This is very important for the future development of eco-innovation.

And the process?

Well, the process has already done. Optimization, high quality process, high energy saving or reusing have been well developed in the past years. All the car makers and the other big companies in the supply chain has a high level of low impact process. It's true that they can improve but really a lot of efforts have already done. The problem is in the little suppliers or in the upstream suppliers. Without collaboration they are rested in an inefficient process and so with a high environmental impact. Eco-innovation practice and culture need to be transmit to them in order to improve all the supply chain.

What are the most barriers for eco-innovation? Are there different from the classical innovation barriers?

The first barrier is a social barrier. So eco-innovation need collaboration but if the culture does not care about collaboration this mean no eco-innovation, or better an eco-innovation that does not exploit all its potentiality.

Second barrier is the regulation. Regulation need to push innovation and even eco-innovation step by step. It can ask a big jump because the result will be the killing of the industry, or the killing of a lot of companies. In this context, there is even the pressure of the big companies to change slowly. they can forecast who takes the value, the money, with a radical-destructive innovation.

The third barrier is people. They are going to accepted the change? They are going to accept another way to conceive cars and driving? They are going to accept a different relationship with car?

The last one is a technical barriers. It is not easy to surpass the technical borders. But in this point a lot of efforts has been done and with a good results.

Car self-driving, 100km/l etc. The problem rest always the same in France. More and more to overpass the limit we need collaboration
Car makers ask to find a solution to its supplier for a specific problem and supplier try to find the solution, even for the ecological issues.

Another important barrier for the innovation in general, and above all for eco-innovation is the cost. The eco-innovation costs are more and more higher and are going to increase. So, two issues: companies need to collaborate even to share cost and risks (even them always higher); final customers are ready to pay more to have a car or a service environmental-friendly?

We need to think about the system. Now, the actors in the automotive industry are not the classical actors that you study in the old books. Now there are several and several actors that are in the automotive industry and that they have great advantages from this sector. Insurances company, telecommunication, tech-companies etc. As you know Google has developed the cars that go without driving, do you think that this is a good news for insurance companies like Axa? So car makers has to understand that is already late to start cooperation only with supplier. hey have to understand that cooperation has to have done with all the players interests bringing.

Who requires to be eco-friendly?

There is a lot of pressure to have less environmental impact. The first pressure come from costumers. Costumers influenced car makers and at the same time influence regulators. So the second pressure come from regulators. Regulations is not only for the car makers but even for the suppliers. Every way there is pressure from car makers to the supplier in a way to respect standards and the environmental policies of the company. Environmental policies that easily are transformed in marketing and communication activities. There are some companies that have like a self-

pressure to be eco-innovators, Michelin is following this path, aware that eco-innovation build an important competitive advantage.

How the actors adopt/absorb eco-innovations?

As already said, usually car makers ask to his suppliers to find a solution for some problem, or to reach a prefixed standard. Rang 1 supplier try to develop the product asking as well some standard to his suppliers. But, most of the times are the car makers' suppliers that propose eco-innovation to the car maker.

Pressure for green has induced companies to change the innovation process? How?

Theoretically yes. But in the reality non. The collaboration approach is the need to be eco-innovative and to well developed eco-innovation. This is the big difference from Germany. German car makers has developed a great collaborative approach to innovation in general and to eco-innovation as well. They try to develop all the supply chain actors in competences and knowledge. One of the tools is the supplier management as: competences analysis and development; quality control and development; project team approach, information systems that allow a fast and clear information flow in all the supply chain, cluster building. There are two other important issues to face in France:

-put the CSR function (or similar function) in a high power position

-insert environmental goals in the innovation project/plan/process

Why if companies think that eco-innovation can build a competitive advantage, they do not eco-innovate?

The system is very complex and there are a lot of interests. The problem of eco-innovations is the uncertainty of who is going to take the value.

Because if I'm Michelin and I can develop an amazing eco-innovation why I do not do?

If I'm Michelin, and as Michelin has done, I develop a tire that does not get a flat. How I can sell the others tires?

So, the fact is to change the business model and to develop another way to take the value created?

Yes. This is the point. Change the business model keeping in mind that now we are not selling cars. But we are selling a service. Car is only a part of the service but there is inside even other actors: insurance companies, mobility companies, telecommunications companies etc. I had the opportunity to start a project, as advisor, between an important car makers and two other companies not in the automotive industry (in the old point of view). In France everyone wanted to take the centre of the bargaining. "I'm more important than you", "No, I'm more powerful than you " etc. This is the lack of collaborative culture.

Only for curiosity, what kinds of solutions you can suggest?

One of the question to ask is: is there some possibility to solve this problem yet? Really I think that in Europe this problem is really difficult to solve. But there are some actions that different players can take. The first one is the European Union and all the European apparatus linked with innovations and research. Nowadays most of the research programs have done by single countries. France, Germany, Italy etc have different innovation and research programs. If we want to compete with the other countries, and we know that to compete we need innovations and research, programs have to be at European level. Europe can really develop a eco-system of cooperation thanks to regulation and thanks to used funds.

The second one is from companies. They have to understand that the problem is in the people and in the culture of people. Change the people way of thinking is not easy. But companies have a lot of tools to make it, internally and externally in a way to improve the cooperation.

Déclaration sur l'honneur

Je, soussigné(e), Manolli Diego Girolamo, certifie sur l'honneur que je n'ai rien plagié dans le travail ci-joint, ce qui signifie que je suis le seul auteur de toutes les phrases dont le texte est composé. Toute phrase ayant un autre auteur que moi a été mise entre guillemets, avec indication explicite de sa source. Je suis conscient(e) qu'en contrevenant à la présente règle je transgresse les principes académiques reconnus et m'expose aux sanctions qui seront prononcées par le conseil de discipline.
J'atteste également que ce travail n'a jamais été présenté dans le cadre d'études antérieures à ESCP Europe.
S'il s'agit d'un travail réalisé dans le cadre d'études effectuées en parallèle, je dois le préciser.

Les propos tenus dans ce mémoire n'engagent que moi-même.

Fait à Paris le 12/05/2013

Affidavit

I the undersigned, Manolli Diego Girolamo, certify on the honor that I have not plagiarized the paper enclosed, which means that I am the only author of all the sentences this text is composed of. Any sentence from a different author than me was written in quotation marks, with explicit indication of its source. I am aware that by contravening to the present rule, I break the recognised academic principles and I expose myself to the sanctions the disciplinary committee will decide on.
I also confirm this work has never been submitted during studies prior to ESCP Europe.
If this work has been written during studies conducted in parallel, I must precise it.

The remarks written in those pages only commit me.

Paris, 12/05/2013