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"OPEN INNOVATION AND CROWDSOURCING IN THE AUTOMOTIVE INDUSTRY. THE BMW CASE"

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Open innovation and crowdsourcing in the automotive industry. The BMW case.

Introduction

Today the world is changing: recent trends led companies all over the world to adapt their strategies to survive in a growing competitive environment. In a so changeable scenario, it becomes crucial to rethink the ways in which economic players generate ideas and bring them to market. For this reason, innovation has become a key factor for the competitiveness among enterprises. In past years, the strategic use of internal research and development was a remarkable barrier to entry against competitors for most of the sectors, but nowadays it is no longer enough. Indeed, given the context, today we have available an enormous amount of ideas in technology, information and economy, but not all of them can be considered truly ground-breaking or pioneering. This is why the concept of "innovating innovation", theorized by the economist Henry Chesbrough, has never been so actual: disruptive innovation can change the way we live and even our social practices. Ideas can come from a multitude of directions, thus companies must use and keep innovation "open" and to allow purposive inflows and outflows of knowledge, in order to catch any possible input, leading to a potential competitive advantage. Open innovation, typically described as opposite to the so-called traditional closed innovation model, is a more dynamic and less linear approach whereby companies look both inside-out and outside-in and can take several forms, such as crowdsourcing, that uses internet users, customers, professionals and enthusiast to obtain new viable ideas.

This dissertation aims to analyse benefits and issues of open innovation and, in particular, it focuses on crowdsourcing, as a co-creation approach to broaden the technology base, using people as a strategic external source. Crowdsourcing, as a way to deal with innovation problems, cannot be considered a brand new concept. In past years, communities of innovators allowed the birth and rise of different organizations, allowing the development of several industries. What is changed today is that technology and more specifically, online platforms, allow collaboration between people everywhere and everytime, easing the absorption of information by companies. This open innovation form has been used in several industries and it has largely been demonstrated by numerous case studies, illustrating how companies implement the platform in practice.

The first chapter of the dissertation provides an overview of various innovation theories and it underlines the key points of transition from the "Chandlerian innovation system" to the "open innovation paradigm". Then, it continues describing all the contributions to the "open innovation" theory, provided by the most influential authors of the topic, such as Henry Chesbrough, Alex Ostelwalder, Richard Rosenbloom and Eric Von Hippel. Finally, it reports

several surveys to validate the importance of outbound and inbound open innovation practices.

The second chapter focuses on the meaning, structure, use and development of crowdsourcing, with special attention for benefits and issues of the model. In particular, this section provides an analysis on how the use of crowdsourcing platforms by carmakers can successfully impact the automotive industry. This sector represents a complex environment in which OEMs strive to satisfy the growing customers needs, that are eager to buy more and more technologically advanced products. This naturally leads automakers to innovate their models and looking for new modes of innovation, like crowdsourcing. The latter has been used by many automotive companies, since they saw in it an effective way to reduce costs of R&D, but, at the same time, understanding customers' desires and gain a competitive advantage. So, the analysis goes through many success stories and positive examples of how companies can benefit from obtaining ideas from the general public and implementing them into their manufacturing process, starting from the pioneering Fiat Mio Project to more advanced collaboration between crowd, Linux and Jaguar-Land Rover.

Finally, the third and last chapter of this work focuses on the BMW approach to open innovation and crowdsourcing forms. Particularly, the company has made use of a crowdsourcing platform called "Co-Creation Lab", in order to achieve new innovative ideas directly from the crowd. This part studies the correlation between ideas created by the BMW platform's users and the technologies actually introduced in the market by BMW. The research has been carried out using a web platform called Orbit, which allowed to analyse patents that the company filed and so, to assess what are the connections between crowdsourcing at BMW and technological progress developed over the last years.

1. Open Innovation

1.1 Prior theories of innovation

The processes of open innovation have been analysed for a long time, leading to a real tradition of studies. One of the most recognized theoretician was Joseph Schumpeter; he compared the entrepreneur and the entrenched incumbent firms, giving a meaningful contribution to the study of innovation. Moreover, in 1942, he stated that innovation process was increasingly affected by the influence of corporation and their R&D activities.

In fact, David C. Mowery affirmed that the rise of a vertically integrated innovation model must be attributed to the benefits of scale and scope for internal R&D. Through this model large firms internalized their firm-specific R&D activities, and commercialized them by way of internal development, manufacturing and distribution processes. Afterward, Rosenbloom and Spencer (1996) asserted that the leading industrial labs were in deep trouble, talking of a model of innovation that was 'at an end of an era'. This was mainly due to the fact that these R&D organizations had relevant difficulties when internal research produced spill overs that cannot be internally commercialized. In order to avoid the issue, such technology would be licensed to others, but in the majority of cases it 'sat on the shelf' waiting either for internal development or the researcher to leave the firm and develop it on their own. All this led to the Kuhnian anomaly, according to which the benefits of the innovation do not mature for the firm that financed its development, but for other companies who were able to capture that benefits (Chesbrough H. *et al*. 2006).

Another crucial source was the work on the importance of external technology. Useful contributions can be attributed to Nelson and Winter (1982), Cohen and Levinthal (1990), about the 'two faces' of R&D and the importance of investing in internal research to be able to use external technology, an ability they called 'absorptive capacity' (Cohen W. M. and Levinthal D. A. 1990).

Eric von Hippel (1988) identified four external sources of useful knowledge: (a) suppliers and customers; (b) university, government and private laboratories; (c) competitors; (d) other nations (Von Hippel. 1988)

One of the latest researches is due to Richard Langlois with his documentation about the 'post-Chandlerian firm' (2003) in which innovations develop in a less hierarchical trend.

If firms are not able to generate enough absorptive capacity, they may use strategic alliances in order to achieve such knowledge or utilize complementary resources to exploit that knowledge (Langlois R. N. 2004). Furthermore, as reported by other scholars, the external

knowledge could be incorporated into the innovation process by means of strategic alliances. For example, the work of Woody Powell examines the costs and benefits of networks for innovating firms, while the work of Jeffrey Dyer applies the concept of networks to the automotive industry (Dyer J. H. 1996).
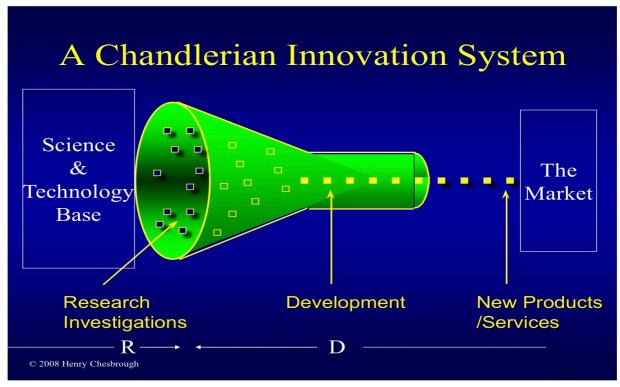
Recent researches focused on the rise of intermediate markets in particular industries. These intermediate markets modify the incentives for innovation and influence the entry mode of new technologies and new firms into an industry. In doing that it can change the way in which innovation is organized (Arora *et al.* 2002)

1.2 The Open Innovation paradigm. A revolutionary concept that changed the mode of using ideas, building business models and managing the development of products

The term "Open innovation" was coined by Henry Chesbrough, adjunct professor and faculty director of the Center for Open Innovation at the Haas School of Business at the University of California, in a book of the same name.

It has become one of hottest topic in innovation management. A search in Google Scholar on open innovation provides over 2 million hits, Henry Chesbrough's 2003 book has gathered more than 1,800 citations in just seven years (Google Scholar, July 2010), and surprisingly a wide range of disciplines, including economics, psychology, sociology, and even cultural anthropology (Von Krogh G. and Spaeth S. 2007) have shown interest in it. The book describes a new innovation paradigm shifting from a closed to an open model. The work is based on observation of few companies, documenting the adoption of practices tied to this new paradigm.

Figure 1 illustrates the innovation process under a closed model. As easily showed, science and technology base launch research projects. As they flow through the process, some of the latter are stopped, while others are chosen for further works. At this point, a subset of these is selected to go to the market. This process is clearly closed because projects can only enter in one way at the beginning and can only exit in one way, that is the market. One example over the others can be AT&T's Bell Laboratories with a remarkably inwardly focused culture. On the other hand, figure 2 is a representation of an open innovation model. In this case, projects can be launched by both external and internal technology sources and a new technology can enter into the process at different stages. Moreover, there is no one way to go to the market.

According to the theory, there are several modes of going to market such as outlicensing, spin-off venture company or, more traditionally, through the company's own marketing and sales channels. The model is called "open" because there are many approaches for ideas to flow into the process, and many ways for it to flow out into the market. Companies like IBM, Intel and Procter & Gamble can be pointed out as examples of open innovation model adoption.

Compared to antecedents in the academic literature it is possible to identify several detachment points. First of all, in classical theories such as the works of Alfred Chandler, the firm was the locus of innovation and internal activities of the firm were the central object of study, whereas, in Open Innovation, external knowledge is considered to be at the same level of internal knowledge, playing an equal role to that afforded by the latter.

A second point of differentiation lies in the centrality of the business model affirmed in the Open Innovation paradigm. With the new model, firms seek actively talented people from both outside and inside the company and do not wait that people of genius knock at the firm's door.

Figure 2: The open innovation paradigm

Source: http://www.rnd2015.sssup.it

A third key issue to be reviewed is the fact that in earlier innovation theories firms did not assume any measurement error in the evaluation of R&D projects (Judge G. et al. 1985). In Open Innovation, the business model is a cognitive device that focuses the evaluation of R&D projects within the firm. Indeed, the business model filters in projects that fit with the model, and chooses against those that do not (Chesbrough H. and Rosenbloom R. S. 2002).

The fourth distinction is about the recognition to purposive outbound flows of knowledge and technology. Firms that adopted closed innovation concepts, even when they went outside trying to absorb external knowledge, all the effort was for the purpose of internal development, manufacture and sales. Differently, in Open Innovation outward flows of technologies are enabled so that technologies that do not have a clear path to market internally can seek this path externally.

A further contribution is given by the fact that in proprietary model of innovation, useful knowledge is scarce and hard to find, while in Open Innovation, this is believed to be extensively distributed and it has high quality. It is crucial to have a strong connection with these external sources of knowledge, even if we are referring to sophisticated R&D organizations.

It is important not to forget a sixth differentiation: the proactive role for IP management in the Open Innovation model. In previous theories, the use of intellectual property was primarily

defensive due to the fact that firms thought that this strategy would have allowed to practice their (internal) technologies without being blocked by external IP. On the contrary, in Open Innovation, IP can flow out and in of the firm; moreover, it can ease the use of markets to exchange valuable knowledge and, eventually, IP can be also transferred or donated.

A seventh point of departure lies in the rise of intermediaries in innovation markets. Today, they play a direct role in innovation and they have arisen at different stages they could not enter in the past because the latter were conducted entirely within the firm.

The last area of difference concerns the new way of assessing performance of a firm innovation process using different metrics. Previously, the common evaluation measurement consisted of percentage of sales spent on (internal) R&D, the number of new products, and the number of patents produced per dollar of R&D. With the adoption of the Open Innovation theory the range of metrics has been expanded including the percentage of innovation activities originated outside of the firm, the time it takes for ideas to get from the lab to the market, the rate of utilization of patents owned by the firm and the rate of investment outside the firm (Chesbrough H. 2002).

Given these evidences, the work of Chesbrough seems to considerably improve performances of firms that decide to embrace the Open Innovation approach.

From what has been analysed so far, the theory, refined through several studies and surveys by the author, highlights a significant role of technology, but it is not all about the latter. Indeed, technology alone has no single objective value. The value is intrinsically tied to the business model adopted and so the value of a technology remains latent until it is commercialized using tools and strategy pursued by the firm. For these reason it should not surprise if the same technology commercialized in two different modes leads to diverse results; often, a mediocre technology pursued with a great business model may be more valuable than a great technology exploited via a mediocre business model. What emerges is that business models that are already familiar to the company and so broadly tested are not always the best choice. In many cases, managers have to adapt themselves to new perspectives in order to find the business model that best fits a technology and only in this case they will be able to capture the value of the technology.

Chesbrough understood the importance of business models through a research program conducted with the cooperation of the Xerox Corporation. It was a crucial research in which 35 technology projects brought forward by five Xerox research laboratories all around the world were analysed. He noticed that there were projects judged to have little worth under internal development and these were pushed outside the company or taken by researcher and continued after Xerox terminated the support. Chesbrough was intrigued by a difference

between projects that remained in Xerox and others that were performed by researchers outside the firm: the former fitted well with Xerox's business model, whereas the seconds did not (Chesbrough H. and R. S. Rosenbloom. 2002). However, most of the projects that left Xerox were not successful outside, but only a small part became valuable. This is due to the fact that companies need to develop the skills necessary to innovate their business models, ideas and technologies.

A useful example comes from a Xerox spinoff: 3Com. This commercialized the Ethernet networking protocol developed at PARC[1], that had lot of value for computer in subsequent years and also offered immediate benefits for copiers. The problem was the costs were too high, hence Xerox tried to reduce its expenses giving in leasing the Ethernet technology to Robert Metcalfe, a former PARC employee. But the opportunities to create a higher value being an important industry standard for networking computers, printers and file servers, proved to be greater and greater. At this point, Metcalfe, understood the potential of the technology, decided to raise a venture capital and started 3Com. Of course, a path of experiments was necessary to appreciate what is the best business model to use for 3Com and this required several adjustments. In those years, the IBM PC was launched, and a new computing market was established. Thus, he went after the IBM PC market with the aim of building his own direct sales force, but it turned to be more profitable to distribute his products through retailers and value-added resellers. 3Com decided to limit its business to design add-in boards for providing networking capabilities to IBM personal computers and shared laser printers. After the establishment of a working business model, 3Com went public (1984) and continued to play its role in the market for many years.

Hence, to overcame these barriers managers need to conduct experiments and one of the best ways of doing it, is by building of maps of business models and combining different processes until the best configuration is reached. One example of the mapping approach just discussed comes from Alex Ostelwalder, with 9-points decomposition that characterizes a business model. Another instance can be recognized in IBM view of creating business models: a pro-active approach that allows to experiment different models simulating various scenarios before turning the investment into reality (Osterwalder A. 2004).

In sum, according to Chesbrough, the innovation of business models is crucial for the upcoming years, but also difficult to achieve. All the above mentioned tools such maps, organizational processes, discovery driven planning and experiments are helpful and they generate data to unlock previously latent opportunities. Internal leaders are a powerful

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[1] PARC (Palo Alto Research Center). Founded in 1970 as a division of Xerox Corporation, PARC has been responsible for such developments as laser printing, Ethernet, the modern personal computer, graphical user interface (GUI) and desktop paradigm, object-oriented programming, ubiquitous computing, amorphous silicon (a-Si) applications, and advancing very-large-scale integration (VLSI) for semiconductors.

weapon to address the business model change and even middle managers must be subjected to empirical data if local objectives are to be subordinated to those of the whole organization (Chesbrough H. 2010).

Chesbrough's work turned out to be so attractive for several reasons. First of all, he assigned a single term to a collection of developments. Thanks to this insight, a range of already existing activities was connected, integrated and included under a unique definition. This enabled practitioners and academics to rethink the design of innovation strategies in a networked world.

Second, the timing was great, since in that period there was a growing interest for networks, collaborations, outsourcing, core competencies and the Internet.

Third, the development of an integrated theory, measurement instruments and management toolboxes has expanded opportunities for extension and proliferation.

However, the revolutionary concept developed by Chesbrough collides with the theory promulgated by Von Hippel. The first contrast can be detected in the very definition of open innovation, which in Von Hippel's view is intended as collaborative: "An innovation is 'open' in our terminology when all information related to the innovation is a public good, nonrivalrous and nonexcludable." (Baldwin C. and Von Hippel E. 2011) and also "it involves contributors who share the work of generating a design and also reveal the outputs from their individual and collective design efforts openly for anyone to use." (Baldwin C. and Von Hippel E. 2011).

The two theories differ each other because Chesbrough and other authors suppose ideas can come from everywhere and they must be commercialized through business models, whereas Von Hippel argues that users are the source of many innovations and, at the same time, they benefit directly from sharing, stating there is no need for a business model.

From the Von Hippel perspective, basically there are two kinds of uses on the term 'open innovation' and there is some confusion amongst the two. The first use is about 'open' as in Procter & Gamble's "connect and develop" advice and it means: no matter who you are, most of the smartest people work for someone else; thus the procedure applied is to look outside the firm for solutions to the R&D problems. But there is a more fundamental use of the term and it is 'open' as in open innovation commons - "free information" – information as a public good; this is the kind of thing on which Linux, well-known open source software is based on. This last concept led to the biggest revolution in innovation understanding and pattern since the industrial revolution: the user-centered (democratized) innovation paradigm, according to which lead users innovate to solve their own needs at private expense and then freely reveal their innovations. This vision stands opposite compared to the traditional, manufactured-

centered innovation paradigm, where manufacturers identify user needs, develop products at private expense and profit by protecting and selling what they have developed. Hence, the innovation process works with two parties involved: the manufacturer that produces goods in volumes developed by the users. For this reason, there are two different systems that need two kind of policies: if we focus the attention on the producer, it needs intellectual property in order to pay back its investment and this must be true because it invests in order to sell something, but, on the user side, users reveal their innovations for free.

Hence, the functional source of innovation depends upon the functional relationship between innovator and innovation. Von Hippel declared that when we talk about users we don't necessarily means individuals, in fact, a user can be a firm, an individual or also an organization that develops something in order to use it, otherwise, a manufacturer develops an innovation in order to sell it.

Thus, firms can have different relationships with the same innovation. For instance, when a company of international standing as "Airbus" makes a machine tool that makes airplanes better, it is a user or process innovation, bur when the same firm develops the "A380" we are facing a producer innovation expecting benefits from selling. In order to discover these patterns, Von Hippel carried out a survey involving a series of studies. He selected a particular area, scientific instruments, as a sample, and searched back in each case (scientific instrument) to find out who the innovator actually was (Riggs W. and Von Hippel E. 1994).

Figure 3: How Von Hippel discovered that users develop many major new products

Innovations Affecting	First Device	Major Improvement	Minor Improvement
Gas Chromatography	1	11	-
Nuclear Magnetic Resonance Spectrometry	1	14	-
Ultraviolet Spectrophotometry	1	5	-
Trasmission Electron Microscopy	1	14	63
Total	4	44	63

Source: http://www.vinnova.se

Example - Study of scientific Instrument innovations

New functional capability	82% user-development
DOM improvements	87% mfr-development

Total innovation sample size: n=64
Source Riggs & Von Hippel (1994)

Source: http://www.vinnova.se

Figure 5: First device used in field developed and built by:

Innovations Affecting	% User	User	Mfg.
Gas Chromatography	83%	10	2
Nuclear Magnetic Resonance Spectrometry	80%	12	3
Ultraviolet Spectrophotometry	100%	6	0
Trasmission Electron Microscopy	72%	44	17
Total	77%	72	22

Source: http://www.vinnova.se

First of all, he asked to the examined commercializing company who developed the particular instrument and nearly always, the answer was that they did the development of that tool. But, interestingly, when he tried to go deeper and discover what was the first thing which allowed starting the development of the instrument, the commercializing company admitted they

began from a prototype. The second remarkable issue was that when he looked back five to seven years prior to the first commercial introduction, users had already developed this thing. So, in those years, users asked what the tool was, they had replicated it and it emerged a population of users that were asking to manufacturer to fix the tool.

Results in this area show that almost 80% of innovation comes from this pattern.

Thereafter, user and manufacturer innovation differ. As a matter of fact, users tend to develop "Novel functional capability" innovations, while manufacturers tend to produce "Dimension of merit" improvements, but one of the biggest mistakes manufacturers do is to undervalue what users create just because innovations do not look like products in structure, quality or external appearance. But, even though innovations do not seem products, they are exactly the same; for this reason, Von Hippel documented several cases, from agriculture to financial services, in which the model holds, showing that the major part of the innovations are started from users creating, fixing, testing and modifying tools during the years (Gault F. et al. 2012). Again, the research demonstrated user innovators' motives are not profit.

Figure 6: Evidence that user innovators' motives are not profit

Kayak Equipment innovation study
Lead users' **Innovation motive %**

Profit from innovation sales	**2.07%**
Personal need for innovation	**54.82%**
Enjoyment from creating it	21.13%
Learning from creating it	7.32%
To help others	11.98%
Other motives	2%

Source: http://www.vinnova.se

There are benefits of course, bounded with personal needs, like enjoinment or learning from creating it, but they are not connected with selling the innovation to earn money and this means that consumers are not rivals and they share information for free. This is a totally new paradigm and necessarily needs new policies to be regulated.

Figure 7: Consumer product innovation almost always share their innovations for free

Consumer-innovator	Proportion of Innovations
...shared the details of the innovation with other consumers or firms	33%
...knows of other people or organizations who adopted the innovation	17%
...applied intellectual property rights to protecr the innovation (e.g. patents, trademarks)	2%
...shared the details of the innovation with other consumer or firms and was compensated	4%

Source: http://www.vinnova.se

Hence, in order to summarize what it has been discussed above, there are three key points to be mentioned:

- Users get private returns to innovation investment from use and from innovation process itself – not from sale.
- Free riding is not a cost to non-rivals – so user seldom patent.
- Social welfare likely increased due to free innovations rather than IP protected innovations.

Another issue that deserves particular attention is the way of innovating collaboratively of many users. In order to do so, Von Hippel and others studied the phenomenon of "kitesurfing". At the beginning, this sport instrument was entirely developed and improved step by step by user; subsequently, manufacturers understood there was a hundred million market on the products, so they decided to takeover the business and actually they made it. But, something unexpected happened. A man named Saul Griffith, one of the first kite surfers, asserted there was more than producer innovation and so he decided to post his own kite designs on a website (zeroprestige.com), attracting people to join in. The consequence was having a hundred of real experts and a thousands of other people downloading these designs,
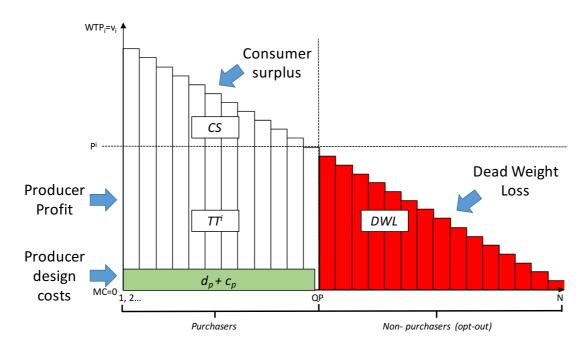
commenting and resulting in several companies with two engineers each competing with the top aerodynamicist in the world.

The reaction of the companies, that initially tried to walk alone excluding innovations coming by users, was to give up and adopting the innovations proposed by users.

Substantially, the possibility of user collaborative to out-compete producers in design is given by the fact that heterogeneous users innovating independently and freely revealing can produce more and better design work that is collectively available compared to individual producers which protect their private innovations (Baldwin C. and Von Hippel E. 2011).

Generally, it is true that this kind of innovation is better for social welfare and the latter is the crucial subject to analyse. When producers innovate, they set their prices at a level they think they can earn the higher amount of money and, as a consequence, any user that wants to pay less than prices established by producers, cannot participate in the market. But if we think an innovation like an information product, the marginal cost of production is basically zero and this creates a dead weight loss, because all the people that want to pay less have a positive value for the innovation but they can't get it (Raash C. et al. 2008).

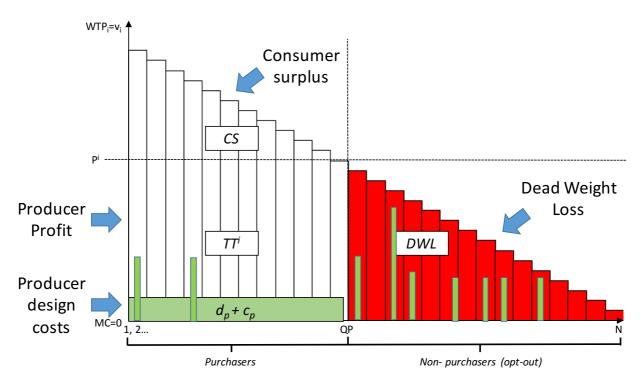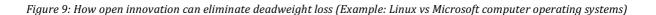*Figure 8: How IP needed by producer- innovators creates "deadweight loss" for the economy*

On the contrary, users that come in and innovate have innovation costs as well, but, if they can collectively get together and, for example, innovating like in "Linux", they do not have to

buy a "Windows", and as a result deadweight costs disappear, because everybody can enter into the market. The policy implications of what it has just been explained is that single user innovation and open collaborative innovation are the invisible but essential feedstocks for the industrial innovation engine. It is in industry's and society's best interest to protect the "innovations common space" (Blecker T., Abdelkafi N. et al. 2008)

Eric Von Hippel also suggested policy directions in order to overcome these issues. First of all, it must be measured the innovation by users along with producer innovation, then, we have to protect the innovations common space from costly regulations and intellectual property and last but not least, it is important to support infrastructure to reduce costs for innovating in the common space.

Ultimately, Von Hippel asserts that we have to start to pay attention to where the innovation really comes from and not just regulate them from the perspective of the company.

Figure 9: How open innovation can eliminate deadweight loss (Example: Linux vs Microsoft computer operating systems)

Source: http://www.vinnova.se

Indeed, the basic premise of the open innovation theory is to opening up the innovation process. The most used definition is: the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively.

Open innovation is usually contrasted with its predecessor called closed innovation, where firms generate their own innovation ideas, and then develop, build, market, distribute, service, finance, and support them on their own (Eelko K.R.E. Huizingh. 2011).

In contrast, open innovation can be explained as a paradigm in which firms can and should use internal ideas as well as external ideas, but also internal and external paths to the market, if firms want to evolve their technology. The paradigm can be seen as the opposite of the traditional vertical integration model. In the latter, internal research and development (R&D) activities allows the creation of internally developed products, subsequently distributed by the firm. Hence, open innovation represents the use of inflows and outflows of knowledge to quicken internal innovation, and expand the markets for external use of innovation respectively.

Thus, this system allows to have a different flow of valuable ideas, coming from inside and outside the company and they can go to the market from inside or outside the firm as well.

Collaboration with consumers is also an essential part of the concept popularised by Chesbrough. Recently, open innovation with customers was mainly 'inside-out' (Sonali K. S. and Mary T. 2007).

Furthermore, it should not be underestimated the role of web in implementing the concept of open innovation. During the years, the online world has approached to Web 2.0, synonymous of user empowerment and user generated content. Thanks to these technologies, the corporate strategy of many firms has changed, including programs such as open source, crowdsourcing and mass customization. Through these innovations Web 2.0 has remarkably lowered the barriers to user creation and today many services derive their value almost exclusively from the creation and content provided by users. Hence the role of user is deeply changed, leading to a new definition of the latter as "prosumer". The role is not passive anymore, but the user is now part of the creative or productive process and he is seldom significantly rewarded for his contribution.

However, one of the drawbacks could be represented by the weakened power of monitoring and enforcement firms have with industrial partners. It is clear that co-creation also leads to face significant challenges in terms of incentives, costs and risks, and intellectual property rights.

The strategy of companies aimed to implement the ideas that customers had about new products or improving existing items. This process was very linear and companies just limited themselves to exploit customer knowledge. What has changed now is that firms are trying to do more and to involve customers in the process in order to co-create knowledge and eventually to create value with them. This new strategy is more complex and involves an

active contribution of both consumers and companies. As Zwass suggested in 2010, it is possible to distinguish between autonomous and sponsored co-creation. In fact, with the autonomous one individuals or consumer communities are directly involved in the creation of value through voluntary activities that are independent from what as settled the organization. Instead, for what concern the sponsored co-creation, it is the firm that organize everything, driving consumer communities and individuals to begin the activities.

Hence, the role of customers has become more and more fundamental to implement the right process. In particular, their role it is crucial in two different stages in the production process:

1. Product design: in which they participate actively at the suggestion of their own design, or present a new feature to add or to modify an existing design.
2. Product manufacturing and distribution: that involves activities in which customers have the chance to manufacture products themselves (for example using a 3D printer or new techniques) and, at the end, they might even distribute it.

In any case, it is important to take into consideration that the actual contribution of consumers can be different depending on the type of co-creation practice setup by the company.

In a global perspective, innovation became a key factor for the competitiveness of OECD countries, because of the growth of emerging countries. In this sense, competition is more and more global and intense, leading to shorter products life cycles and innovation even more expensive and riskier to be implemented. In order to meet these challenges, innovation strategies must be reshaped and firms look for new partnerships able to unlock the access to different technologies. Thus, co-operation in technology has become a fundamental source of knowledge, allowing generating new ideas and bringing them to the market.

Today, the use of open innovation is a growing trend and companies use different modes for implement it:

1. Partnerships with external parties (alliances, joint ventures, joint development…)
2. Acquiring/selling knowledge (contract R&D, purchasing, licensing)

These two are both used to source external knowledge, but there are also less common ways to realize open innovation, such as corporate venturing (equity investments in university spin-offs or in venture capital funds) and the use of venturing to look for external partners in order to commercialize innovation not used internally (divestments, spinning out, spinning off).

An important role was certainly played by globalization, which altered the scope of open innovation, leading to an expansion of choices on feasible potential partners. The

establishment of networks distributed globally has been essential to measure local markets' trends, to obtain local knowledge and to provide further sources of new technology. So, companies link these networks to universities, people and other firms established abroad to solve issues and find new ideas (Athreye S. and Cantwell J. 2007).

Global innovation networks influence significantly the innovation systems of countries and regions. The eco-systems of innovation by global multinational enterprises can be seen as the nodes between regional/national systems of innovation across borders. The scope of MNEs consists in maximizing agglomeration economies across countries, combining codified knowledge with tacit national knowledge through communication channels. In doing that, the competitiveness of MNEs' activities in their own country is positively affected (Bathelt H. *et al.* 2004), moreover, data available have showed that MNE's activities played and play a large role in the international funding of business R&D.

Hence, business models must be opened in order to exploit a new division of work in the innovation. With this expression it is intended a system in which there are two parts joining the game. The first one generates a new idea, but it does not introduce it on the market directly; it joins another subject instead, or it sells him the idea. The purchaser will put later the idea into the market. If firms will be able to open their business models, they will have access to many more ideas and they will find more solutions to set free the economic potential, often unexpressed, of unused ideas. Of course, firms adopting open business models have greater possibility to thrive.

Theoretically, the business model has two functions: it creates value and it allows to acquire a portion of that value. It generates value defining several activities, starting from raw materials to the end customer; these activities will give added value to a new product or a new service.

The open business model makes use of this new division of work in innovation, both in value creation and in the acquisition of a part of that value. The open models create value exploiting many more ideas, thanks to the inclusion of a variety of external concepts.

These models permit a superior acquisition of value through the employment of a critical asset, resource or position, not only in the firm's specific business, but also in those of others.

In order to understand the huge potential of the new approach to innovation, we can consider these firms and what they have in common: Procter&Gamble (operating in fast-moving consumer goods), Qualcomm (producer of technologies for mobile phones), Genzyme (a biotech company) and Chicago (a movie or musical). The components of these firms have a mutual characteristic: they are all born from a single idea, which passed from the invention to the market, through at least two different companies. Moreover, they shared the work of innovation among them. For instance, P&G gave a new impetus to its growth by way of a

very successful program called 'connect and develop', which grants or takes license of other firms' products (such as SpinBrush, Olay Regenerist or Swiffer Duster) by placing them into the market with the P&G trademark (Anand *et al.* "The Structure of Licensing Contracts"). The firm is steadily hunting ideas and external technologies through a broad range of "opportunities hunters".

On the same wavelength, Genzyme reached success by taking license of an external technology and by further developing it inside the company. The firm has transformed the external ideas into a series of innovative treatments, which allow to heal rare diseases. They also reached record profits and sales in a sector where it is very difficult to achieve high earnings.

Hence, in absence of a business model prone to take advantage of these external subjects, the following innovations would not have seen the light.
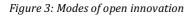
Thus, even if these ideas were so precious, original owners did not find the best way to use and to bring them to the market. This is due to the fact that different firms own diverse assets, resources, competitive positions and their own histories. Such differences induce enterprises to look at opportunities under various perspectives. In general, companies struggle to adopt ideas, which need a different assets configuration to be successful, but they immediately recognize ideas that fit their business model (Chesbrough H. 2013)
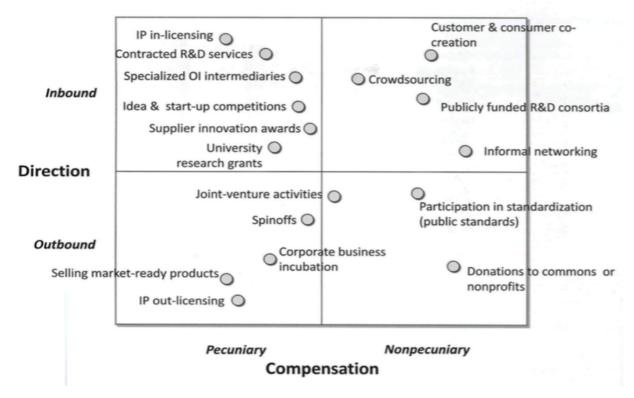

1.3 Surveys on open innovation

The empirical evidence on (global) open innovation consists mainly of case studies, often of larger companies in technology-intensive industries. Henry Chesbrough and Sabine Brunswicker published one of the most interesting surveys about open innovation recently in April 2014. They surveyed 125 large firms in Europe and the United States with annual sales in excess of $250 million to verify the extent to which large firms are practicing open innovation. Results showed that 78% of firms adopt open innovation and none of them have abandoned it. Furthermore, the 82% of companies practicing open innovation declared that it is more used today than three years ago.

The survey was organised in 23-item questionnaire. The questionnaire was three pages long and took about 15 to 20 minutes to complete. In addition to that there was a demographic section and five sections about: adoption of open innovation and strategic moves to pursue open innovation, the role of individual open innovation practices in the firm, the organizational implementation, the measurement of innovation activities and performances. The sample of 125 companies included low tech and high tech firms; the median firm is 78.5

years old with annual revenues of $2.9 billion and 7,980 employees.

Figure 3: Modes of open innovation

Source: Chesbrough and Brunswicker (2013)

Analysing the adoption of open innovation, data indicates that this paradigm is adopted by enterprises from low-tech as well as high-tech sectors. Hence it is not only a phenomenon driven by the information and communication technology sector.

Additionally, as further analysis, they asked to firms, how long they practiced the open innovation concept and the result was a median of about 5 years. Other investigations gave answers related to the support for open innovation that management was performing and the researchers concluded that open innovation is not pervasive among large companies, but it is broadly practiced. This suggests that open innovation is fast growing and well established (Lindegaard S. 2011).

Henry Chesbrough and Sabine Brunswicker differentiated between inbound and outbound open innovation, and they included both practices that offered financial and non-financial compensation. In doing that they created a matrix to classify open innovation practices. It arose from the latter research that inbound open innovation procedures are more used than inbound ones.

The importance of outbound and inbound practices was examined by asking for an evaluation, on the base of a seven-point scale, of the preferred activities used by firms in their open innovation strategies.
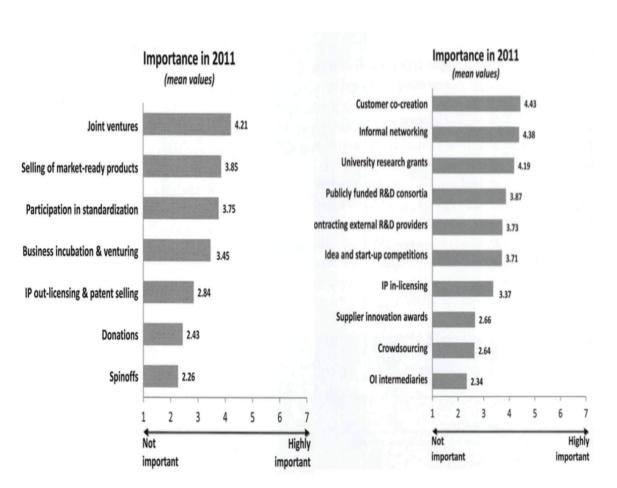
Figure 5: Importance of outbound open innovation practices

Figure 4:Importance of inbound open innovation practices
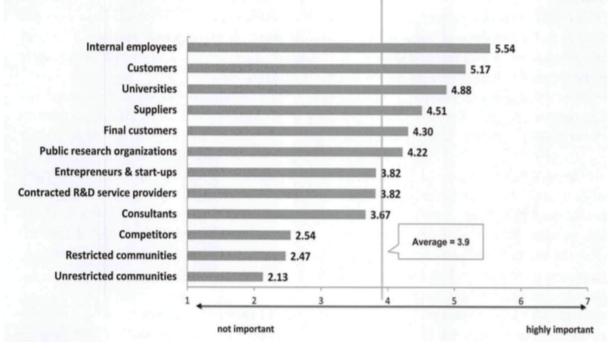
Source: Chesbrough and Brunswicker (2013)

Source: Chesbrough and Brunswicker (2013)

It was crucial to analyse preferences about particular types of partners used in open innovation activities as well. The survey inquired firms the same rating discussed above. Remarkably, internal employees were considered the most critical source of innovation ideas. This data counters the notion that open innovation may be a way to reduce internal R&D staff; rather, our data indicate that respondents consider employees a key element in their open innovation efforts (Henry Chesbrough and Sabine Brunswicker. 2014).

Figure 6: Importance of various types of open innovation partners

Source: Chesbrough and Brunswicker (2013)

Gassman and Enkel (2004) made an analysis on 124 companies, finding that open innovation approach is mostly used in high product modularity industry (high speed industry) (Gassmann, O. and E. Enkel. 2004). In their thoughts, there is an "era of open innovation" which can be unlocked only by firms or businesses that want to commercialise their own ideas and other firms' innovation, using processes outside their businesses in order to bring their in-house ideas to market. This is mainly because there were a lot of products invented for specific businesses that gave their best results in other markets. For instance, we can recall the case of BMW that used a joystick technology from video games industry to create the iDrive system, today incorporated in almost all the manufacturer's models. Not to leave alone the BMW experience, we can bring the example of the TCI/IP protocol, originally invented for military purpose, now leading the internet, or Teflon, initially developed for space missions, it has found use in kitchenware segment.

In order to take this step, one company needs changes. The first consists in making thinner the boundaries of the firm to have a more semi-permeable membrane allowing to enable innovation, so that the latter can flow between external environment and internal processes of

the firm. Under this optic, it is important to fully integrate the external knowledge that is fundamental for the internal development and combining approaches that take market demands and the company's vision into account. Hence, according to Gassman and Enkel, the most revolutionising way to change the traditional innovation method is by using "open source": a phenomenon of cooperative software development by independent programmers who modify or develop lines of codes to create new applications or increasing program's applicability. Of course, all the source code has to be freely available such as the created software itself. The two scholars relied on a database divided into four areas related on innovation processes for several companies:

- The first area concerned the intellectual property management and included 9 transnational companies. They employed interviews, questionnaires and participating observation to collect data. This research allowed to develop a model of IP Management for co-operative innovation processes.

- The second field was about external knowledge sourcing involving 23 multinational companies and led to identify three different ways of listening posts according to their main goal: the match-maker, trend scout and technology outpost.

- The third part formed the largest data sample with its 89 investigated companies and was crucial to depict an understanding of physical and geographical structure of a firm's R&D organisation and processes.

- Based on the data analysis of the previous areas in the last phase of our data collection for the open innovation research, we collected data in two action research projects. They analysed the area of outside-in innovation using 10 companies, and the second part was in the area of customer-driven innovations with 13 companies.

The sample was also flanked by the research on IBM's industry solution laboratory in Zurich, one of the greatest examples of the concept of open innovation.

Thanks to the aid of the above-mentioned data sample, the researchers were able to create a framework for open innovation involving three core processes: outside-in, inside-out and coupled.
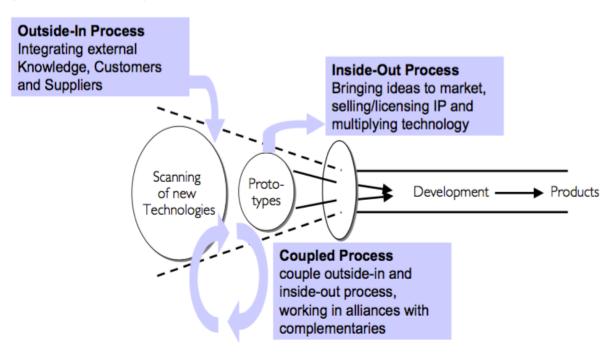
Outside-in means enlarging the knowledge base of a company through the integration of suppliers, customers and external knowledge sourcing. One example is the automotive industry: American companies such as General Motors tie their co-developing suppliers with contracts to ensure exclusivity, whereas European companies like BMW or Volkswagen use

to rely on common suppliers (e.g. Magna Steyr[2] which is integrated with the innovation process of most of the OEM in Europe) and therefore they gain value from the competence accumulated by the supplier in each new project with a competitor.

Then, they described the inside out, that is a process in which the company sells or licenses IPs and brings its own technology to market in order to gain profits from this activity. This process is mainly used by pharmaceutical companies that make fortunes licensing IPs.

Last but not least is the coupled process that concerns in coupling outside-in and inside-out processes working on alliances with complementary partners. It is important to recall that these three represent an open innovation strategy but not all the processes are equally relevant for every company. Hence, they concluded that nowadays the future of open innovation is about following a flexible innovation strategy creating several innovations by combining various strategies and not about outsourcing all internal innovation activities (Gassman O. and Enkel E. 2004).

Figure 7: Three archetypes of open innovation process

Source: Gassmann O. and Enkel E. (2004)

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[2] Magna Steyr AG & Co KG is an automobile manufacturer based in Graz, Austria, where also its primary manufacturing plant is located. It is a subsidiary of Canadian-based Magna International and was previously part of the Steyr-Daimler-Puch conglomerate. Magna Steyr engineers, develops and assembles automobiles for other companies on a contractual basis; therefore, Magna Steyr is not an automobile marque. In 2002, it absorbed Daimler AG's Eurostar vehicle assembly facility. The company's vehicle assembly capacity reached 200,000 vehicles a year. It is the largest contract manufacturer for automobiles worldwide, and has several manufacturing sites, with its main car production in Graz in Austria.

A third, less recent but significant, survey of R&D globalisation was promulgated by INSEAD, in co-operation with Booz Allen Hamilton (2006), completed by 186 companies from 19 countries and 17 industries also included some results on the importance of external collaboration and R&D networks. The survey asked two types of questions: those which required companies to provide specific answers, and those which provided statements or options against which the respondent ranked their opinion or situation using a seven point scoring system (1 being no collaboration, and 7 being high level). This research showed some turning points over the decades prior to 2005. Indeed, the logic of R&D internationalisation seemed to be changed in two ways: primarily, due to the tendency of companies to spread across the world in order to access the potential of new markets, the footprints of their R&D activities had become more international or dispersed. Moreover, the economic emergence of India and China had brought the rate of R&D internationalisation to increase and to grow significantly. In second place, the drivers behind R&D internationalisation changed in response to the increasing dispersion of knowledge and industry convergence. All these changes to the R&D/innovation landscape have had a crucial impact on a wide set of capabilities that companies needed to develop in order to extract value from their innovation activities. The survey reveals that whilst many companies are building more international R&D networks, few have really begun to build the internal capabilities to run these networks effectively and efficiently.
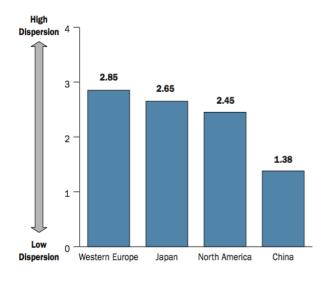
According to the survey, the level of dispersion depends on home country region and sector and it can be measured with the use of a "globalisation index"[3]. Companies based in Western Europe were the most dispersed and North American firms attested in the middle, whilst Chinese ones resulted to be very localised. On the second hand, sectors with really complex knowledge difficult to move, had a minor propensity to dispersion.
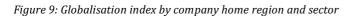
As dispersion increases, firms face new challenges and the most tough is about managing and integrating new activities and knowledge. In general, companies have difficulties in assessing the correct value of an innovation: the survey concluded that firms dealing in complex knowledge had more problems in this field rather than organizations who focus on codified knowledge. Hence, first thing to do is to invest in optimizing the configuration and integration of R&D networks, so that the benefit resulting will be an improvement of the speed of innovation (Doz Y. et al. 2006).
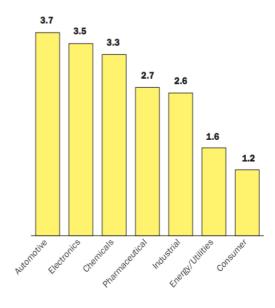
To conclude, the results illustrated an increasing importance of collaborative and global R&D and that global R&D firms have more external collaboration, even though the latter seem to be highly concentrated around the headquarters in the home country (De Backer et al. 2008).

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[3] It is based on a scale of 1 to 4, with '1' indicating a non dispersed company and '3' or above a dispersed company.
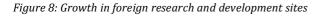
But, there are still opportunities for companies to optimise the diversity of their external network using collaborators in several fields and improving their internal knowledge mobility by promoting the encouragement of internal knowledge re-use.

Figure 9: Globalisation index by company home region and sector

Source: Insead survey (2006)

Figure 8: Growth in foreign research and development sites
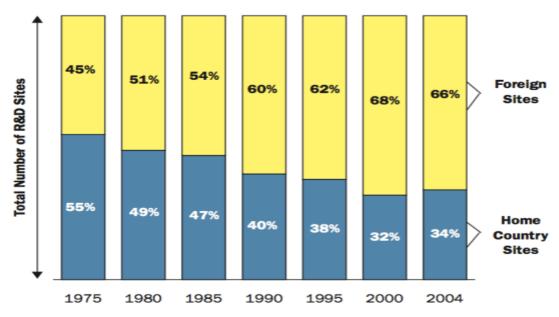
Source: Insead survey (2006)
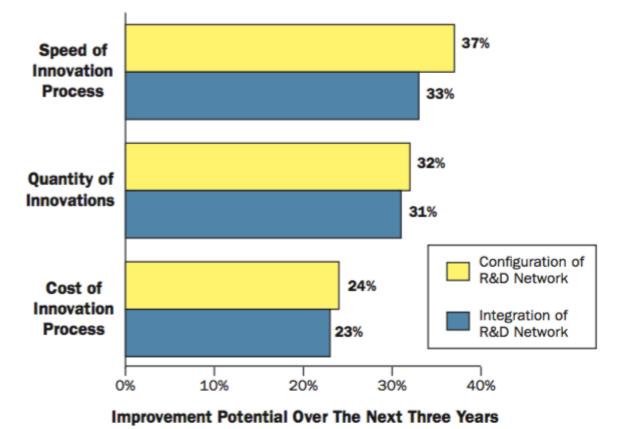
Figure 10: Potential improvements from optimising the configuration and integration of R&D networks

Improvement Potential Over The Next Three Years

Speed of Innovation Process — Configuration of R&D Network: 37%; Integration of R&D Network: 33%

Quantity of Innovations — Configuration of R&D Network: 32%; Integration of R&D Network: 31%

Cost of Innovation Process — Configuration of R&D Network: 24%; Integration of R&D Network: 23%

Legend:
- Configuration of R&D Network
- Integration of R&D Network

Source: Insead survey (2006)

2. Crowdsourcing

2.1 A general understanding

As implied in previous chapter, with open innovation there has been a shift from the simple exploitation of customers' knowledge to co-create knowledge with together with customers. There are several kinds of actual contributions which depend on the form of co-creation practice adopted by firms. Moreover, when in organization are required more than one co-creation stage, such as a firm which uses both co-design and co-manufacture customers can participate to only one stage

Crowdsourcing is deemed to be one of the most famous models of co-creation. The term was originally coined by Howe in 2006 and defined as a new web-based business model that uses a distributed network of individuals to find creative solutions for existing problems. As stated above, practices may be different according to processes of examining contributions (Geiger et al, 2011) or marketing applications (Whitla, 2009).

Since the concept of crowdsourcing is relatively recent, it consists of many practices and this leads to confuse the limits of the matter, which can be identified as an type of Internet-based collaborative activity, such as co-creation or user innovation.

In doctrine, there exist different definitions of crowdsourcing and authors have diverse opinions on many examples. Anyway, we cannot mention a particular form of crowdsourcing called crowdfunding, a method widely used in last years to involve customers in the production process. This is a particular form of co-creation which involves customers in providing funds, in cash, subsequently used by organizations to pay or purchase something.

Another form to quote is mass customization, often associated with co-creation, enabling firms to learn from their customers and to develop new ideas. Nevertheless, Prahalad and Ramaswamy (2004) affirmed that not all forms of mass-customisation correspond to co-creation activities. An example could be when a company designs a set of predetermined options and then manufactures these options on demand, this is not co-creation, as customers do not have any input.

Hence, co-creation can take place between companies and individual consumers but co-creation communities are formed between customers. The latter, often called "communities of creation" (Sawhney and Prandelli, 2000) or "communities of co-design" (Piller et al, 2004), contribute to create common knowledge and value for members of the community itself but even for "outsiders". Furthermore, many advantages come from the adoption of co-creation

such as savings in R&D, issue which can have particular importance when a company has not enough resources to develop more advanced technologies and products.

Thus, since crowdsourcing is used for a wide and different group of activities, it is provided with significant adaptability, which allows to be very effective and powerful (Howe J., 2008). Clearly, given the youth of the term, the theoretical knowledge is still not solid and fragmented. Several scholars tried to give answers, such as Brabham in his work which attempted to create typologies of crowdsourcing or Vukovic that made general reviews of crowdsourcing's characteristics, like who makes up the crowd, what are the incentives for users and so on or, ultimately, Geiger, developing a taxonomy through different examples.

So, the matter is surrounded by many definitions which can be changed depending on the perspective used in evaluating crowdsourcing. For these reasons, different points of views imply not homogeneous problem resolution or business process improvements (Burger-Helmchen T., 2010). To understand the reality of these statements through some examples, Buecheler considers Wikipedia to be an example of crowdsourcing, as Huberman does of YouTube, while Kleeman declares the opposite in both cases. Others, such as Andriole, identify crowdsourcing as a web 2.0 technology only.

However, there are perspectives about authors are rather united. One of this is the interpretation of the name crowdsourcing. It is formed by two words, crowd, making reference to the people who participate in the initiatives, and the word sourcing, which refers to a number of procurement practices aimed at finding, evaluating, and engaging suppliers of goods and services. This approach was particularly followed by Jeff Howe, which stated that crowdsourcing "is a business practice that means literally to outsource an activity to the crowd" (Howe J., 2006).

According to Howe definition, crowdsourcing can be viewed as outsourcing: the purchase of a good or service that was previously provided internally (Lacity M. C. et al, 2012). But crowdsourcing can be thought as a small-scale outsourcing (Gefen G. et al, 2008) that shares similar objectives with the latter, because both search their business needs from outside entities to achieve their objectives.

Anyway, even though they have similarities, the way of using suppliers and service providers is deeply different. In traditional outsourcing, companies make agreements of furniture, process or need with professional third-party companies, whereas crowdsourcing relies on an undefined, non-professional, and heterogeneous online "crowd" to get its needs. Thus, the online community, made of anonymous masses, has a preponderant role of service providers. In this sense, even though the basic idea of crowdsourcing is not totally new (we have evidence of the implementation of the concept even in 1714, when the British Government

needed a solution to "The Longitude Problem" that made sailing difficult and dangerous, killing thousands of sailors every year. The British government offered 20,000 pounds for lay people to find a solution, and the problem was ultimately solved by a working-class person with little formal education) (O'Donnell J., 2011), internet has widened the audience for a larger number of products and services, improving the speed of the market as well. Therefore, Web 2.0 allows to have access to a virtual work force that was unreachable in the past, and as a matter of fact, applications like Wikipedia.org, Flickr, YouTube, Facebook, and Del.icio.us, represent a "rich" media source which is easy to use, cheap, interactive and decentralized. Web 2.0 does not impose any notion on how the work has to be done and there is no pre-defined knowledge structure; flexibility, instead, and a user-centric system are the passwords to run the model (McAfee A. P., 2006).

However, beside the new most advanced technologies, the "old" Web 1.0 still remains very important nowadays. But, one must notice that traditional e-businesses have many differences compared to crowdsourcing. Indeed, the former have their own internal organizations and consider external web users as passive consumes of a product or service; this deeply contrasts with crowdsourcing which assumes the concept of meta-innovation that means "...innovation not just in the technology but innovation in some of the institutions that manage the collaboration and that manage a global community working on problems" (Brynjolfsson and McAfee., 2007). Hence, the diversity is especially prominent in the ability that crowdsourcing has in understanding the web and the role of web users, which by now is a creator and not a passive consumer. Overall, traditional e-business models use web technology as an additional channel of supply chain sourcing and marketing/distribution to reach potential customers, whereas crowdsourcing takes advantage from crowd's knowledge and the web. To better understand the difference between the two models just think about Amazon or eBay, they both take advantage from aggregate information available in user reviews or ratings, but the role of customers is confined in these activities and they are not involved in the creative process or production process as well.

2.2 Crowdsourcing internal structure

Once understood what a crowdsourcing platform actually is, it is crucial to analyse its composition. Basically, there are two parts involved: the crowd and the crowdsourcer.

2.2.1 Who is the crowd

For what concerns the former, crowd, it reveals to be useful the work of Enrique Estellés-Arolas and Fernando González-Ladrón-de-Guevara (2012), according to which there are two crowd characteristics: number of people and their typology. Regarding the number, most of the authors agree to an indeterminate and large group of individuals, which not necessarily know each other. One only exception is played by online communities, where there is higher probability of people knowing each other.

Instead, in identifying the type of people, Kleeman interpreted the crowd as users or consumers, essence of crowdsourcing. Schenk and Guittard identify the nucleus of the crowd as amateurs (students, young graduates, scientists or simply individuals), although they do not set aside professionals. Authors such as Grier and Heer and Bostok identify the crowd as web workers. According to Howe, Crowdsourcing certainly requires a smart, well-trained crowd.

But, in genera, all the definitions coincide when the crowd is considered to be a large group of individuals. There is not an optimal number of people because it depends on the type of initiative, activity and due to the capacity to filter and to evaluate information (La Vecchia G. and Cisternino A., 2010).

Again, in relation to the knowledge that people have to possess in order to be a part and work within the crowd, there is no unique answer. This depends on the activity on which crowd is called to participate. For instance, in Amazon Mturk (we will examine this platform in following paragraphs) tasks do not require special or advanced skills.

On the contrary, for websites as Innocentive or Starmind, designed for allowing organizations to solve R&D problems, a skilled crowd is a requisite, and this is also reflected in a substantial reward.

Hence, heterogeneity, characteristics of number and knowledge will be determined by the type of crowdsourcing initiative.

2.2.2 What is the crowd's reward

Since people act voluntarily, they have to be compensated for their contributions. The reward is not always the same, it can be material, such as a financial one, or not material. Of course, the best situation for an organization that are implementing a crowdsourcing platform is a non material reward, and it takes the form of the motivation to participate: passion about an activity and the pleasure of participating for fun (Stewart O. et al, 2009).

However, prior to have compensations, crowd must have real motivations to participate. The topic has been faced by many scholars and many studies suggest different motivations that fit some of Maslow's individual needs: the financial reward, the opportunity to develop creative

skills, to have fun, to share knowledge the opportunity to take up freelance work, the love of the community and an addiction to tasks proposed. Indeed, the crowd often spends a considerable amount of time on the crowdsourcing site and this proves their love for the site.

Thence, the crowdsourcer plays a fundamental role, since the recompense varies depending on him, but he will always look to satisfy more than one of the individual needs proposed in Maslow's pyramid: economic reward, social recognition, self-esteem, or to develop individual skills.

Furthermore, it is important to underline that certain authors, such as Kazai, deem entertainment as a type of motivation but, at the same time, this is present in any of the hierarchical levels proposed by Maslow (Maslow A. H., 1943). In fact, the use of a free service cannot be considered recompense, think about Delicious or Youtube. In these cases, the user does not have to take on a concrete task to use the services.

To conclude, the principal reward is that given by the crowdsourcer, interpreted as he who begins the crowdsourcing initiative. Nevertheless, there can be also secondary rewards like social recognition from other crowdsourcing participants, but these rewards are not the main ones, and are not required to be present.

Hence, satisfaction can be obtained in several ways, but it is always connected with a given necessity, which can be economic, social recognition, self-esteem, or the development of individual skills.

2.2.3 Who is the crowdsourcer

The crowdsourcer has more than one meaning. It can be a company, as in most of the cases (Amazon, Crowdflower, L'Oreal, etc.) or a public organization (European Union, FBI…) or even individuals, as in the case of crowdfunding used by many professional to seek funds.

So, crowdsourcing can be a powerful tool for many sectors, that are not only those in which corporations participate but also non-profit sectors or the government itself.

Therefore, it can be concluded that the crowdsourcer can be any given entity that has the means to carry out the initiative considered, whether it is a company, institution, non-profit organization, or an individual (Estellés-Arolas E. and González-Ladrón-de-Guevara F., 2012).

2.2.4 What is the crowdsourcer's reward

The major part of scholars agrees that the crowdsourcer achieves as return the solution of a problem. Broadly speaking, there are three types of reward for the initiator of the platform: knowledge, ideas and added value for the organization.

It can be concluded that the crowdsourcer will obtain the solution to the problem via the fulfilment of a given action or task by the crowd. The crowdsourcer will benefit from the work of the crowd, from its experience, from its knowledge, and also, in the case of crowdfunding, from its assets ((Estellés-Arolas E. and González-Ladrón-de-Guevara F., 2012).

2.3 Business models, rules and forms of crowdsourcing

The emergence of crowd-based businesses allows firms to exploit the collective energy and creativity of a huge number of contributors. There can be many different processes of crowdsourcing but, eventually, all of them result in capturing a share of the value created and they share revenues with the crowd. As we have already examined, several new companies have grown under this business model innovation and existing organizations are pushed to change their models from linear to networked, from top-down to bottom-up, from centralized to decentralized and from closed to open (Chesbrough H. 2006).

In doctrine, a business model is deemed to explain how a company creates and captures value (Zott C. et al. 2011). Crowdsourcing-based business models consist of three elements:

- An *open business model*: this ultimately enables companies to broaden the set of resources available, sharing ideas and technologies with others.
- *Leveraging technology*: such practice allows to exploit social networks, user-generated contents and mobile connectivity. Indeed, today the internet increased reach and richness of information so people are stimulated in participating to value creation activities (Dahlander L. et al. 2008).
- *Transferring value-creating activities* to a crowd: members can co-create value with the platform provider or interacting with other groups (Cusumano M.A. et al. 2002).

A further categorization of business models based on crowd can be done in respect to who-sells-to-whom. According to Lakhani and Boudreau there are three types of platform business models for external innovators (Boudreau K. J. et al. 2012):

- The *integrator platform* model, where a platform takes contributions from crowd and sells them to consumers. Platforms owners have high degree of control and owns the relationships with customers.

- The *product platform* model, that is an inside-out open innovation in which a company uses external paths to market. Creators build on top of a technology and sell the resulting products to customers.
- Two-sided or multisided platforms, which concerns a direct interaction between creators and customers.

However, organizations are different and each one has its own problems, so do the types of crowds and the ways through which they can bring contributions to the firm. This suggests managers to identify a business problem, then considering what type of contributions are required from members of the crowd and how these contributions will collectively help find a solution. First, the types of contributions required from the crowd could either call for specific objective contributions or for subjective content. Specific objective contributions help to achieve an impartial and unbiased result; Subjective content contributions revolve around the judgments, opinions, perceptions, and beliefs of individuals in a crowd that are sought to collectively help solve a problem that calls for a subjective result.

Second, contributions need to be processed collectively to add value. Depending on the problem to be solved, the contributions must either be aggregated or filtered. Under aggregation, contributions collectively yield value when they are simply combined at face value to inform a decision, without requiring any prior validation.

Together, these two dimensions help executives distinguish among and understand the variety of crowdsourcing alternatives that exist today.

Respectively, there are four forms of crowdsourcing. Two of them rely on aggregation as primary process (micro-task crowdsourcing and crowdvoting) and the other two based on filtered contributions (idea crowdsourcing and solution crowdsourcing).

- Crowdvoting: an organization proposes an issue to a crowd and subsequently aggregates all the responses to make a final decision. This form can be used by prediction markets to reach specific predictions exceeding the accuracy of experts.

- Micro-task crowdsourcing: used by organizations in order to engage a crowd for undertaking works that are impossible to achieve through standard procedures. For instance, works concerning labelling and tagging photos. The use of this method allows to segment work into micro-tasks and so be completed in less time, efficiently and to lower costs. An interesting and non conventional example is the Google re-CAPTCHA. These dialogue boxes ask users to enter the text in order to verify they are

actually human users to avoid spambots, but every time a person enters characters, he is actually digitizing what optical character recognition (OCR) software is unable to read. In this way, micro-task crowdsourcing is helping to digitize the archives of The New York Times and moving old manuscripts into Google Books. Even crowdfunding is deemed to be a form of micro-task crowdsourcing, since the financial goal is broken into smaller contributions, which are then aggregated.

- Idea crowdsourcing: organizations seek creativity from a crowd generating unique solutions for problems. Of course, each idea has to be filtered before it can be implemented. An organization using this model is Threadless, which asks the crowd for creative t-shirts and then internally chooses the best to be sold.

- Solution crowdsourcing: it stands as opposite of idea crowdsourcing and it provides organizations propose a well-defined issue to a crowd asking for actual solutions. For example Netflix, invited crowd members to participate in a competition to improve the company's predictive accuracy regarding how much viewers are going to enjoy a movie based on their film preferences.

Figure 11: Crowdsourcing forms

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All the just mentioned forms can be implemented simultaneously or in complementary fashion, according to predetermined goals and organizational needs. Starwood Hotels and Resorts implemented an idea crowdsourcing activity which used also crowdvoting systems to understand the best marketing campaign ideas exploiting employees and customers' preferences (Prpić J. et al. 2015).

2.4 Benefits and issues of crowdsourcing

2.4.1 Strengths of the model

What emerges is that these models lead to potential enormous positive achievements, but also some issues to be solved.

The first strength of a model based on crowdsourcing is that allows to overcome a barrier which is naturally linked to a company-centric business model: failing in systematically meet changing user needs. Indeed, if users are intended as creators, the company has more chances to have an insight on what the customers want, so those needs and offers are aligned (Prahalad C. K. et al. 2002).

Of course, crowdsourcing firms do not depend only on the crowd, but from internal assets as well. It is the combined use of both internal and external resources to make the difference. Since users can create substantial value getting rewarded with relatively small fees, the firm can rely on an improved cost structure and higher margins due to a reduction of salaried employees. Moreover, the company will be more capable to attract and exploit talented people that otherwise would not have obtained and the overall result will consist in higher productivity.

Crowdsourcing allows access to large numbers of people to benefit from the wisdom of crowds; that is, the collective knowledge of a number of people is greater than that of any one contributor or consultant. Hence, an organization needing help in accessing new knowledge to solve new problems can find it in a crowd of knowledgeable people. This requires only a platform for people to discover an organization's problem and a motivating process to engage them in solving it. Many large corporations such as Microsoft, GE, AT&T, eBay, IBM, Apple, and Sun (West J. 2003) and government agencies such as NASA (Boudreau K. et al. 2013) are increasing investment in crowdsourced solutions to both drive cost efficiencies and over- come resource constraints, thereby gaining the potential value of crowdsourcing as an open innovation platform (Ford R. C. et al. 2015).

Another factor not to underestimate is time; when a company adopts such a model, the high number of contributors allows to reduce the time required to take new offerings to market and to solve problems. These results can be seen in many success stories, demonstrating that companies which are using crowdsourcing are able to unlock significant value, such as "Lego Ideas" (a platform that seeks product ideas from the community and sells them through a mass-market channel), or even Wikipedia.

Furthermore, advantages are obvious in building entry barriers as well. Companies that build crowd as a resource are difficult to imitate by competitors because replicating a community is a very arduous feat compared to copying a technology (Kholer T. 2015).

As we have already stated in previous paragraphs, advanced Internet technologies represent a crucial characteristic of crowdsourcing and it has positive repercussions on the entire model. Social web has the unique capacity of collectively extracting the tacit knowledge latent in crowd's brains and also allows to aggregate the intelligence and it makes usable this knowledge. This is possible due to an involvement of the community in the process of online production activity: it is hard to manage and monitoring complex contractual processes with third-parties' companies (traditional outsourcing), while crowdsourcing models autonomously involve the community in a production that takes place on the web.

Finally, we have already discussed the composition of the crowd and another possible advantage of using crowdsourcing resides precisely on the performance achieved by users. More and more often, crowdsourcing initiatives can outperform professional in-house activities in generating new product ideas. In literature, there are several authors in support of this thesis, for instance Terwiesch and Ulrich (2009) noticed that in most of industries, a quarter of innovation opportunities come from customers and new customer requirements. In brief, there are two forms of user input for idea generation: a market research, which reveals user needs not yet commercially satisfied, so that firm's professionals can use this information to develop new products, or a second type of user input in which the company asks users what are their problems/needs and how to solve them. In many cases, as designers, engineers or other categories of professionals, increase their level of expertise, they are able to create more reliable products because they can avoid errors made in the past (Vincenti W. G. 1990). If this pattern is followed, increased competence will be equal to higher quality of solutions in the future and that is the main reason why many companies rely only on their internal expertise and knowledge to generate new products' ideas. This approach allows firms to easily manage their innovation rents, competitive advantage and complementing existing products, but, on the other side, it may hinder or even block the firm from finding more successful alternative solutions (Martin X. et al. 1998). To support this statement, it can be brought an interesting

research of Katila and Ahuja (2002) according to which, using and re-using existing internal knowledge favours the creation of new products, but there is a curvilinear relation, underlying that beyond a certain level internal expertise will no longer lead to a good new product. Additionally, to prove the importance of users over professionals, Poetz (Assistant professor, Department of innovation and organizational economics at Copenhagen Business School)and Schreier (Associate professor, Marketing Institute, Department of management at Bocconi University) developed a survey, supported by a real-world comparison, indicating that ideas created by professionals are inferior in terms of novelty and customers benefits, in addition to being easier to realize compared to user ideas. Still, the findings showed also that professionals are more capable to suggest ideas more easy to develop so having greater feasibility, but, again, overall best ideas tended to be heavily concentrated among users rather than firms' professionals. However, the research is based on only few case study, but, for sure, justifies a more active involvement of users in idea generation (Poetz M. K and Schreier M. 2012).

2.4.2 Drawbacks of the model

However, besides several stories of success, it must be acknowledged there are many companies who failed to apply a crowdsourcing-based business model. There are many examples involving even firms which were considered to be highly promising startups. As instance, CrowdSpirit (Chanal V. et al. 2010) a platform for allowing communities to design innovative products, or Myoo Create, which used contests to face societal and environmental issues, but ultimately the company disappeared. These are only few examples of a long list of platforms that never taken off. The main difficulty can be connected to the complex nature of crowdsourcing itself, since the latter has to coordinate a huge set of human actions, each requiring diverse skills. Everytime a company switches from a traditional business model to crowdsourcing there are some changes that it has to deal with:

- *Role of the customers: from passive consumers to empowered co-creators*. The appropriate structure has to be provided as well as incentives for motivating users to participate the process (Füller J. 2010).

- *Role of the company: from selling products to enabling interactions*. The firm has to abandon hierarchical and centralized decision to embrace distributed input, ownership and decision making. The real challenge is about enabling interactions and managing crowd's activities.

- *Value creation: from linear to networked.* The work is no longer sequential and the pattern which saw the company as creator of value and customers as consumer of value has changed. With crowdsourcing everyone contributes to value creation. Setting traditional strategies alongside crowdsourcing business models means to fail almost certainly (Nenonen S. et al. 2010).

- *Value capture: from centralized to distributed.* Using crowdsourcing the value is created thanks to interactions and there is no more one-way transaction. Hence, the power has to be shared between company and the crowd, so that the value creation of participants is taken into account as a real valuable contribution (Osterwalder A. et al. 2011).

Thus, there are implications derived from changing a business model in crowdsourcing-based model and these can be identified in three issues.

First and foremost, researches on crowdsourcing have discovered the problem of services and products being outsourced. Every company using crowdsourcing has to deal with what Amazon mTurk calls "human intelligent tasks" (HITs), which represents the evident proof that certain activities (productions) cannot be yet replaced by automated computers or algorithms.

Amazon mTurk is a crowdsourcing web service which describes its service as an artificial intelligence. In brief, it involves tasks performed by humans because they cannot be duplicated by artificial intelligences. As result, the platform is able to apply real persons' skills and mental capacity in an artificial environment in order to solve problems that are too difficult form machines. But the innovation does not stop here, because the Amazon-developed system connects people and makes the virtual production place a space were persons can interact each other, but, at the same time, the crowd is managed by the firm for production, innovation or problem solving issues.

Taking as reference the mTurk, we can see that a key dimension is played by the level of task complexity. The largest part of HITs on the platform are represented by low complexity tasks (simple data coding, transcription services, ratings…), but there are also more complicated tasks covered by crowdsourcing, like R&D, accounting, digital media production, software development and others. Hence, this is a tangible proof that crowdsourcing is diversifying sourcing mechanisms, creating new markets or replacing traditional businesses through a

better management of online communities that allows to use the crowd to perform task with various levels of complexity.

The second issue regards the level of collaboration. In general, this concept is used to designate the opening of internal information to outside online community in return for something. Nevertheless, there is a considerable variation of the level or even nature of collaboration in different crowdsourcing platforms. Many companies wrongly focus on only increasing the level of collaboration, because the latter is not the key of crowdsourcing. What it is really important is the control of community, which eventually allows to extract the best skill sets and solutions while protecting intellectual property.

The third matter to analyse concerns the managerial control systems. This field is highly controversial due to the role of online community users. Questions arise since, in crowdsourcing, users are producers, innovators and problem solvers of a firm, but they cannot be considered as employees, as they would be in traditional organizations. Rather, these individuals have only a temporary connection to the firm, which ends when a specific task has been accomplished. Hence, there is no incentive for management to enhance skills of employees, but the strategy will be focused on attracting more skilled and intelligent people into the platform and easing user participation. For these reasons, managerial control in crowdsourcing systems must rely on three important basics (Saxton G. D. et al. 2013):

- *Compensation schemes.* Financial or other types of rewards are key motivators for involving the crowd in working better and harder. A 2013 study by Saxton G. D., Oh O. and Kishore R. supports this assumption. They found that 89 out of 103 crowdsourcing organization examined used some sort of compensation scheme to encourage participation. The 50% of them provided a monetary reward. The extent of the amount is different depending on the task performed by the user. For instance, InnoCentive, specialized in R&D can pay thousands of dollars, while Amazon mTurk pays only few cents for most of the trivial tasks.

- *Trust building systems.* One of the biggest obstacle in crowdsourcing is related to risk. As we have already discussed, uncertainties come from both parts, buyers and workers. Skills of workers are difficult to verify before the task is competed. Fortunately, there are methods to reduce the lack of trust and the most common involves market-driven buyer/worker rating systems. The latter creates more trust and lead to premium prices (Ba S. et al. 2002). Another system used concerns escrows

systems, useful because they help to ensure secure financial transaction through the use of third parties. When both buyers and sellers are satisfied the funds are released.

- *Voting and commenting.* Useful tools to understand members' opinions and the quality of ideas, products and services. Here is why it is broadly used by crowdsourcing companies to check past history of buyers and sellers, so that this system acts as a virtual management control tool to make predictions about consumers' preferences or to control quality and making decisions on compensations as well. We can bring several cases to witness this tendency, such as Threadless, which uses votes and comments submitted by the community in order to generate right rewards for designers and choosing products to bring to market.

Coming back to Amazon mTurk, we can sum up that through its crowdsourcing platform, a new labour market is created and workers have to evaluate whether is convenient or not to work for the amount offered by contractors. However, compensations are often very low, insecure and, above all, old assembly line alienations arise. The latter generates a further issue concerning collaboration between man and machine. In this field, crowdsourcing is a debated and controversial phenomenon, which presents remarkable implications due to its economic consequences, but ethical and social ones as well. In its better forms, it represents the use of collaboration of the most effective energies and visions, which are available on the web, to reach the execution of a project. Such a sharing should foster ideas spreading and creative and innovative ways for realization of a task. Anyway, in its worst forms is characterized by an uncontrolled and indistinct outsourcing of costs, duties and constraints unloaded on the community crowd. Hence, it takes the form of an indiscriminate exploitation of work force with very low cost, which can be instantly recruited in order to perform iper-fragmented tasks (microtanking). The latter are often repetitive and short lived and final aim is frequently known by applicant only. This mode of work escapes from social agreements useful for contractors.

The spread of these forms of labour is strongly growing due to opportunities offered by the Internet. Through the Web they are able to organize themselves and recruiting people to perform the task on the web-based platform. Again, thanks to the web constraints caused by geography and limitations are broken down, but, at the same time it pushes away, separates and increases inequalities. Amazon's platform goes further the classic assembly line and overturns the relation between man and machine. The human being acts as mere component of machine without any autonomy. The substance's absence of the system leaves workers

alone and disaggregated in the web universe, founded on a huge power disparity, so that man is deprived of his own human attributes, he loses self-awareness and the meaning of their work and social life (firstonline.info)

Companies have to go beyond this problem of obvious discomfort, before malaise would corrode platforms themselves. The issue has become tangible since December 2014, when the Turker Christy Milland wrote a letter to Jeff Bezos, Amazon's CEO, saying: "I am a human being, not an algorithm, and yet [employers] seem to think I am there just to serve their bidding". Amazon does not set minimum rates for work, which can pay less than $2 a hour, and takes a 10% commission from every transaction. Employers can even refuse to pay for work altogether, with no legal consequences. Hence Christy's complaint triggered a mail campaign with the aim to achieve more protections and rights for over five hundred thousands Turkers working for Mechanical Turk in 190 countries (theguardian.com)

The phenomenon is not insulated since, during the same period, Handy's workers made request of recognition and dignity through the article published on The Wall Street Journal: "We are not robots" (wsj.com).

For these issues future researches will be addressed to study the impact of various components of managerial control systems on the success of crowdsourcing and to ascertain how different ways of performing managerial control system have repercussions on diverse crowdsourcing models. Moreover, social dimension should not be underestimated and companies operating the online market must give answers to workers' requests.

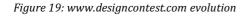## 2.5 Crowdsourcing evolution

After the term crowdsourcing was coined, the model has come a long way. In particular, also the industry moved on with companies in design, idea creation, innovation, testing and so on. The crowdsourcing model allowed many startups to grow significantly and to face competitive scenarios across the entire globe, including developed economies like US, UK, Europe, Australia, but also growth economies like Middle East, India etc.

The years between 2009 and 2011 have seen an evolution of the industry becoming more mature with analysts like Crowdsourcing.Org, The Daily Crowdsource coming in and conferences like CrowdConference taking place. Crowdsourcing has not stopped to develop during the following years and it gave rise to business platforms such Amazon Mechanical Turk, Handy (also known as HandyBook) and the latest Crowdflower.

Anyhow, there are still issues, challenges, and countries which are strangers to the term. It is a burden of early movers to convince industry, researcher and analysts that the model is viable and profitable, encouraging the ripening.

In order to understand how much crowdsourcing has evolved, we can bring an interesting analysis on design field developed by Alena Govtvianica, marketing manager at the crowdsourced design platform DesignContest. From the beginning, design has played a major role in crowdsourcing platforms, that is why this consideration can be considered highly reliable.

According to the manager, crowdsourcing in the design space has become very popular since 2010, but the history of design crowdsourcing started in the early 2000s. In these years, there are very few companies providing such service.

Figure 19: www.designcontest.com evolution

2003-2006

2007-2009

2010-2013

2014-2015

Source: www.designcontest.com

Firms had to persuade customers that crowdsourcing was an easy and affordable method to get good design quickly, but the aim was hindered by limited resources such that they can only provide services through internet message board. This was the main obstacle which prevented the pioneer websites, such as designoutpost.com, to take off. As any other early stage project there were a lot of biases on the argument and as consequence no one wanted to

invest in such a risky business, leading to poor opportunities for companies to implement quality sites. However, as the concept of crowdsourcing became better known and clear, functionality and appearance of design platforms started to improve. This can be easily witnessed by the following image portraying the evolution of the DesignContest site.

Today, the mechanism of such sites has become very precise and transparent: firstly, clients create a task or brief indicating all the requirements and setting the prize they are ready to pay; then, once the contest is launched, designers can submit their work; so, clients can leave their feedback, request changes, and rate the designs provided so that the contest could move in the right direction and at the end of the contest, clients select the winning design and get the source files and copyrights.

Hence, customers have understood what is the potential of crowdsourcing and how they can get advantage from it, such as access to a large number of designers from all over the world; the ability to ask for edits, fast delivery or 100% money back guarantees.
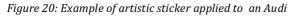
Of course there are still drawbacks in the spread of crowdsourcing popularity, indeed the latter attracts any type of companies in the market, even the less professional and these ultimately lower the image of crowdsourcing. Thus, many efforts are made to decrease this tendency.

Interestingly, data from designcontest.com show that most of the designers come from developing nations (India, Pakistan, Indonesia…). In fact, even though they were considered as cheaper and unskilled, crowdsourcing allowed to overcome these disparities and to guarantee an access to European and American markets, resulting in significant competition against qualified professionals from developed countries. Unfortunately, as a matter of fact, one of the most discussed issue concerns payments. For example, designers claimed that a prepayment is necessary otherwise working on crowdsourcing platforms is too dangerous, but, from the other side, clients declare they cannot pay until they see results. This problem was solved by crowdsourcing sites providing money back guarantee for both clients and professionals. In the first case, if the client is not satisfied, he can ask for a refund, and for what concerns designers, they can participate to guaranteed contest, in which at least one of the participants will be rewarded. Moreover, even if the applicant is not the winner, his work is always available if a client wants to buy it, so there is still a chance to sell his design. However, crowdsourcing is taking many markets and it seems to be a network in huge expansion. To show how the crowdsourcing network is spreading in every direction I decided to bring a proof of a recent connection between design and automotive, two sectors which are certainly related because eye wants its part, but not in a so obvious way.

Tim Roberts, a long-time tech executive who previously helped Twitter get off the ground, launched a new web site called "Infectious.com". The platform buys car art from independent designers like Nico Berry, formerly of skate magazine Thrasher, and Apple Creative Director Andy Harding. He provides vinyl stickers having several shapes, fantasies, characters or even logos that a car owner can apply to any part of the car and can be removed easily only with the use of a blow dryer and the cost ranges from 35 dollars to few hundred dollars.

The system works with the simplest classical crowdsourcing mechanism: they ask professional or aspiring designers to submit artwork, then a larger community votes on the best of the bunch. Hence, Infectious sells the best choice and the winning designer gets a cash reward. The web site had immediately success and the key factor which permitted such result resides in the fact that crowdsourcing is one of the best ways to stay on top of consumer trends.

A business model "is more powerful when the consumer is telling you what they want", stated Mariam Naficy, CEO and founder of Minted.com, a high-end design site for wedding invitations, birth announcements, and holiday cards. For Roberts, crowdsourcing is a way to get people used to a relatively new idea of putting disposable art on their cars, but for the market has a deeper meaning since few years ago customizing a ride could cost hundreds of dollars, while now the art work starts from 35 dollars only. As result, we can assume that crowdsourcing also keeps costs down.

Figure 20: Example of artistic sticker applied to an Audi

Source: www.infectious.com

Now, as new trends arrive, Infectious has new markets to widen its affairs like smartphone covers, skateboards art and so on.

One must point out that Crowdsourcing is not only for start-ups, but rather it involves and it is used by all of the world's 25 most valuable brands ranked nowadays by "Interbrand".

Apple, the company which is on the top of the rank, has never used crowdsourcing in its history until April 2015, when "eYeka" (a creative crowdsourcing firm) discovered the WWDC 2015 Scholarships contest, in which the Californian brand asked students for application ideas. Google, the second best global brand, launched the Doodle 4 Google 2014 contest and eleven-year-old Audrey Zhang of New York was the winner, receiving as reward a $30,000 college scholarship for herself and a $50,000 Google for Education technology grant for her school, Island Trees Memorial Middle School, a Google Chromebook computer, an Android tablet, and a T-shirt featuring her Doodle.

For what concerns the automotive industry, all the firms ranked in the list promoted crowdsourcing initiatives. Toyota, in eighth position, was looking for ideas about what could make buying a car more appealing and attractive: "Create an innovative and engrossing poster showing what amazing offer Toyota can give you, besides a car, to make buying a car a cooler and a more appealing decision. Go beyond the gimmicks like price discount or cheap fuel and create a revolutionary and irresistible offer that no other car brand has ever given to its customers."

The German automaker Mercedes-Benz celebrated its 125th anniversary in Singapore with a "First Thoughts" contest to commemorate the invention of the first automobile and stimulate future developments. The winner was Heng Ming Yuan, with a revolutionary idea of solar cells for the roof, suggesting that cars' roofs can be used to charge batteries or capacitors to allow the driver to start the engine or run the electronics in a hybrid car.

While remaining in the same Country, BMW, eleventh best global brand, launched a YouTube contest called 'Zero to Desir3 in 5.9' — a reference to the time it takes the vehicle to go from 0 to 60 mph. The contest asked participants to submit a video running approximately 5.9 seconds, showing how much they "desire" a new BMW 3-Series Sedan.

To conclude, in order to promote the strengthening of crowdsourcing, we need to have people who can understand how to manage the crowd force, how to increase their efficiencies, how to keep them motivated from provider perspective. Customers have to be better informed about the benefits of such practice and how to achieve results in a disconnected environment.

Hence, there is still a long way to go but the future seems to be a bright one, since the age of communities has arrived.

2.6 Crowdsourcing and open innovation in the automotive industry

The automotive sector represents a complex environment where different forces act in a mature market with only marginal growth for countries that are almost saturated. The work of Original Equipment Manufacturers (OEMs) rotates around desires of final customers, which want to buy cars more and more technologically advanced for the same old price. For this reason, OEMs are pushed to innovate their products and forced to seek new modes of creating innovation. But, it is even more complicated to match these requests, since the innovation is also driven by environmental protection laws, safety requirements and, last but not least, by the increasing competition, which requires a commitment in building attractive brands hitting customers on an emotional level as well. Year after year, major car manufacturers have increased their expenditures in R&D to match higher standards of of quality, reliability, and functionality.

To witness that R&D is a primary factor in automotive industry future and growth, in this thesis is implemented a specific assessment on R&D expenditures of major automakers around the world, comparing years 2010 to 2013 (last data available). Results underlined the giant Volkswagen as first of the ranking with almost 12 billion euros invested in R&D, but what is really impressive is the growth rate of such company between 2010 and 2013 which records a +88%. Similar trend is registered for the other German car manufacturers BMW with a +73% and a steadier fashion from Daimler with a shy +11% while keeping a huge expenditure of up to 5 billion euros. US still invest considerable money in R&D, but the percentage increase is not so high with +1% for GM and +25% for Ford, except for Tesla Motor. The latter, with is amazing project of bringing electric car to the reach of everyone, reveals to be the one with the higher growth rate among European and US based car companies, scoring +143%.

Moreover, what emerges is an incredible R&D expenditures' increase in Asian companies, now clearly interested in competing against Europeans and Americans through more advanced technological contents. Numbers are extremely high and the ranking is led by the South Korean company, Kia Motors, going from 103 million euros in 2010 to 737 millions in 2013, resulting in a +611% expenditure increase.

The company is immediately followed by one of the most important automaker of China, SAIC Motor, with +333% and this should make us think over on how the automotive industry is evolving.

Overall, these findings show an R&D expenditure average growth rate for the sector of about +23%, proving the positive fashion discussed above and a need for new ways of creating and implementing innovation due to an increase in competition and customer needs.

In fact, OEMs focused the attention on building characterful, individual and attractive vehicles in an attempt to maintain market share; in addition to that, differences in ride, handling, braking and performance between brands have now narrowed due to the standardization of platforms and products.

Figure 21: R&D expenditures of all major automakers around the world. Growth rates comparison

World Rank	Name	Country	R&D 2013 (€million)	R&D 2012 (€million)	R&D 2011 (€million)	R&D 2010 (€million)	Growth rate 2013-2010 (%)
1	VOLKSWAGEN	Germany	11743,0	9515.0	7203,0	6.258,00	88%
7	TOYOTA MOTOR	Japan	6269,9	7070,9	7754,5	6.666,69	-6%
10	DAIMLER	Germany	5379,0	5639,0	5629,0	4.852,00	11%
11	GENERAL MOTORS	US	5220,8	5584,4	6278,7	5.189,60	1%
13	BMW	Germany	4792,0	3952,0	3373,0	2.773,00	73%
17	FORD MOTOR	US	4640,7	4168,6	4096,1	3.727,09	25%
20	HONDA MOTOR	Japan	4366,7	4906,3	5169,1	4.258,72	3%
30	NISSAN MOTOR	Japan	3447,2	4115,0	4256,3	3.542,75	-3%
32	FIAT	Italy	3362,0	3295,0	2175,0	1.936,00	74%
54	PEUGEOT (PSA)	France	1966,0	2481,0	2634,0	2.402,00	-18%
60	RENAULT	France	1793,0	1889,0	2064,0	1.728,00	4%
99	HYUNDAI MOTOR	South Korea	1033,6	934,0	1386,7	1.587,04	-35%
104	TATA MOTORS	India	1011,3	1496,0		311,92	224%
127	SUZUKI MOTOR	Japan	875,2	1044,4	1092,3	999,84	-12%
153	KIA MOTORS	South Korea	736,8	604,2	251,9	103,6	611%
157	SAIC MOTOR	China	699,9	693,7	702,3	161,54	333%
159	MAZDA MOTOR	Japan	684,2	787,5	912,0	783,13	-13%
185	YAMAHA MOTOR	Japan	523,9	610,5	646,5	507,19	3%
290	TOYOTA INDUSTRIES	Japan	319,0	342,0	252,1	179,06	78%
351	MITSUBISHI MOTORS	Japan	252,8	304,9	348,0	206,61	22%
409	GREAT WALL MOTOR	China	201,2	115,3	77,9	50,61	297%
426	DONGFENG MOTOR	China	194,2	409,1	424,3	296,38	-34%
467	TESLA MOTORS	US	168,2	207,7	161,5	69,32	143%
634	GUANGZHOU AUTOMOBILE	China	117,3	101,1	71,5	116,85	0%
657	HARLEY-DAVIDSON	US	110,4	104,1	112,4	101,53	9%
1247	FORD OTOMOTIV	Turkey	46,9	45,8	43,7	40,11	17%
1288	GEELY AUTOMOBILE	Cayman Islands	44,9	123,3		58,41	-23%
1304	CHINA MOTOR	Taiwan	44,2	53,8	45,6	34,42	28%
1461	KTM	Austria	36,7	35,2		21,96	67%
	TOTAL	WORLD	60080,8	51113,6	57161,4	48963,4	23%

Source: Data available on http://iri.jrc.ec.europa.eu

Moreover, automakers have reduced the time range after which a model is totally updated or refreshed (Figure 23) and this choice not only impact on spending in R&D, but also continues to force the industry to reduce costs.
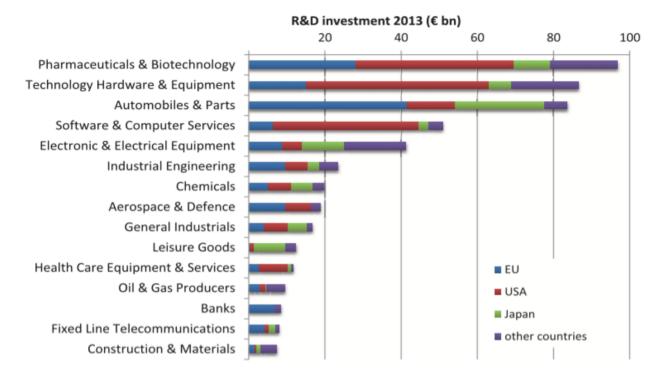
Figure 12: R&D ranking of industrial sectors and share of main world regions for the world's top 2500 companies

Source: The 2104 Eu industrial R&D investment scoreboard, Europea Commission.

Figure 23: Typical times between vehicle platform changes and facelifts

Segment	Model	Time between platform changes	Time between vehicle facelifts
B	VW Polo	8 yrs	3 – 4 yrs
	Renault Clio	7 – 8 yrs	2 – 3 yrs
	Ford Fiesta	6 yrs	3 yrs
C	VW Golf	4 – 5 yrs	-
	Renault Megane	6 – 7 yrs	4 yrs
	Ford Focus	6 – 7 yrs	4 yrs
D	VW Passat	7 – 8 yrs	5 yrs
	Renault Laguna	7 yrs	3 yrs
	Ford Mondeo	7 yrs	3 yrs

Source: Source: TNO, AEA et al, 'Support for the revision of Regulation (EC) No 443/2009 on CO2 emissions from cars', 2011.

Rising oil prices coupled with policies to encourage demand for vehicles with lower CO2 emissions are resulting in a shift to smaller more fuel efficient vehicles in the European market. Thus, it is expected a growth in mini and small car segments (A and B).

Fortunately, all these trends go to benefit of open innovation models. Indeed, it is an increasingly important phenomenon for the automotive industry, which takes the form of a rising cultural trend, reinforced by positive experiences gained in other sectors, such as software industry or consumer goods. Adopting open innovation models means also to change the responsibility of researchers and developers and not to underestimate the cultural change that needs to be absorbed over time. However, probably this step is required in order to advance the technology by using external sources and expanding markets for technologies.

In order to understand if the open innovation model is appropriate for the automotive industry we have to start from a Gassmann definition, stating that "the more an industry's idiosyncrasies correspond to developments and trends like (1) globalization, (2) technology intensity, (3) technology fusion, (4) new business models and (5) knowledge leveraging, the more appropriate the Open Innovation model seems to be" (Gassmann O. 2006). In this regard, a research by Serhan Ili, Albert Albers and Sebastian Miller, provides a reliable answer, illustrated by the following graph, according to which open innovation is already appropriate for the automotive industry, and it will become more and more crucial since the increase in technology intensity and fusion implies a considerable integration of external technology and collaboration with other industry sectors (Ili S. et al. 2010).
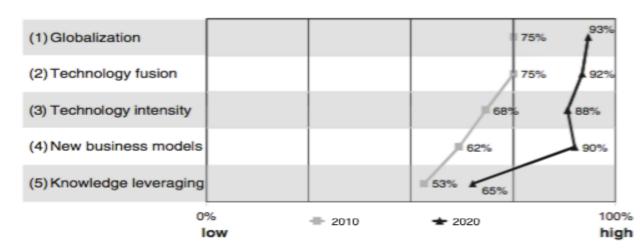
Figure 24: The relevance of each trend and development within the automotive industry

Source: Ili, Serhan, Albert Albers, and Sebastian Miller. "Open innovation in the automotive industry." 2010

Probably, the tendency toward open innovation results from the increasing cost pressure in this industry and, to do that, many firms decided to save costs in research.

Hence, open innovation and all its subcategories are appropriate for the automotive sector.

For what concerns the mechanism that triggers innovation, for many years, it has been the use of R&D directly owned by firms.

Sources of innovation can be recognized primarily in customers, followed by competitors, suppliers and, lastly, governmental regulations.

Moreover, most of innovation potentials come from other industries (Ili S. et al. 2010). One example over the others can be the case of solutions for noiseless blower developed by medical industry, which were used by OEMs in order to increase the customer well-being inside the cockpit of a car. For these reasons, it could be considered a huge advantage to use new external sources in order to increase science and technology base.

For what concerns license parties, they are mainly competitors. Porsche, is the only auto-firm which uses two forms of external exploitation of intellectual property through its subsidiaries Porsche Consulting and Porsche Engineering.

Of course, adopting new methods to identify and top take advantage from technologies provided by external sources, implies changes in the automotive industry.
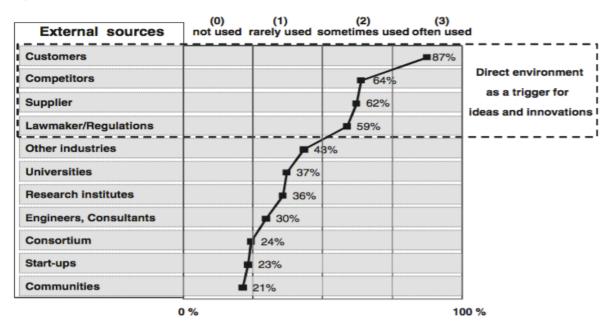
Figure 25: External sources used by the automotive industry

Source: Ili, Serhan, Albert Albers, and Sebastian Miller. "Open innovation in the automotive industry." 2010

As we have already stated previously, there are essentially two methods for innovating, outside-in and inside-out, which are used from automakers as well. We found evidence of the

first one especially in the creation of "learning journeys and trend scouting" foster by firms like BMW, Daimler and VW to achieve innovations with differentiation characteristics. Nonetheless, these active initiatives are also supported by new passive web-based methods such as the "Virtual Innovation Agency" for BMW or the "online interface allowing engineers from outside the company to share their ideas" by VW. On the other hand, inside-out methods are more conservative, indeed the largest part of automotive firms grants a license only on request, resulting in absence of active exploiting. To overcome this tendency, it should be used online market places in order to exploit own intellectual property.
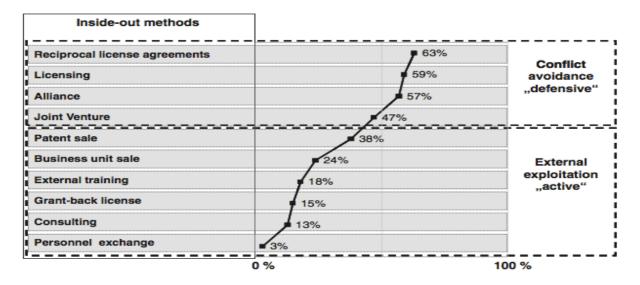
However, we must not forget there are barriers in adopting open innovation practices. Automotive companies often have strong brand images to be sustained and fuelled, year after year, in order to create a reliable and desirable mark for all the present and future customers. Hence, considerable concern is triggered by fear that external ideas and technologies could not fit the brand image and then, it is perceived a lack of acceptance for these ideas. Anyway, these barriers can be overtaken by using strategies for implementing open innovation. First and foremost, there has to be a sustainable support from top-management and so, a top-down strategy that allows to increase the awareness of potential benefits for all employees involved in the process. Changing people mind-sets is one of the toughest feats of open innovation in general. But, it must be also crucial the ability to look outside the boundaries of the industry.

Figure 26: Outside-in methods in the automotive industry

Source: Ili, Serhan, Albert Albers, and Sebastian Miller. "Open innovation in the automotive industry." 2010

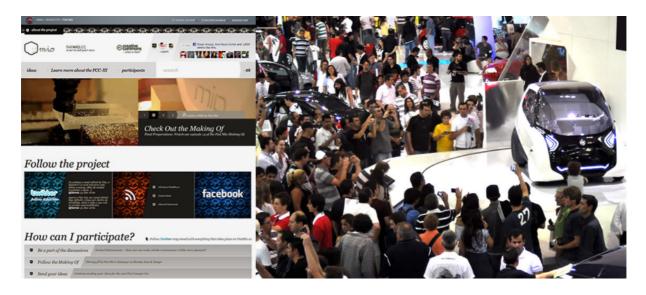*Figure 27: Inside-out methods in the automotive industry*

Source: Ili, Serhan, Albert Albers, and Sebastian Miller. "Open innovation in the automotive industry." 2010

Many car manufacturers have turned to crowdsourcing, seeing in this model a very cost-effective and convenient way of reinventing a company. The use of crowdsourcing in the sector in mainly recent, but there are many success stories and positive examples of how companies can benefit from obtaining ideas from the general public and implementing them into their manufacturing process.

The world's first crowdsourced car was the small Fiat Mio. The firm started its development in 2009 and revealed the new car at the Sao Paulo Auto Show in October 2010. The vehicle was manufactured in Brazil with the official name of Fiat FCC III and was a prototype developed on the base of more than 10000 hints sent by 17000 registered web site members. At the time, the project represented the willing to change strategy and direction by the firm. The idea was to create a car which arose from requests by those who had to use it.

The car had high-tech content, a small size, which makes it suitable for city movements supported by an electric engine. The prototype will never be commercialized, but it allows to reflect about important insights on what will be the car of the future, that will be assembled starting from customer requests. This project has demonstrated that crowdsourcing can greatly increase the number of creative ideas for product development, while reducing costs and production time.

Figure 28: Fiat Mio, official website and launch at Sao Paolo Auto Show

Source: www.cargocollective.com

After this initial attempt, many others OEMs promoted crowdsourcing activities and it seems it will be more and more used by all automakers.

Indeed, Nissan recently started the so-called "Project Titan", that aims to invite automotive enthusiast from all over the world to contribute to the creation on a new off road full-size truck. The project started in June 2014 on Facebook page Nissan Truck, asking fans to "help build the ultimate off-road capable full-size truck for the adventure of a lifetime" and it invited fans to choose custom modifications for a 2014 Nissan Titan that two Wounded Warrior Project Alumni[4] would pilot through Alaska. Users were encouraged to vote on their preferences for the Titan's performance, utility, design and other modifications, on the base of options proposed by the automaker. Under the feedbacks of customers, Nissan has built the project and documented the feat sharing exclusive videos and photos of its progress. Through this way, the firm was able to understand what its potential customers want in a truck, in order to manufacture a vehicle that agrees with their needs.

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[4] Wounded Warrior Project is recognizing its ten-year anniversary, reflecting on a decade of service and reaffirming its commitment to serving injured veterans for their lifetime. The mission of Wounded Warrior Project® (WWP) is to honour and empower Wounded Warriors. WWP currently serves 50,000 warriors and nearly 7,000 family members through its unique 20 programs and services. WWP's purpose is to raise awareness and to enlist the public's aid for the needs of injured service members, to help injured servicemen and women aid and assist each other, and to provide unique, direct programs and services to meet their needs. WWP is a national organization headquartered in Jacksonville, Florida.

Crowdsourcing has affected smaller companies as well, such in the case of Local Motors, founded in 2007, a small Arizona-based outfit which from its start decided to go with a lean and nimble corporate organization. Rather than competing without success against companies like GM and Toyota, which spend countless hours and millions of dollars creating perfect manufacturing and design efficiencies, Local Motors decided to crowdsource the entire design of one of his model: The Rally Fighter. The vehicle is the result of 35000 designs by 2900 community members from over 100 countries. Major systems of the car, such as exterior design and interiors are developed in an open source development process. Moreover, once there is enough support for any single design, Local Motors allows members of the community to help in developing the projects. For what concerns the development, contests are held and the winner receives a monetary reward, which will depend on the importance of the system for the overall vehicle. The cars are built in regional micro-factories, so that each car designed by community will be based on regional desires, tastes and preferences. But, there is more; once design and engineering is fully developed the buyer goes to the Local Motors Micro-Factory and builds it with a little bit of their help.

The company acts in a totally innovative way and they are looking to work with the major automakers and not against them. Indeed, there are several unfulfilled niche markets that are not already covered from major automakers because the cost for building these vehicles in small runs are too high. So, the aim is to also help automakers to build the niche products they want to make but just can't because the volume is not there to make it profitable.

Since its first project, the company has made more than 50 cars, while expanding its offer with motorcycles, electric-powered tricycles for adults and introducing a 3d-printed car series, called LM3D. It was April 2014 when Local Motors kicked off the 3D Printed Car Design Challenge, a crowdsourcing to assist in the production of what the label reads. In collaboration with Cincinnati Incorporated and Oak Ridge National Laboratory, the Local Motors Strati 3D-printed electric vehicle came to life. The first prototype took 44 hours to print from the bottom up during the 2014 International Manufacturing Technology Show in Chicago. A year later, today, with Local Motors announcing the first pre-orders in October 2015.

According to the company, their 3D-printed car will be available in at least two flavours. Known as the Local Motors Reload Redacted, customers will be offered the low-speed Swim model for a price between $18,000 and $30,000. The highway-oriented 2+2 coupe variant known as the Sport will cost around $50,000.
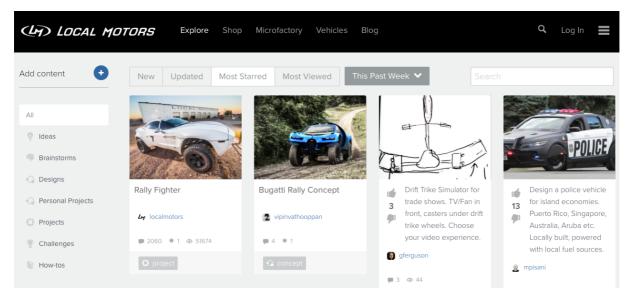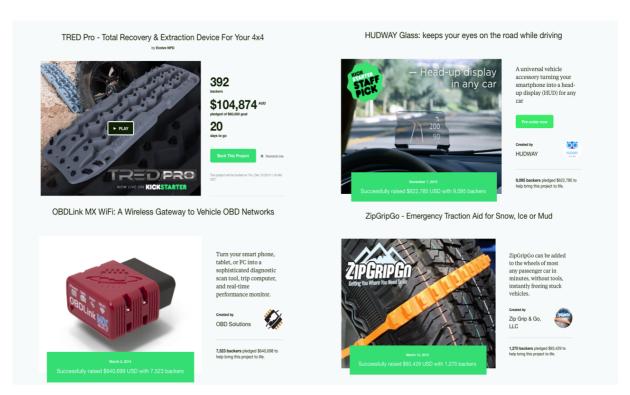
Figure 30: Official Local Motors website

Source: www.localmotors.com

Overall, the company "combines co-creation and micro-manufacturing to bring hardware innovations to market at unprecedented speed" as reported in its official website and this idea can be considered really visionary.

Innovation starts from many channels, some of which are completely detached from original equipment manufactures outsourcing initiatives or R&D investments, as the case of crowdfunding platforms, which we have already introduced. Websites such as Kickstarter, IndieGoGo and the Italian Kapipal, are able to raise thousands of dollars for particularly worthy projects. They allow to help reduce transaction costs and legal complexity, and

ultimately provide a certain amount of users that run regularly to check for new projects, and which represent all potential investors who are outside the usual network of contacts. Furthermore, these platforms enable the evolution of technologies that otherwise would not have seen the light for the abovementioned reasons. Figure 31 shows some examples of funding in the specific field of automotive sector.

Figure 31: Successful projects on crowdfunding website Kickstarter

Source: www.kickstarter.com

"Automotive is a wonderful place to innovate, there is a lot of technology involved in every process from designing to manufacturing". The statement comes from Nancy Gioia, Director of Electrical, Connectivity and User Interface in Strategy and Planning department at Ford Motor Company, while interviewed by AutolineTv in February 2014. She maintains that nowadays there is a new philosophy of acting for developing new products: a firm launches a product and makes improvements repeating the process, learning quick and making it better. Even the giant Ford is moving toward crowdsourcing. The company believe in the "cloud" as "anticipatory technology" which will be more and more used in the future. According to Ford, the cloud allows to store an amazing mass of data and cars as well will be equipped with powerful computers registering information (if the user agrees), in order to know when an

obstacle occurs, weather conditions in a particular area and other features. With the increased computing power, but decreased dimension, the vehicle architecture and infrastructure will be redesigned to support the integration of all these technologies, affecting the supply chain model as well.

Another direction in which the OEM is moving is autonomous vehicles, a technology that will allow to reduce about 32000 casualties every year. A massive reduction that can be achieved, but it is still hindered due to regulations, technology barriers and the general fact there is a much larger environment involved than the only automakers. All industries need to work together to allow perfect connection between devices (for example between cars and smartphones). Hence, it is necessary a joint effort coming from both car industry and other sectors supplying devices and software.

To overcome the hurdle, Ford is investing in creating solutions and they are actively accelerating the process using customers to find solutions as well. Indeed, Ford has implemented a section dedicated to open innovation for developers (crowdsourcing), so that the innovation comes from outside reducing costs, and in the next generation of engineers the community will be a crucial strength.

To answer the question if there are already initiative aiming to cooperation between automotive companies and other industries, we can refer to Linux.

Since 2013, Linux has promoted the Automotive Grade Linux, which enables the automotive industry to successfully utilize open source technologies for products development and deployment with open collaboration and processes, reference software and hardware platforms. The issue arose from the fact that many people are unhappy about infotainment in their vehicles, so they made a research on what they really want and it emerged a necessity for multimedia (HD displays, improved voice control, media management when driving), connected world (app store, telematics, connected navigations) and HD audio/video. Thus, what they desire it is not future: it is just what they have outside the vehicle, that they want inside the vehicle. Hence, Linux begun to work wit Jaguar-Land Rover, focusing on customers (clean and clear graphical user interface, class leading voice control system, latest displays), maintaining the underlying services, and full base platform awareness (operating systems-linux, device drivers, hardware, networks). Teams worked to open-up Linux as a development platform in the automotive marketplace. It gave several benefits: low cost of entry (potentially free), easily available, developer friendly, providing a solution to enable rapid development of a professional looking proof of concept to demonstrate to the community and, ultimately, enabling anyone to innovate within 20 minutes.

All this system is based on the concept of rapid development, which takes distance from the

traditional one (analysis, high-level design, detailed design, construction, testing, implementation). Now, we have a first analysis and quick design, a built-demonstrate-refine process, a testing phase and finally, implementation. Moreover, to increase the competition, they sat a contest on http://automotive.linuxfoundation.org/2013-agl-user-experience-contest for 3 categories: best user experience, best visual appearance and best new concept/additional feature. There were prizes for the top 3 in each group and anyone can participate.

In conclusion, allowing online communities is fundamental, because the crowd is mostly made by young, well-educated, creative, environmentally-conscious people that want to be actively involved in the process of designing vehicles. Exploiting this potential, auto companies can gather a lot of potential solutions that could help them in many aspects like lightening cars, complying with environment laws and improving fuel economy; the result would be a great benefit for auto industry and the general public. Moreover, this activity allows also to have the access to information from specific categories of experts from different areas, such as journalists, dealers, suppliers, employees in public sector, and to invite them to public forums, with the aim of getting idea of what people from other industries have about the auto industry.

Industry growth will come from delivering additional value rather than just selling more vehicles. Study emphasizes that the rigid, self contained industry of the past century must quickly transform into an ecosystem that is expected to be open, collaborative and filled with new innovators. Indeed, 73% of OEM executives rated mobility services, cost-effective alternatives to vehicle ownership like car/ride-sharing, as a significant area for co-creation with consumers, 73% of all executives rated collaboration with other industries as the best opportunity for industry growth as it progresses toward 2025 and 75% of all executives expect non-traditional industry partnerships to have a key role in the automotive ecosystem by 2025.

"Looking toward 2025, as the borders continue to come down, the new ecosystem will create challenges and opportunities the industry has never had to face before; the enterprises that welcome openness will set the stage for long term success and industry leadership" said said Alexander Scheidt, Global Automotive Industry Leader, IBM Global Business Services.

In general, automotive companies have become quite open to the idea of crowdsourcing, this happened mainly because they need that tool to enhance research and development efforts and to make new vehicles appealing to younger population and controlling the negative impact cars makers have on environment.

3. The BMW case

3.1 Overview of the BMW Group

Bayerische Motoren Werke Aktiengesellschaft (BMW AG) is a German firm specialized in manufacturing of motor vehicles and motorcycles, based in Monaco. The origins of the company date back to First World War. At the time, the German engineering industry was committed to improve the strength and reliability of the new "flying machines" that, for the first time, played an important role in the war. Even Daimler had perfected an aircraft engine realized by the Austrian subsidiary called Austro-Daimler and developed by Max Friz, brilliant engineer of Daimler racing department. For several reasons, including the necessity to have faster manufacturing, the Austro-Daimler was entrusted to the Bavarian licensee Rapp Motorenwerke. Working for Rapp Motorenwerke, the abovementioned Max Fritz who joined the firm, showed to Josef Popp the sketches of the engine he himself had drawn. Popp immediately understood it was a technologically advanced engine and suggested the adoption of the innovative invention to Julius Auspitzer, cofounder and only shareholder of Rapp Motorenwerke. The prototype (Illa) was immediately realized and it aroused the interest of the Prussian government, which ordered the production of 600 units. However soon after, Auspitzer declared his willingness to sell the company due to severe health problems. Thus, in July 21, 1917, Popp decided to take over the firm and he changed the corporate name in Bayerische Motoren Werke GmbH with the adoption of a new badge, consisting of a black circular shape, containing the stylistic representation of a moving airplane helix dominated by the BMW acronym in the Bavarian national colours: white, blue and gold. Thanks to the orders of war, the small company grew rapidly and the company built a large plant at the border of the military airport "Oberwiesenfeld" of Monaco, to cope with the strong growth in production.

The 13th of August 1918 - about three months before the end of the First World War - Bayerische Motoren Werke GmbH was transformed into a limited company (AG) with a capital of 12 million German marks, a third of which owned by the Italian trade adviser Camillo Castiglioni. Anyway, the technical direction of the company was assigned to the administrator Franz Josef Popp.

After the war, the decisions arising from the agreement of Versailles of 1919 brought many changes that completely overturned the history of BMW. The Kingdom of Bavaria was

blended with the Weimar Republic, which was banned from the construction of aircraft. In doing so, the company cut any possibility to sell and develop the well-tested "Illa" engine.

In order to look for new market opportunities that allowed the use of the equipment and of the technical knowledge acquired, Popp decided to target the production towards the motorcycle and nautical sectors. Moreover, from 1929 they also produced cars using the BMW brand: initially they manufactured cars on the basis of an English car, the Austin Seven, of which the BMW acquired the production license. After a few years, the range was gradually shifted towards more affluent customers and the German company started to proposed models like the "BMW 320 and 326". During the period of the Second World War, the company found itself heavily involved in the war as much of other German companies. Indeed, Adolf Hitler commissioned BMW to produce several military vehicles, such as the realization of one of the classic sidecar ever made, the "R75".

With the end of hostilities, it opened a period of great difficulties: plants must be converted again to civilian production. The re-launch was therefore based on motorcycles production that enables BMW to survive. But this was not enough: there was also the necessity to return to car production. Unfortunately, at the end of the war, the Soviet authorities presided eastern Germany, so that the city of Eisenach, where the German manufacturer usually built their own cars, was not authorized to manufacture cars. Anyway, BMW was able to obtain through a lawsuit, the permission to build cars in Eisenach under the use of another brand. Hence, the EMW (Eisenacher Motorwerke) was founded. In these years, the automaker launched the "BMW 340", but unfortunately it revealed to be a failure. Afterwards, BMW's financial situation started to get worse and the company decided to interrupt the production of high-end cars and decided to start an new strategy: propose something popular and more accessible to the population which still experienced economic crisis.

The firms had a chance to test its new strategy, when it launched the "Iso Isetta", collecting a relevant commercial success in Germany, but the situation still was tricky and at the end of the decade, BMW receives a takeover offer by Daimler-Benz. Fortunately, December 9, 1959, the German magnate Herbert Quandt, became majority shareholder of BMW and the company reached its definitive stability through the success of the "BMW 700", a small car belonging to medium-low level. Since that moment, BMW gradually returned to a positive economic pace: they subsequently launched the "1500", first model of the "Neue Klasse" series, from which derive "02 Series" models.

The success pushed BMW to search for a new plant in order to increase the production pace. To do so, in 1966, the company took over the German brand "Glas" and took possession of the Glas' plant based in Dingolfing, while Glass itself made a deal with BMW to continue the

manufacturing of vehicles, but only under BMW trademark. However, BMW-Glas models turned out to be a flop, so the Glas brand was cancelled and Dingolfing was dismantled and rebuilt according to BMW needs.

Between the seventies and eighties, BMW consolidated its role of car manufacturer up to be worldwide recognized and it created successful divisions such as "BMW" (creation of racing cars starting from road-legal vehicles) and "Alpina" (production of luxury and high performance models).

In 1994, BMW took over the Rover Group and it was managed until 2000, when it was disjointed, selling Land Rover to Ford and other brands (MG Rover) to Phoenix Union; BMW held only "Mini".

From 2003, the company produces vehicle under the English brand "Rolls Royce" as a result of an agreement with Volkswagen Group and in 2006, it begins a collaboration between BMW Group and PSA Group to develop petrol engines which power Mini and several Peugeot models.

Nowadays, the BMW Group is one of the most successful manufacturers of cars and motorcycles in the world and its BMW, MINI and Rolls-Royce premium brands are three of the strongest in the automotive industry. In addition to its car brands, the BMW Group also has a strong market position in the motorcycle industry and this can be considered as a successful financial services provider. In recent years, the company has also become one of the leading providers of premium services for individual mobility. One example of this is DriveNow, the car-sharing programme the company offers in collaboration with Sixt SE.

Today, the BMW Group is an international company, represented in over 140 countries around the globe. At the end of the year it employed 116,324 people (2013: 110,351). The company has a large research and innovation network, with 12 locations in five countries around the world. Currently, its production network comprises 30 locations in 14 countries. The worldwide vehicle sales network is made up of approximately 3,250 BMW, 1,550 MINI and 130 Rolls-Royce car dealerships. The company also has approximately 1,000 BMW Motorcycle dealerships around the globe.

With these brands, the BMW Group offers its customers a wide range of products for individual mobility in the premium segment. In addition, the BMW "i" brand is further expanding the concept of what "premium" actually means. BMW "i" is even more strongly characterized by the idea of innovation and sustainability; it stands for vehicles that lead the way in terms of electric drive, revolutionary lightweight construction, exceptional design, and mobility services that have been designed from the ground up.

Also the BMW Motorcycles division focuses on the premium segment, offering a wide range of products, which since the beginning of the current financial year have also included the evolution of e-scooters for urban mobility. Innovative technologies and a large number of driving apparel options contribute towards increasing customer safety and comfort.

For what concerns the financial services segment, it is a partner to the sales organization, and is represented in over 50 countries. The largest business area in this segment is loan financing and leasing of BMW brand cars and motorcycles for private customers. Under the brand name Alphabet, the BMW Group has an international multi-brand vehicle fleet business that offers loans to large customers to finance their car fleets. It also provides comprehensive management of company vehicle fleets in 19 countries. This also includes full-service solutions such as the corporate car-sharing programme AlphaCity, as well as AlphaElectric, a comprehensive e-mobility solution.

Long-term thinking and responsible action have always been the basis to maintain the company business success. In addition to business aspects, other integral parts of the BMW Group's strategy are the environmental and social criteria along the entire value chain and the product responsibility in all areas as well as a clear commitment to resource efficiency.

Figure 32: BMW in numbers

OUR PRODUCTION NETWORK	OUR SALES NETWORK	OUR SUPPLIERS
30 PRODUCTION AND ASSEMBLY PLANTS IN 14 COUNTRIES	**APPROXIMATELY 6,000 DEALERSHIPS IN MORE THAN 140 COUNTRIES**	**APPROXIMATELY 13,000 SUPPLIERS**

INVESTMENT IN TRAINING AND FURTHER EDUCATION 2014 — in € million	EMPLOYEES OF THE BMW GROUP 2014 — as of 31.12.2014	AUTOMOBILES DELIVERED IN 2014 — units
335	**116,324**	**2,117,965**
	of which 4,595 apprentices	of which 1,811,719 BMW 302,183 MINI 4,063 Rolls-Royce
282 (2012) 288 (2013) ↗	105,876 (2012) 110,351 (2013) ↗	1,845,186 (2012) 1,963,798 (2013) ↗

RESEARCH AND DEVELOPMENT EXPENDITURE 2014 — in € million	CO$_2$ EMISSIONS OF BMW GROUP AUTOMOBILES 2014 — in g/km*	PROFIT BEFORE TAX 2014 — in € million
4,566	**130**	**8,707**
	*Fleet consumption of newly registered vehicles in Europe (EU-28)	
3,952 (2012) 4,793 (2013) ↗	138 g/km (2012) 133 g/km (2013) ↘	7,803 (2012) 7,893 (2013) ↗

Source: www.bmw.com

3.2 Innovation at BMW Group

Starting from the history of the BMW Group, it is clear that what has brought the company to achieve this success are surely its attention on the customer needs linked to the focus on innovation and sustainability. Indeed, the firm has a strong product responsibility policy and it is committed in several fields which involve a considerable effort on research of innovation: efficient mobility, product safety, resource efficiency and recycling management, future mobility and, as result, customer satisfaction. These aspects of responsibility are integral part of target systems and organizational processes of their products development.

Since increasing regulation, fuel price trends, environmental impact, rising awareness of climate change and low-emissions vehicles have affected customers' behaviours, alternative drivetrain systems and mobility services are becoming more and more important.

The way BMW faces these changes is through an ad hoc development strategy called "Efficient Dynamics". The purpose of this strategy is to raise the efficiency level of conventional petrol and diesel engines through engine optimization, lightweight design, aerodynamics and energy management. Hence, improving the potential of electric vehicles and implementing Efficient Dynamics not only in niche models, but also as a standard component in company's high-volume vehicles. In view of climate change and scarce resources, the strategy will allow achieving specific CO_2 targets in order to protect the environment. Actually, between 1995 and 2014, they were able to reduce CO_2 emissions of newly sold vehicles in Europe (EU-28) by over 38%, and, at the same time, they are successfully offering more electrified drivetrains based on the BMW iDrive technology. The launching of the battery-driven electric model BMW i3 and the plug-in Hybrid BMW i8 has shown a certain appreciation from the audience, corresponding to an actual future chance of use of electric cars by masses. For this reason, the German automaker decided to introduce a BMW X5 plug-in hybrid with eDrive technology that it has been launched in 2015. Additionally, electric cars only reach their full potential when they run on carbon-neutral electricity, therefore BMW gives its customers the option of purchasing a suitable renewable electricity package to charge their electric vehicles with green power and buying solar modules for house roofs through its partnership with Solarwatt.

They claimed that in 2015 and 2016, further plug-in hybrids would be added to their portfolio. In fact, introducing the "i" brand in 2013, they are successively implementing electromobility in their core models.

Alongside electric drivetrains development, BMW is working on alternative solutions, and the most relevant is represented by hydrogen and fuel cell technology. Hydrogen is used here as

an energy source that is converted by the fuel cell into electricity and water. To do so, the Group is collaborating with Toyota Motor Corporation and they aim to develop series-ready components by 2020.

3.2.1 Breakthrough Innovation through Cross-Industry Alliances with 'Non-Suppliers'

BMW's vocation towards innovation can be also witnessed by the willingness to introduce more than merely incremental innovations. Indeed, even though firm's product innovations are mostly based on input from its suppliers, who deliver innovative components, modules and entire systems, BMW decided to collaborate with non-supplier too. The most relevant example is provided by the abovementioned iDrive system. In the late 1990s, BMW took the decision to introduce an integrated control technology in order to decrease the large number of control elements in a car. The system was firstly applied to the new BMW 7-series which incorporated a computer-like flat-screen and a multifunctional control device. However, even if BMW is also recognized for its competencies in automotive electronics, its R&D department did not have know-how about automotive man-machine software, screen technology, or in depth programming competencies. Hence, the company asked several well-known automotive electronic suppliers to suggest ways to achieve the realization of its concept, but they failed to propose a solution that integrated many functionalities and BMW was really disappointed. Thus, to overcome the hurdle, BMW started to look for innovative solutions beyond its suppliers' network and contacted Immersion, a small Silicon Valley based company, which developed the TouchSense^{TM} technology for haptic feedback, used for joysticks and medical equipment. After the first contact with BMW, Immersion started to show how its TouchSense^{TM} technology could be used in automotive. So, BMW decided to launch a feasibility study in which Immersion could meet BMW's more specific requirements. This led the "non-supplier" company to adapt its system for the auto needs and they came up with a simple working prototype that was tested and subsequently incorporated into an experimental car.

Finally, in 1999, the two companies signed a dedicated contract and a standardized list of requirements for developing an automotive force feedback control system for BMW new 7-series. When all BMW's standard requirements had been fulfilled, the technology was ready for series development in the iDrive environment. However, both sides knew that automotive series development and design-for-manufacturing required a different set of know-how that Immersion did not possess. Hence, BMW used the electronic supplier ALPS to series develop the individual iDrive elements. At this point, BMW's engineers had internalized the relevant iDrive technologies and were able to guide their established suppliers in designing a

manufacturing component for the new in-car-control system of 7 series and so Immersion took the position of technology advisor. In the end, series development was completed in the fall of 2001 and the BMW 7-series was launched equipped with the new iDrive system (Gassmann O. et al. 2010).

Overall, BMW considers the collaboration with Immersion a success and a breakthrough innovation in the automotive industry. Despite alliance literature argues that a fundamental precondition for successful alliances - and thus for entering them in the first place - is a high level of fit between partners (Bierly P. E. and Gallagher S. 2007), BMW Group, with this case, demonstrated the opposite. Indeed, the two firms were highly different: BMW was a giant company operating in a mature industry with intense competition along all its value chain, high R&D expenditures and long development times, while Immersion was a small startup in a dynamic contest, owning one proprietary technology and really reactive to new opportunities.

Figure 33: Comparison of firm profiles of BMW and Immersion as of 2005

	BMW Group	Immersion
Founding year	1913	1993
No. of employees	105.000	135
Turnover [in K€]	>46,000	>20
R&D intensity	Medium-high	High
Industry structure	Mature	Dynamic
Vertical integration	High	Low
Buyer-supplier relationship	Medium to strong supplier integration and supplier dependency	Low supplier dependency
Product life cycle	Long: 4–6 years	Short: a few months
Product modularity	Medium	High
Technology scope	Broad	Narrow
Innovation process complexity	High	Low
Automotive experience	Extensive	None
Intellectual property strategy	Proprietary and exclusive	Royalty-based

Source: "Explaining alliance partner selection: fit, trust and strategic expediency." Bierly, P. E., & Gallagher, S. (2007)

Moreover, the companies were also different in their strategic goals and in their industry and organizational structures. These differences led to challenges at a strategic and operational level. The apparent lack of fit between the two brought considerable uncertainty to the deal. However, BMW decided to enter the partnership because there was a high prospect of having a breakthrough innovation. Anyway, BMW was concerned about the ability of a small firm as Immersion, to adapt to the strict requirements and timelines of the automobile development

process. This doubt was reinforced of course by the fact that Immersion had no automotive experience and had not ever worked with a partner as large as BMW. Thus, in order to have a fall-back solution, BMW established a parallel cooperation with an established automotive electronic supplier, just in case the alliance with Immersion had failed. The backup solution was cancelled only when Immersion passed the feasibility study and the proof-of-concepts had been realized in a prototype car.

For what concerns the dominance, BMW was the initiating partner of the cross-industry alliance and it showed high interest in collaborating with Immersion. On the other hand, BMW has always had a dominant position in the auto industry, so that it dictates all the requirements to its suppliers, but collaborating with an industry outsider was a new experience for BMW too. Indeed, the innovative haptic feedback technology could only be accessed through this partner, meaning that BMW was dependent on Immersion to a certain extent. Hence, although they had huge difference in terms of dimensions, they were more or less equal partners in terms of dependency or dominance. Eventually, both partners strove to guarantee each other flexibility with respect to their core business models and this facilitated the success of the collaboration.

3.2.2 Commitment on product safety and resource efficiency

Another field in which the company shows great commitment is product safety. Indeed, as a provider of premium products and services for individual mobility, safety is fundamental for the sense of responsibility that the company has. Furthermore, carmakers are facing increasingly stringent safety regulations both for active and passive systems; thus, new technologies have to be developed. To face this issue, BMW takes an integrated approach, analysing the entire process chain, from accident prevention to post-crash applications. They integrated into their models a "warning system with city braking", which analyses urban traffic and warns the driver when there are potential collisions with pedestrians. Another support function is the "traffic jam assistant" that helps to keep the car longitudinally and laterally positioned in the lane. However, product safety is non only relating to accidents reduction, indeed a role is played also by the use of safe production materials, including both series parts and all auxiliary production substances and process materials (paint, adhesives…). Last but not least, a further concern is represented by emission inside the vehicle: BMW is working to ensure that the targets set by the experts are met in all new vehicles. The Group made clear they want to strengthen both active and passive safety features, expanding their competencies in the areas of technologies and methodology, in order to enable the offering of modern driver assistance systems and to get closer to the ideal of accident-free mobility.

Several steps have been taken also on resource efficiency and recycling management, in particular for what concerns intelligent design and the use of secondary and renewable raw materials. In the early stage of model development, they already had vehicles and processes that enabled the use of valuable resources. Hence, once the vehicle reaches the end of its life cycle, its components can be reused or recycled, so, as result, they are able to recycle 95% of materials in their current models. Electric powered cars are exempt from this strategy: BMW i3 and i8 use lightweight carbon-fiber-reinforced plastic (CFRP) for passenger compartments. The material could be also used in rear window shelves, pillar trims and other components, all ways in how the company continuously tests recycling concepts for new vehicle components. For example, the substrate used for the central console and the door armrest is made of recycles thermoplastic materials. Forecast tell us that in next years BMW will improve resource efficiency and material cycles, with particular attention to find innovative solutions for the reuse of old batteries from electric cars. Moreover, a recycling and dismantling center will be opened in Shenyang (China) in early 2016.

3.2.3 Sustainable mobility services

BMW is also committed in developing and implementing sustainable mobility services. They help to shape the cities of the future, providing intelligent or integrated solutions with and without the use of a car. For instance, they focus in the areas of car sharing (DriveNow), finding parking (ParkNow), recharging (ChargeNow) and mobility for business customers (AlphaCity). One of the most successful projects was DriveNow, a premium car-sharing service in collaboration with Sixt SE.

Figure 34: ParkNow app running

Source: www.bmw.com

By 31 December 2014 it can count more 360000 customers in Germany and over 390000 worldwide. Anyway, almost all initiatives had good results, for example, since November 2014, BMW "i" customers from Germany, Austria and Belgium can quickly find one of the 24000 public charging points to charge their cars.

Similar results were achieved through JustPark, an online market place that connects owners of unoccupied spaces with those searching for one. This service is now available in UK and it significantly helps to reduce traffic volume and time wasted and leading to lower CO_2 emissions.

Even social networking was not overlooked, since an innovative smartphone app has been created. BMW called it Life360 and the app connects families and other groups within urban spaces with the help of location-based technology and check-in feature. This is a social networking method to connect people each other by forming a community, or simply, enabling people to have the access to a chat function for direct contact.

BMW is very careful to topics on future mobility, so that since 1998, a research organization that is part of the Group, Institute for Mobility Research (ifmo), is studying mobility challenges that vehicles will face in the future and all the findings are incorporated into the BMW strategy process. Moreover, the firm is participating in the three-year Sustainable Mobility Project II promoted by the World Business Council for Sustainable Development (WBCSD). This project aims to collaborate with cities on road maps in order to ease the access to safe, reliable, convenient and intermodal mobility.
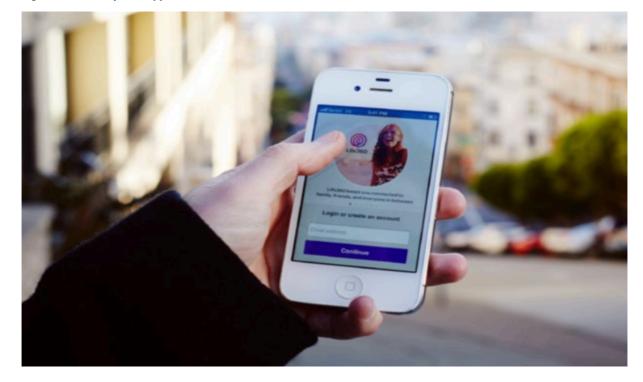
Figure 35: BMW Life360 App

Source: www.bmwgroup.com

Finally, BMW set up the Center of Competence Urban Mobility that will work towards solving urban traffic problems through implemented products and mobility services. According to the company, online applications and networking opportunities will change the face of future urban mobility. For this reason they will continue to strive to make intelligent mobility services (DriveNow, ChargeNow, ParkNow) more flexible, convenient and sustainable (www.bmwgroup.com).

3.3 Crowdsourcing in BMW: The "Co-Creation Lab"

The German automaker has been one of the first OEMs to deliberately use crowdsourcing and, more precisely, a co-creation approach to broaden its technology base and design ideas, using people as a strategic external source.

They used a programmatic approach, characterized by a defined degree of intentional planning and central leadership. Many actors take responsibilities and joint their forces enabling and facilitating innovation, which will result in an effect bigger than the sum of the individual activities. Of course, this approach must be built on solid foundations: the use of correct methods and tools, the development of appropriate processes and involving organization and culture. BMW seems to have understood these requisites introducing the "Co-Creation Lab". This is a virtual meeting place for people that are interested or passionate about cars' world and want to share their opinions or even ideas regarding the future developments of new models, technologies or designs.

The web-platform allows individuals to join multiple activities and tasks connected to various automotive fields positioned at different stages in new product development, making the lab a proper meta-platform. The latter makes use of idea contests, user toolkits, virtual concept tests and innovation research studies in order to have access to new innovative ideas. Each user interaction is tracked and communicated to the platform, so that what result is a displayed history of ideas suggested by customers.
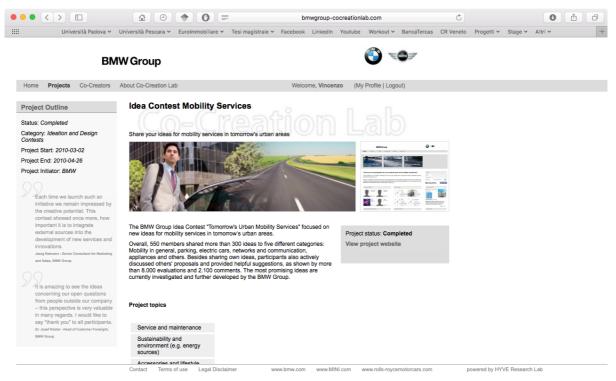
What emerges is the BMW's intention to secure the long-term innovation and technology leadership through creative minds outside the Group. This is certainly a change in strategy compared to few years ago, when most of the firms were only interested in their own research and development departments (Bartl M. et al. 2010).

The first co-creation project of the Lab was launched in March 2010 and was called "Tomorrow's Urban Mobility Services" (Figure 36). The company was interested in

innovative mobility services in cities and metropolitan areas of the future, so they created five topics through which ideas could be submitted.

- Mobility. Ideas related to any type of vehicle and mobility concept for manifold occasions.
- Parking. Services related to efficient and innovative use of parking space in urban areas, systems of payment and additional services.
- Electric cars. Ideas for electric-powered cars, such as solutions for charging or exchanging batteries, alternative uses of these vehicles and possible extension of distance with a full charge.
- Networks and Communications. Concerning mobile services, inter car communication and mobile Internet access.
- Applications. Ideas for software solutions. For instance, integration of the vehicle on-board computer with other devices such as IPhones or Android-based devices, to improve navigation systems.

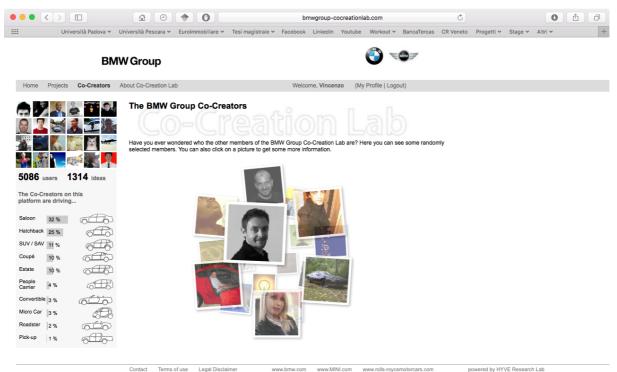*Figure 36: First BMW CCLab contest launched in March 2010*

Source: www.bmwgroup-cocreationlab.com

The results were good enough and after only 6 weeks more than 500 participants from all over the world joined the community to prove their talent and submit their ideas. There were created more than 300 concepts in different segments and a web community grew, creating

relationships and providing feedbacks about improvements thanks to 5000 posted comments. Through an evaluation scheme, more than 8600 evaluations were contributed, hence, the contest provided new intuitions for the BMW Group. To witness the importance of the tool, a statement of a Group manager, Jörg Reimann, fits perfectly: *"Each time we launch such an initiative we remain impressed by the creative potential. This contest showed once more, how important it is to integrate external sources into the development of new services and innovations. The generated ideas added innovative and valuable input to the topics we are already working on and confirmed us that the overall direction we are following leads into the right direction. We are eager to further pursue the generated ideas and establish fascinating mobility services for tomorrow's world"*.

Since 2010 many further projects have been launched and the crowd grew up to five thousand users with a mean of about 1300 offered ideas (Figure 37). There was created a space dedicated to the interaction between co-creators, in which each person from anywhere in the world can have the access to information related to another user, such as areas of interest, origin country, age and owned car. Today, the ongoing contest is about improving the luggage compartment of BMW and it exists out of three categories: variability, restraint system, and coverage of the luggage compartment.

Figure 37: BMW CCLab - Space dedicated to co-creators

Source: www.bmwgroup-cocreationlab.com

Moreover, the web-platform allows to invite users who have already shown their creativity and skills in previous innovation tasks and it attracts additional individuals who are unfamiliar

with the innovation platform. It can be also noticed that many users register as members just to stay informed about innovation challenges or particular projects, but they are not active. Therefore, the BMW Group Co-Creation Lab shows a recent application of a programmatic approach in co-creation and the synergies that can be used between a permanent co-creation hub and a single innovation projects.

3.4 Connections between Co-creation lab and technological progress in BMW

As we have already stated above, BMW has done several efforts in order to promote innovation and development of automotive industry, but it would be interesting to analyse whether the adoption of the Co-Creation Lab has effectively led to the creation and subsequent usage of the inventions proposed in the contests. To do so, in this dissertation, it was used a web platform called Orbit: a portal for patent, design, and legal professionals looking for a comprehensive coverage and powerful tool. Through this system it is possible to analyse all the patents that the company has published from 1995 to 2015, publication countries, technology domain of patents, inventors' names and, ultimately, for research purpose, to detect potential patents publications derived from BMW's crowdsourcing platform. For what concerns the distribution of patents published from 1995 to 2015, it is possible to observe a general growing trend, except for the period running from 2009 to 2012.
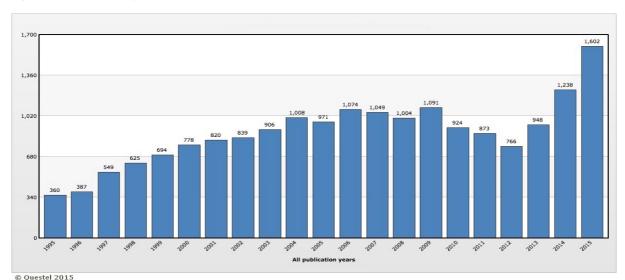
Figure 38: Distribution of patents by years 1995-2015

© Questel 2015

Source: www.orbit.com

The latter was likely provoked by the Global Financial Crisis of 2008, which effects extended until 2012 triggering the sovereign debt crisis and expanding the crisis on public finances, especially for Eurozone countries. In those years BMW decreased its R&D expenditure to face the dramatic scenario and narrowing eventual damages. Indeed, since 2012 the analysis shows a recovery, which gradually increases until nowadays with 1602 publications in 2015. The following figure witnesses a reduction of research and development expenditures, showing a R&D ratio which equates to R&D expenditure/Sales. It is evident a gradual depression from 2008 that reaches its lower peak in 2010 and then grows since 2010.
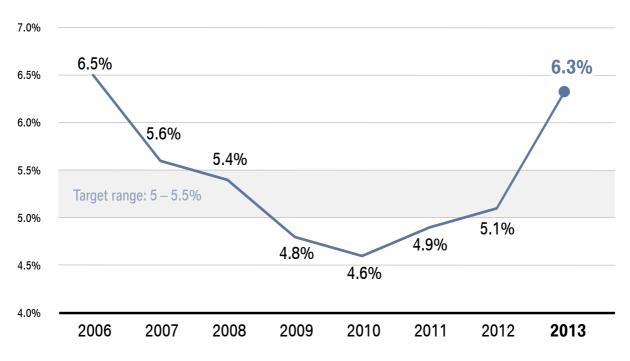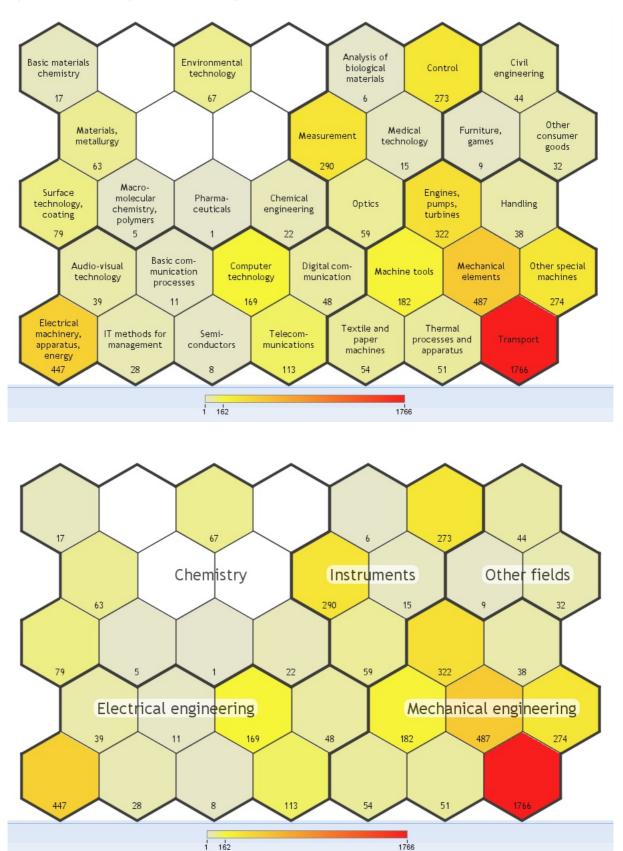
Figure 39: R&D ratio (R&D expenditure/sales)

Source: www.bmw.com

For what concerns the contents of patents, an analysis of BMW patents by technology field can be useful to understand how the Group operated and operates. The following charts divide patents published between 2010 and 2015 depending on the technological domain to which they belong. Results outline three fields of particular interests: transport and mechanical elements, which represent traditional sector-dependent investments and a third one, composed by electrical apparatus and energy. The latter testifies the recent commitment of the company in services for e-mobility (electric mobility); in particular BMW combines a wide range of innovative products and services that make electric driving a comfortable experience and a daily pleasure: from simple home charging and the ease of using a continually-expanding network of charging stations to connected navigation and the option of using conventional cars for holiday trips with BMW Add-on Mobility.

Figure 40: Distribution of patents by technology domain 2010-2015

Source: www.orbit.com

The innovative BMW eDrive technology is the result of many years of BMW "EfficientDynamics" development work. Three key features deliver an unequalled emission-free driving experience: the entire torque of the extremely agile electric motor is virtually available from a standing start, and uninterrupted acceleration is maintained up to the maximum speed. Innovative battery technology combines the ultra-powerful high-voltage battery with a cooling system that keeps the battery at the ideal operating temperature and boosts its performance and lifetime.

Electric cars have many advantages over conventional vehicles – for example, they have a 'full tank' every morning, because they can be charged quickly and easily at home using the standard charging cable supplied. This process can be made simpler and faster with the BMW "i Wallbox". This wall-mounted charging station for home use increases charging capacity, reducing charging time and making it the ideal design accessory for BMW "i" vehicles. The installation service available through BMW "i" is part of the complete Wallbox package and is customized to your specific needs. And because BMW "i" promotes consistent sustainability in e-mobility, BMW "i" will also arrange the appropriate green electricity contract with a selected renewable energy provider.

Moreover, BMW creates innovative solutions for city e-mobility, especially for all those drivers without their own charging options: they have access to flexible and time-saving parking and charging options in public car parks.
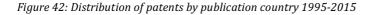
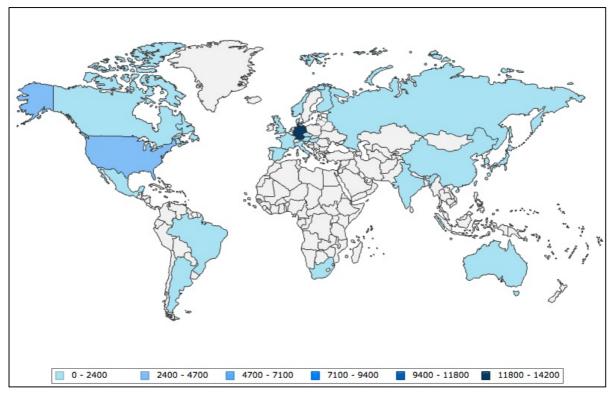*Figure 41: BMW ChargeNow Mobility Service*

Source: www.bmw.com

Thanks to BMW ConnectedDrive, the BMW i3 knows where the nearest charging station is, indicates whether it is available - and, if necessary, incorporates it into your route. So BMW "i" drivers can easily find one of the increasingly common public charging stations in the city and top up their battery.

Alongside the development of electric cars and the entire required infrastructure, BMW has registered several patents for the EfficientDynamics package that ensures a marked reduction in consumption and emissions for traditional cars, increasing at the same performance and driving pleasure. The fixed standard of sustainable mobility is achieved thanks to three important factors: the BMW eDrive, the efficient motor and drive technologies, and the intelligent lightweight construction. This aim is complemented by many innovative developments, e.g. in aerodynamics. Between 1995 and 2010 the BMW Group has reduced CO_2 emissions by more than 25%, even if the goal is to reduce them by a further 25% by 2020, thanks to electric cars.

Furthermore, on the front of geographical distribution of patents, the company shows publications on global scale with a relevant concentration in Germany and USA. The figure 42 outlines distribution of patents from 1995 to 2015.

Figure 42: Distribution of patents by publication country 1995-2015

| 0 - 2400 | 2400 - 4700 | 4700 - 7100 | 7100 - 9400 | 9400 - 11800 | 11800 - 14200 |

As a matter of fact, the largest part of "i" mobility services has been launched in Germany and United States of America. For instance, the abovementioned DriveNow app is currently

available in Munich, Berlin, Düsseldorf, Cologne and San Francisco, even if further cities have been planned. Again, another example of geographical concentration of patents can be detected by the fact that the app called ParkNow is today available only in the greater San Francisco area.

This geographical concentration is due to relatively recent commitment of the company upon the sustainability themes, especially towards electric cars and useful mobile platforms. Indeed, this explains the particular concentration of published patents in Germany and USA as result of testing procedures for new potential markets and opportunities.

As anticipated at the beginning of the paragraph, the main purpose is to identify whether the projects submitted in Co-Creation Lab have impacted the development of new technologies or helped the startup of new systems. Hence, the goal of this study is to assess the effectiveness, relevance and potential of the platform, in creating new opportunities through the use of the digital crowd.

To get an answer, it is fundamental to start taking into consideration 13 subjects that include 6 winners of two Co-Creation Lab contests. They are respectively below mentioned:

First contest, *"The BMW Urban Driving Experience"* 2012: a search for ideas to improve the driving experience of premium vehicles in the megacities of the future, in which megacities are defined by having 10 million or more residents. The contest was held in collaboration with Local Motors, also using its online community and the response was amazing with more than 3500 designs board sent and 400 concepts.

- 1st place: Cosmin Mandita for "BMW Light My Way". The idea envisions making drastic cuts in the electricity consumption of streetlights by placing proximity sensors in cars. As people/cars approach parked vehicles their lights come on and illuminate the way. They automatically switch off once the vehicles and or pedestrians have passed by (rewarded $7500).
- 2nd place: Xavier Gordillo or 'BMW Connected Park'. This idea brings networking to parked cars so that they can communicate with each other. An example given of how this might be useful was if a mother lost her child. She could approach a car, explain the situation and it would activate cameras in all the other vehicles in the network. Other uses could be to identify parking places and spot stolen cars (rewarded $2500).
- 3rd place: James Lin for 'The Lifeboat'. This is a car model that could supply Wi-Fi and electricity during emergency situations/disaster scenarios (rewarded $1500).
- 4th place: Devon Plamer with Energy Harvesting-2025

- 5th place: Tram with BMW SRP
- 6th place: Prestige with BMW Intelligent Drive
- 7th place: Gopi Thambirajah with Emergency Urban Reward Program
- 8th place: Ajay Rao with the Beamer
- 9th place: Boris Shwarzer with BMW I-Care
- 10th place: Francesco Angioloni with BMW Driver's Social Network

Second contest, *"Tomorrow's Urban Mobility Services"* 2010: seeking new ideas for mobility services in tomorrow's urban areas. In total 497 users published around 300 ideas that were evaluated and commented by over 1000 persons worldwide. The final decision was submitted by the jury represented by: Jörg Reimann (Strategy and Innovative Mobility Services), Dr. Josef Koester (responsible for clients" segmentation and Customer Foresight, BMW Group) and Marc Winterhoff (Director Global Head Automotive & Manufacturing, Arthur D. Little).

- 1st place: Venugopal Panicker who invented the PMUP- concept. PMUP for "Pick me up please" is a mobility-system for pedestrians. So called "trip cards" installed in cell phones as well as in car computers enable the communication between driver and pedestrian.
- 2nd place: Pedro Isusi, for the invention of a "park-sharing-programme"
- 3rd place: Stefanie Mainwaring with a concept that receives available parking spaces via GPS signals.

3.5 Results

Finally, what has been revealed with this research is that many of the ideas coming from the Co-Creation lab gave birth to solutions subsequently patented by BMW. Anyway, it is difficult to go back to the parenthood of the invention and results showed a match only between the ideas created in the Lab and the actually developed solutions, that cannot be linked to the inventor of the original project. In fact, intersecting all participants with the names of patents' inventors provided by the Orbit database, the system does not return any matches. This is due to the fact that BMW researchers in R&D department work out again the already elaborated projects of the Co-Creation Lab, labelling the final invention with their own names.

However, what is important to measure is that a lot of the ideas elaborated in the Co-Creation Lab have been used by BMW or partners of the Group to implement innovative systems. In particular, using the Orbit platform, were detected three main cases in which BMW used the inventions submitted by creators in the Co-Creation Lab in order to implement real working solutions.

For instance, the "Lifeboat" invention submitted to the BMW Co-Creation Lab by James Lin has been re-elaborated and refined by BMW to create a vehicle with integrated Wi-Fi connection in order to ensure communications in case of accidents. BMW calls this invention "ConnectedDrive" system and today it is available on demand for each model of the fleet. The vehicle equipped with this technology have a permanently installed SIM card, that allows users to use innovative functions such as BMW Teleservices, Concierge Services, Internet, Remote Services and Real Time Traffic Information in many countries around the world with ease, without needing their own mobile phone. At the same time, the Integrated SIM card is a prerequisite for using these services. This makes it accident-proof and assures the user of a direct link to the outside world even in difficult situations through Intelligent Emergency Call option. Another feature is that, if an airbag is deployed, Intelligent Emergency Call automatically contacts the BMW Call Centre via an accident-proof telephone unit permanently installed in the vehicle, independently of the personal mobile phone, both at home and abroad. So, specially trained personnel will then establish contact with the unfortunate user, inform the emergency services and give him support by telephone – in his mother tongue if possible.

Figure 43: Intelligent Emergency Call System

Source: www.bmw.com

Another example of the usage of the inventions of the Co-Creation Lab, can be observed by the implementation of the concepts elaborated in the Lab by Stefanie Mainwaring and Pedro Isusi, based on receiving information about available parking spaces through GPS signals. These two projects have been refined and reproduced by BMW in the making of the ParkNow App. It was possible to reach this finding through the usage of the Orbit database, that allowed to explore patents applications presented by ParkMobile (the company that launched the ParkNow App) in collaboration with BMW and find a series of matches of patents related to the App. In fact, ParkMobile and BMW presented in 2012 a patent for a parking enforcement system described as follows: the system and method may employ mobile technology and, in particular, a mobile device.
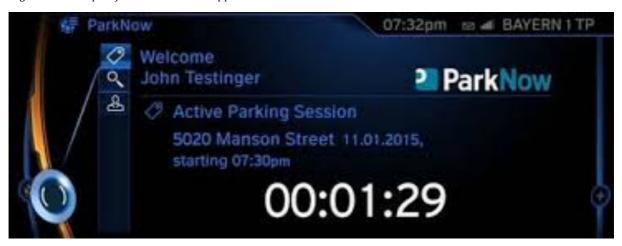
Figure 44: Example of built-in ParkNow App

Source: www.park-now.com

From the perspective of the mobile device, a parking identifier is received, wherein the parking identifier corresponds with a parking space or corresponds with parking spaces. The mobile device then receives parking session information relating to the parking space or spaces corresponding with the parking identifier. The mobile device is capable of outputting this information in various forms to assist with parking enforcement. The parking session information may be transmitted to the mobile device from a network server in communication with the mobile device over the network.

The third example can be observed for the idea submitted to the Lab by Francesco Angioloni who aimed to create a BMW drivers' social network. This idea has been used by BMW to give birth to an App called Life360, that opens up new possibilities for innovative, location-specific and integrated mobility services. As described in sub-paragraph 3.2.3 the App supports and enriches the way in which families live in and experience cities.

Conclusion

Undoubtedly, this research provides an answer to all skepticisms that call into question the validity and relevance of open innovation and crowdsourcing for today's companies by using the evidence of a practical case.

The many given examples demonstrate that, today, "open innovation" is broadly used in all industrial sectors and especially in the automotive field. This sector shows a natural tendency to focus on research and development, indeed it ranks in third place for investments in R&D, right after technology hardware/equipment sector and pharmaceutical/biotechnology sector.

As mentioned above, automotive lives an era where wishes and demands of end customers are becoming increasingly complex, requiring vehicles with high technological content at the same price of previous models. Moreover, to survive in the market is even more difficult due to the burden of increasing safety standards and emissions regulations.

That is why OEMs are always looking for new ways to create innovation at preferably low costs.

The analysed cases, such as the Fiat Mio one (the world's first crowdsourced car) prove that nowadays it is possible to create a vehicle, providing a web platform for consumers. Through the latter, the firm will be capable to extrapolate needs and demands in terms of design, comfort, clean-energy, safety and engine type. In particular, the Fiat Mio initiative has clearly demonstrated that crowdsourcing can greatly increase the number of creative ideas for product development, while reducing costs and production time. After this initial project, it is possible to notice a succession of many other success cases, like the "Project Titan" promoted by Nissan Motor Co. or by smaller firms, such as Local Motors that has crowdsourced the entire design of cars they manufacture.

The final BMW case leads us to meditate on true relevance of crowdsourcing and it provides the most important answer to the question: does the model really work? It does. Indeed, the analysis on different contests implemented by the Group, linked with employment of the web platform called "Orbit", show that there is a clear positive correlation between Co-Creation Lab ideas and innovative technological systems actually implemented by BMW. In fact, the winning ideas, which crowdsourcing platform's participants have supplied to the company, have almost always turned into real applications, such as the "emergency call system" or the "ParkNow" app, directly integrated in most recent BMW models. In this case, open innovation opens to its users a universe of opportunities that lead to excellent results, if exploited in the right way.

A doubt arises for what concerns the recognition of ideas created by Co-Creation Lab inventors and the mode of appropriation of the latter by the company. Sure enough, the mere assignment of a pecuniary reward to creators, albeit high, could be controversial. As a matter of fact, one must bear in mind that BMW's experts and engineers rework creations in a substantial manner, making them working in accordance with the law and removing of all possible defects. For this reason, registered patents contain the name of BMW employees, rather than those of users working in the crowdsourcing platform.

Even though there is no recognition yet for the idea creators, the German Group gives a lot of importance to the platform, considering the Co-Creation Lab as: a virtual meeting place for individuals interested in cars and all related topics, who want to collaborate with the BMW AG team in a variety of innovation-related projects and initiatives. Hence, those who want to collaborate implicitly accept the treatment of their ideas by BMW technicians and the possible use by the firm.

Eventually, what is most important to acknowledge is that crowdsourcing represents a feasible road to make innovation, starting directly from customers' needs and, on the other hand, it sets out to be a powerful resource to obtain competitive advantage in a so dynamic and complex scenario.

References

Anand Bharat N., and Tarun K., *"The structure of licensing contracts."* The Journal of Industrial Economics Vol. 48.1 (2000): 103-135.

Arora A., Fosfuri A., and Gambardella A., *"Markets for technology in the knowledge economy."* International Social Science Journal Vol. 54.171 (2002): 115-128.

Suma A. and Cantwell J., *"Creating competition? Globalisation and the emergence of new technology producers."* Research Policy, Vol. 36.2 (2007): 209-226.

Sulin B. and Pavlou P. A., *"Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behaviour."* MIS quarterly (2002): 243-268.

Baldwin C. and Von Hippel E., *"Modelling a paradigm shift: From producer innovation to user and open collaborative innovation."* Organization Science, Vol. 22.6 (2011): 1399-1417.

Bartl, Michael, Gregor Jawecki, and Philipp Wiegandt. *"Co-creation in new product development: conceptual framework and application in the automotive industry."* Conference Proceedings R&D Management Conference–Information, Imagination and Intelligence, Manchester. Vol. 9. (2010).

Bathelt H., Malmberg A. and Maskell P., *"Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation."* Progress In Human Geography, Vol. 28.1 (2004): 31-56.

Bierly P. E., and Gallagher S., *"Explaining alliance partner selection: fit, trust and strategic expediency."* Long Range Planning, Vol. 40.2 (2007): 134-153.

Blecker T., Abdelkafi N., and Raasch C., "*Enabling and sustaining collaborative innovation.*" Working Papers/Technologie-und Innovationsmanagement, Technische Universität Hamburg-Harburg, Vol. 52, (2008): 80-88.

Boudreau K. J., and Lakhani K. R., *"How to manage outside innovation."* Image (2012), 33-45.

Boudreau K. J., and Lakhani K. R., *"Using the crowd as an innovation partner."* Harvard Business Review, Vol. 91.4 (2013): 60-69.

Brynjolfsson E., and McAfee A. P., *"The future of the web: Beyond enterprise 2.0."* MIT Sloan Management Review, Vol. 48.3 (2007): 49-55.

Burger-Helmchen T. and Pénin J., *"The limits of crowdsourcing inventive activities: What do transaction cost theory and the evolutionary theories of the firm teach us."* Workshop on Open Source Innovation, Strasbourg, France. (2010).

Chanal V. and Caron-Fasan M. L., *"The difficulties involved in developing business models open to innovation communities: the case of a crowdsourcing platform."* M@n@gement, Vol. 13.4 (2010): 318-340.

Chesbrough H., *"Making sense of corporate venture capital."* Harvard Business Review Vol. 80.3 (2002): 90-99.

Chesbrough H., and Rosenbloom R. S., *"The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies."* Industrial and Corporate Change, Vol. 11.3 (2002): 529-555.

Chesbrough H., Vanhaverbeke W., and West J., *"Open innovation: Researching a new paradigm."* Oxford University Press, 2006.

Chesbrough H., *"Business model innovation: opportunities and barriers."* Long Range Planning, Vol. 43.2 (2010): 354-363.

Chesbrough H., *"Open business models: How to thrive in the new innovation landscape."* Harvard Business Press (2013): 1-5

Chesbrough H., and Brunswicker S., *"A fad or a phenomenon? The adoption of open innovation practices in large firms."* Research-Technology Management, Vol. 57.2 (2014): 16-25.Cohen W. M., and Levinthal D. A., *"Absorptive capacity: a new perspective on learning and innovation."* Administrative Science Quarterly (1990): 128-152.

Cusumano M. A., and Gawer A., *"The elements of platform leadership."* MIT Sloan Management Review, Vol. 43.3 (2002): 51.

Dahlander L., and Magnusson M., *"How do firms make use of open source communities?"* Long Range Planning, Vol. 41.6 (2008): 629-649.

De Backer K., Lopez-Bassols V., and Martinez C., *"Open innovation in a global perspective - what do existing data tell us? Statistical analysis of science, technology and industry."* Working Paper, Vol. 4 (2008).

Doz Y., Wilson K., Veldhoen S., Goldbrunner T., and Altman G., *"Innovation: Is global the way forward."* INSEAD, Fontainebleau (2006).

Dyer J. H., *"Specialized supplier networks as a source of competitive advantage: Evidence from the auto industry."* Strategic Management Journal, Vol. 17.4 (1996): 271-291.

Estellés-Arolas E. and González-Ladrón-de-Guevara F., *"Towards an integrated crowdsourcing definition."* Journal of Information Science, Vol. 38.2 (2012): 189-200.

Ford R. C., Brendan R., and Ciuchta M. P*., "Crowdsourcing: A new way of employing non-employee?"* Business Horizons (2015).

Füller J., *"Refining virtual co-creation from a consumer perspective."* California Management Review, Vol. 52 (2010): 98-122.

Gassmann O., *"Crossing the industry-line: Breakthrough innovation through cross-industry alliances with 'non-suppliers'."* Long Range Planning, Vol. 43.5 (2010): 639-654.

Gassmann O., *"Opening up the innovation process: towards an agenda."* R&d Management, Vol. 36.3 (2006): 223-228.

Gassmann O., and Enkel E., *"Towards a theory of open innovation: three core process archetypes."* R&D Management Conference. Vol. 6. (2004).

Gault F. *"User innovation and the market."* Science and Public Policy, Vol. 39.1 (2012): 118-128.

Gefen D., and Carmel E., *"Is the world really flat? A look at offshoring at an online programming marketplace."* MIS Quarterly (2008): 367-384.

Geiger D., Seedorf S., Schulze T., Nickerson R. C., and Schader M., *"Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes."* In AMCIS, (2011).

Howe J., *"Crowdsourcing: How the power of the crowd is driving the future of business."* Random House, (2008).

Howe J., *"The rise of crowdsourcing."* Wired Magazine, Vol. 14.6 (2006): 1-4.

Huizingh E., *"Open innovation: State of the art and future perspectives."* Technovation, Vol. 31.1 (2011): 2-9.

Serhan I., Albers A., and Miller S., *"Open innovation in the automotive industry."* R&D Management, Vol. 40.3 (2010): 246-255.

Judge G., Griffiths G., Hill W. E., Lutkepohl R. C., and Lee T. C., *"The Theory and Practice of Econometrics."* J. Willey & Sons, New York (1985).

Kohler T. *"Crowdsourcing-Based Business Models: HOW TO CREATE AND CAPTURE VALUE."* California Management Review, Vol. 57.4 (2015).

La Vecchia G., and Cisternino A., *"Collaborative workforce, business process crowdsourcing as an alternative of BPO."* Springer Berlin Heidelberg, (2010).

Lacity M. C., and Hirschheim R., *"The information systems outsourcing bandwagon."* Sloan Management Review, Vol. 34 (2012).

Langlois R. N. *"Chandler in a larger frame: markets, transaction costs, and organizational form in history."* Enterprise and Society, Vol. 5.03 (2004): 355-375.

Lindegaard S. *"Why open innovation is not for small companies"*. Innovation Excellence. (1985).

Xavier M., and Mitchell W., *"The influence of local search and performance heuristics on new design introduction in a new product market."* Research Policy, Vol. 26.7 (1998): 753-771.

Maslow A. H., *"A theory of human motivation."* Psychological Review, Vol. 50.4 (1943): 370.

McAfee A. P.*, "Enterprise 2.0: The Dawn of Emergent Collaboration"* (2006).

Suvi N. and Storbacka K., *"Business model design: conceptualizing networked value co-creation."* International Journal of Quality and Service Sciences, Vol. 2.1 (2010): 43-59.

O'Donnell J., *"John Harrison and the Longitude problem."* Retrieved September 23 (2002): 2011.

Osterwalder A., *"Business Model Generation: A handbook for visionaries, game changers and challengers."* African Journal of Business Management, Vol. 5.7 (2011).

Osterwalder A., *"The business model ontology: A proposition in a design science approach."* (2004).

Piller F., *"Toolkits for open innovation-the case of mobile phone games."* System Sciences, 2004. Proceedings of the 37th Annual Hawaii International Conference on. IEEE, 2004.

Prahalad Coimbatore K., and Ramaswamy V., *"Co-creation experiences: The next practice in value creation."* Journal of Interactive Marketing, Vol. 18.3 (2004): 5-14.

Prahalad Coimbatore K., and Ramaswamy V., *"The co-creation connection."* Strategy and Business (2002): 50-61.

Prpić J., Shukla P. P., Kietzmann J. H., and McCarthy I. P., *"How to work a crowd: Developing crowd capital through crowdsourcing."* Business Horizons, Vol. 58(1)(2015): 77-85

Raasch C., Herstatt C, and Lock P., *"The dynamics of user innovation: Drivers and impediments of innovation activities."* International Journal of Innovation Management, Vol. 12.03 (2008): 377-398.

Riggs W., and Von Hippel E. *"Incentives to innovate and the sources of innovation: the case of scientific instruments."* Research Policy, Vol. 23.4 (1994): 459-469.

Mohanbir S. and Prandelli E., *"Communities of creation: managing distributed innovation in turbulent markets."* IEEE Engineering Management Review, Vol. 29.1 (2001): 6-24.

Saxton G. D., Oh O., and Kishore R., *"Rules of crowdsourcing: Models, issues, and systems of control."* Information Systems Management, Vol. 30.1 (2013): 2-20.

Poetz M. K., and Schreier M., *"The value of crowdsourcing: can users really compete with professionals in generating new product ideas?"* Journal of Product Innovation Management, Vol. 29.2 (2012): 245-256.

Shah Sonali K., and Tripsas M., *"The accidental entrepreneur: The emergent and collective process of user entrepreneurship."* Strategic Entrepreneurship Journal, Vol. 1.1-2 (2007): 123-140.

Osamuyimen S., Huerta J. M., and Sader M. *"Designing crowdsourcing community for the enterprise."* Proceedings of the ACM SIGKDD Workshop on Human Computation. ACM, 2009.

West J., *"How open is open enough? Melding proprietary and open source platform strategies."* Research Policy, Vol. 32.7 (2003): 1259-1285.

Whitla P., *"Crowdsourcing and its application in marketing activities."* Contemporary Management Research, Vol. 5.1 (2009).

Vincenti W. G., *"What engineers know and how they know it."* Vol. 141. Baltimore: Johns Hopkins University Press, (1990).

Von Hippel E., *"The Sources of Innovation"*. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship, (1988).

Von Krogh G., and Spaeth S., *"The open source software phenomenon: Characteristics that promote research."* The Journal of Strategic Information Systems, Vol. 16.3 (2007): 236-253.

Zott C., Amit R., and Massa L. *"The business model: recent developments and future research."* Journal of Management, Vol. 37.4 (2011): 1019-1042.

Websites

http://www.anfia.it

http://www.autoline.tv

http://www.blog.crowdfuture.net

http://www.bmwgroup.com

http://www.cnet.com

http://www.crowdsourcing.org

http://www.eyeka.pr.co

http://www.fastcompany.com

http://www.firstonline.info

http://www.infectious.com

http://www.interbrand.com

http://www.iri.jrc.ec.europa.eu/automobiles.html

http://www.kickstarter.com

http://www.localmotors.com

http://www.repubblica.it/economia/2014/12/04/news

http://www.rnd2015.sssup.it

http://www.theguardian.com

http://www.tiki-toki.com

http://www.triplepundit.com

http://www.wsj.com

https://www.bmwgroup-cocreationlab.com

https://www.designcontest.com

https://www.youtube.com