

Open Innovation in the German SME Sector - Development and Test of a Diffusion Model

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ABSTRACT: Chesbrough (2003) described Open innovation (OI) as the new way for companies to generate innovations. Although inclusion of external parties into the corporate innovation process has also happened before, Chesbrough was the first to describe the possibility to include multiple external agents simultaneously to innovate at a faster pace.

In recent times several studies discussed this topic mainly arguing for the use of OI. This research puts the main studies in a time-wise perspective and argues for a phased model of the OI adoption process. The bespoke diffusion model is applied to the German SME market via a two-fold qualitative and quantitative empirical study. It becomes apparent that the current status of adoption of OI does not comply with the previously anticipated adoption rates. The paper reflects this finding by discussing barriers to reach the next levels of OI adoption.

Keywords: Open Innovation, SMEs, Innovation Process, Adoption of Open Innovation

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1. Introduction

Innovation is essential for companies to survive and flourish long term. However, it all comes at a price and innovation is expensive. Costs for research and development in German companies have nearly doubled between 1997 and 2008 [4]. Not only the cost for research personnel has risen, also systems supporting research and innovation are in a strong transformation and growth process worldwide adding to the cost overhead.

In a globalized economy it is ever more important for literally every company to generate innovations more quickly than ever before in order to stay competitive in the market. Frequent economic shake ups like the recent banking crisis followed by the crisis of the Euro add to the need for decreasing costs while simultaneously increasing the innovative productivity. Globalization does not only increase the number and volume of markets a company can more easily assess than ever before it is also the source of a rising number of competitors companies are facing in their traditional home-markets.

These factors lead to the need to enhance competitive capabilities through decreasing enhancing flexibility to change existing

or create new products, decrease the time-to-market for new products, shortening product life cycles for innovative products and so on. Traditionally, large companies have the financial power and outreach to cope better with these changes. Small and medium sized companies (SMEs) on the other hand are forced to find new ways to improve their innovation potentials [5] [12].

A possible method for raising the innovation potential is to open the traditionally rather company-internal innovation process to the outside to create a strategic connection with the outside world. [5] named this approach “*open innovation*” (OI). OI is a new innovation paradigm which helps companies to generate more innovations faster. This includes valuable ideas from inside and/or outside the company. Open innovation is a strategy of proactive innovation management. The open innovation approach integrates customers, suppliers, universities, competitors and other departments of the companies besides research and development (R&D) as value-adding entities into the structured creation of innovations [9]. The aim of OI is to generate new innovations by including external players into the innovation process. The implementation works through an open call to an undefined group of people [24].

Although the OI phenomenon is already well described we still lack an understanding of the overall OI adoption rate and therefore the diffusion process. The paper postulates a diffusion process which is divided it into four stages. This conceptual work is than tested using a twofold empirical study which puts the SMEs in the German economy into perspective to the stages. The current status is assessed and major barriers to further diffusion are identified and discussed.

The paper is structured as follows: Following the introduction a description of the research object and the literature related to the study goals is discussed, followed by an explication of the research question and presentation of the research method. Subsequently the qualitative and quantitative findings are discussed and put into perspective to the proposed model. The paper closes with explications of its limitations, an outlook to further research, the conclusion and an outlook to further developments in the market.

2. The German SME Market

“*SME*” stands for small and medium-sized enterprises. According to the European Commission the main factors determining whether a company is an SME are:

1. number of employees and
2. either turnover or balance sheet total.

As guidelines serve the figures in table 1 below (EU recommendation 2003/361):

Size category	Employees	Turnover	Balance sheet total
Medium-sized	< 250	≤ € 50 m	≤ € 43 m
Small	< 50	≤ € 10 m	≤ € 10 m
Micro	< 10	≤ € 2 m	≤ € 2 m

Table 1. Categorization of SMEs

These ceilings apply to the figures for individual firms only. A firm which is part of larger grouping may need to include employee/turnover/balance sheet data from that grouping too.

Germany has the strongest SME sector of all economies world-wide, followed by China, The US and Italy. Around 99.8% of all registered corporations in Germany fall into that category, which employ around 80% of the German workforce.

The German SME sector accounts for the most world leader positions with 142 corporations ranking 1st to 3rd place in their respective market segment as depicted in table 2 below (source: International Cluster Competitive Project, Institute for Strategy and Competitiveness, Harvard Business School).

In order to stay competitive as a small and medium sized enterprise, the firm has to constantly bring new products to the market

– innovation pays an important role. SMEs need to be able to quickly adopt and change their product portfolio and the corresponding production processes to survive in a globally competitive market.

Rank	Country	Number of top-positions			Number of market segments with a top-3 position	In % of all market segments
		No. 1	No. 2	No. 3		
1	Germany	67	40	35	142	61,21%
2	China	72	19	16	107	46,12%
3	USA	34	37	26	97	41,81%
4	Italy	5	27	26	58	25,00%
5	Japan	10	21	19	50	21,55%
6	France	5	9	17	35	13,36%
7	Great Britain	3	8	8	31	8,19%

Table 2. Global SME-Leaders

These factors (1) the strong market presence and (2) the appreciation of innovation combined with the fact that due to the smaller number of employees the responsible managers can be much better approached by researchers qualified the SME sector as a prime research object for our research question.

3. Related Literature

An innovation does not necessarily have to be something completely new. The main differentiator is that an innovation creates a new benefit for its users [8].

[14] analyzed over 800 companies according to their innovativeness. He came to the conclusion, that the factors of success in R&D are the cooperation and the transportation of information with the customer.

[15] compiled a multiple case study in the field of medical technology. The study focused on five radical innovation projects. The survey shows that users can contribute to the progress of radical innovations. The users have a high motivation, are open to new technology and apply different competences.

[6] wanted to identify early adopters of OI concepts outside the high technology industries. They interviewed 12 persons and showed that certain open innovation concepts are already used in companies outside the high technology industries. They conclude that open innovation can be used in a wide range of industries.

[31] studied companies in the technology industry with over 110 workers. They found out, that the understanding of innovation is changing and four out of ten companies use open innovation. However there are no clear structures and guidelines for successful practical implementation of open innovation. In addition the companies were willing to use external knowledge, but they were not willing to share their own know-how with the outside world.

The study of [10] showed which companies in Europe already used open innovation and gave a midterm conclusion of the previous research. The companies mentioned in the study more than two thirds, employ over 250 workers. The research indicates that most of the companies use the lead-user-method. Furthermore, the barrier for non-integration of open innovation is the not-invented-here-syndrome. The study illustrates that Procter & Gamble is the Best Open Innovator 2010.

4. Conceptual Model

As with every major technical innovation also organizational innovations follow distinctive diffusion patterns. When the key findings and (if given) predictions of the studies mentioned before as well as their year of publication complemented by additional exemplary studies are set into perspective and put on a timeline a four stage adoption process emerges (see figure 1).

The first stage describes the timeline from around 1900 to 2003 and includes the initial discussion of the new innovation process as well as early adoption. Stage 2 begins with the “*official*” definition of open innovation in 2003 by Chesbrough and moves on to roughly 2012. It is characterized by adoption of many corporations. In the 3rd stage the diffusion continuous and it seems that a broad consensus sees widespread adoption (or: full diffusion) by the end of this decade. From that point on -stage 4- OI is expected to be a widely accepted management practice and like a commodity will not differentiate in the market any longer.

4.1 Stage 1: “Innovators”

The “*Innovators*” stage is characterized by novel research and first companies taking cautious steps towards the new invention.

Only slowly tend different companies to partly adopt the new process of including outsiders into the R&D of the corporation.

The first scientific importance of innovations has been identified by [26]. He found out, that innovations are essential for the technical progress and the growth of a company.

[28] agreed to Schumpeter's findings and establishes his theory that a long economic growth come from consistent technological progress.

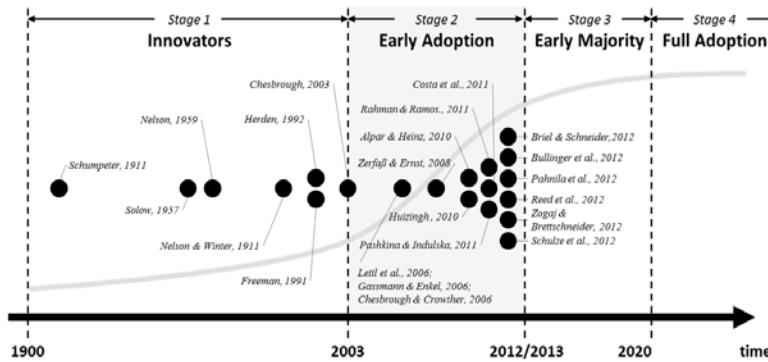


Figure 1. Conceptual Diffusion Model

[18] showed that the creation of value is to closely define by companies and a lack of external application and co-products. [18] give a recommendation to look over the own company borders to search for new technologies. This conclusion has been supported by [11]. In his researches he found out, that the integration of external players are having a positive effect on the development process and the innovativeness of the companies. [14] researched for the technological an economical innovativeness in over 800 companies and came to the conclusion, that the factors of success in R&D are the cooperation's, contacts of universities and transportation of information with customers to increase the innovativeness.

4.2 Stage 2: “Early Adoption”

In stage 2, the “*Early Adoption*” phase, more and more corporations jump on the bandwagon and utilize the new way to produce innovation. Research picks up this topic and provides well defined space, frameworks and empirical studies analyzing the phenomenon.

[5] recognized the change of the innovation process and called the phenomenon open innovation. Thereupon a lot of discussions followed.

[15] figured out, that the customer can contribute to radical innovations. [13] introduced the three core processes of an open innovation strategy. Most of the time it found faulty, that just technological based companies used open innovation. This statement was disproved by [6]. [31] showed that four out of ten big companies already used the open innovation approach and that SMEs did not implemented it yet.

4.3 Stage 3: “Early Majority”

In the third stage the “*Early Majority*” of firms adopts OI as management practice. The formerly experimental process is developed into a more robust and widely used process within the corporation. The necessary processual, organizational and technological changes take place and the *open* part of the innovation process becomes a part of the corporate culture.

Studies (including those discussed in the literature review) forecast that this stage will be reached soon, probably as early as 2012/13 and will last to around 2020.

4.4 Stage 4: “Full Adoption / Commodity”

It currently seems that in the near future, probably around 2020 we will see the move from stage 3 to stage 4 which implies a widespread adoption of OI practices into the market. OI will become a well-accepted management practice and successful implementation of OI does not differentiate any longer in the market. A successfully OI process becomes a commodity as it is widely used by companies all over the word.

4.5 The Chasm

In social sciences it is very difficult to actually predict which state a market is currently in. Adoption of organizational habits is difficult to measure as there are not quantitative output figures. As such the only way is to undertake widespread quantitative empirical studies. Even though these studies provide a measurable insight, at some stages the knowledge gained remains difficult to interpret.

The technology adoption lifecycle model¹ (see e.g. Meade and [16]) illustrates the well-known phenomenon known as the “chasm” (see figure 2 below).

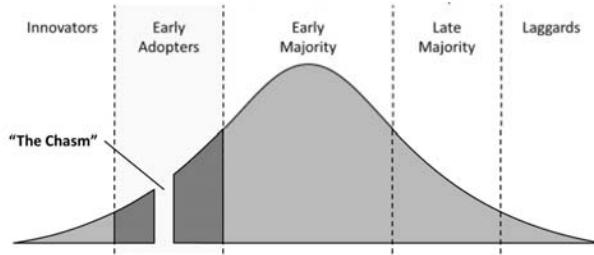


Figure 2. Technology Adoption Lifecycle

The chasm describes the turning point whether an innovation will make it into the mass market (i.e. leaving stage 2 and entering stage 3), or not. Some inventions started promising and never made it to the adoption of the majority. They did not bridge the chasm. In the case of OI our research indicates that the German SME sector is just at the end of stage 2 (see section 5). This means that the make-or-break-point is within close reach.

From the analysis of the literature as well as the qualitative and quantitative interviews it cannot yet be derived whether OI will bridge the chasm or not. Although the indications we got point towards a promising way into widespread adoption, we cannot be certain about that. A statement with a high degree of certainty will not be possible before the market is well into stage 3.

5. Research Methodology and Key Results

To test the research question about the stage of OI adoption in the German SME market a sample from the local economy has been drawn. The selected companies were contacted and via telephone interviews been asked about their adoption of open innovation mechanisms. Interviews with 186 SMEs have been conducted as described in section 5.1 below.

The second research question -building on the hypothesis that we are currently in stage 2- was, whether it seems realistic to be so close to the third stage (i.e. at the end of stage 2 and close or right into the chasm). To assess this question four interviews were conducted with leading experts in the field. The aim was to test our hypotheses and to identify the barriers which need to be overcome in order to enter stage 3. The insights are described in section 5.2.

5.1 Telephone interviews

5.1.1 Research Layout

To research the current adoption of open innovation in SMEs in Germany telephone interviews were conducted. As per today there are over 3.67mn small and medium sized companies registered in Germany. Around 80% of them are single-owner companies or companies with less than 5 employees. We classified these firms as too small to have formal innovation processes in place and excluded them from the sample. Out of the remaining corporations we contacted 500. The selection of these was made by probability sampling. 186 of the 500 firms contacted were willing to participate in the study.

The interviews were guided by a structured questionnaire. The questionnaire comprised twelve questions. The first four questions refer to the size, industry, the interviewed person's position in the company and the perceived role of innovation for the company. The following eight questions aimed to identify the general interest of the company to integrate external players

¹Please note that the Technology Adoption Lifecycle Model defines the space under the curve differently than the diffusion model in this paper. Whereas we depict adoption in the overall market, the TAL-model displays the number of new customers/users

or rather if they are already implementing external knowledge into their innovation process. We also asked about the current status of knowledge and the general opinion on the topic open innovation.

According to [21] there must be the assumption that the evidences of the interviewed persons are blurred. The interviewees are trying to demonstrate their company in a positive way and try to hide the negative characteristics. Because the results however anonym continuous processing, can be supposed that the results are comply with the truth and are significant. Most of the questions are predominated answered by the marketing department or other responsible persons in the public relation.

5.1.2 Participant's Demographics

The survey included 186 SMEs in Germany. In the following, the demographics of the interviewed companies are explicated in terms of size and sector.

No. of Employees	Absolute	Relative
1-5	12	6%
6-19	20	11%
20-49	46	25%
50-99	58	31%
100-249	50	27%

Table 2. Size of the companies (No. of employees)

No. of Employees	Absolute	Relative
R&D	39	21%
Services	32	17%
Media & Communication	71	38%
Industrie / Production	33	18%
Others	11	6%

Table 3. Sectors of the companies

5.1.3 Empirical Findings

Over 90% of the interviewed companies stated that they already integrate external entities in their innovation process and 95% are interested to do this. Additionally 180 SMEs stated that the integration of external knowledge is a company advantage and also a competitive advantage.

Regarding the question which entities to integrate the customer is on the first position with 51%. After that, suppliers (22%) and research institutes (18%) and universities (9%) followed. Besides that 98% of the interviewed companies confirmed, that they can produce a better product by integrating external entities.

The term “*open innovation*” is known by only 16% of the interviewees. However, during the interviews it became apparent that the firms use the concepts under different names.

Eleven out of the 186 companies said, they already used open innovation projects. Mainly used concepts are: *Idea competitions* -aimed at making the transfer of knowledge into a competition- [24] and the *lead-user-method* (lead users have requirements to a product which cannot be satisfied at the current market, these requirements can later be relevant to a large market segment [29]) is the most used one.

Figure 3 shows the use of open innovation by sector. It becomes apparent that it is commonly used in the media and communication industry with 48%. Followed by the service sector with 19% and R&D with 16%. Open innovation is not well known in the industry and production sector (10%) and others with 7%.

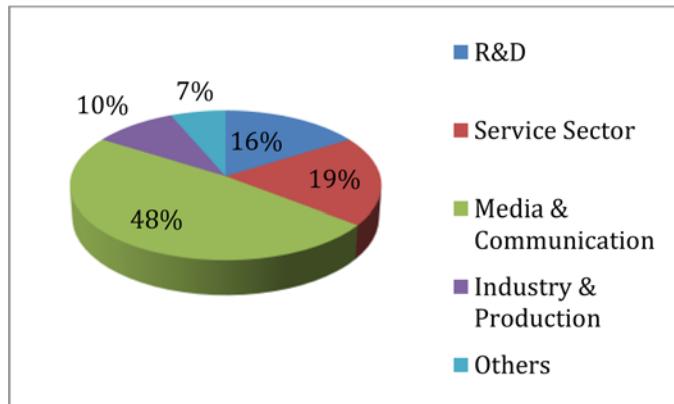


Figure 3. Adoption of open innovation by industry sector

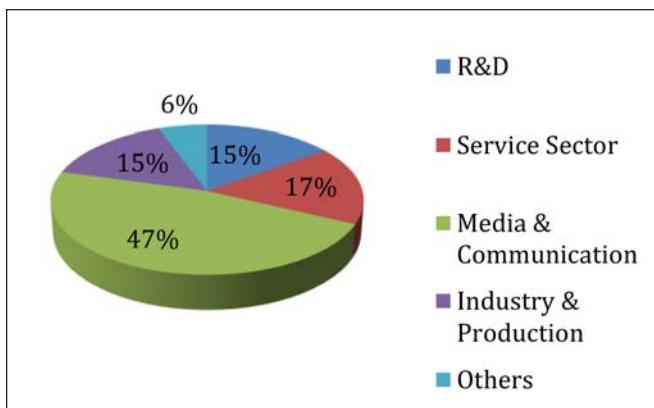


Figure 4. Interests in applying open innovation by industry

The media and communication industry indicates the most interest to implement open innovation (47%) as shown in figure 4. Following are the service sector with 17%, R&D and the industry and production with each with 15% and others with 6%.

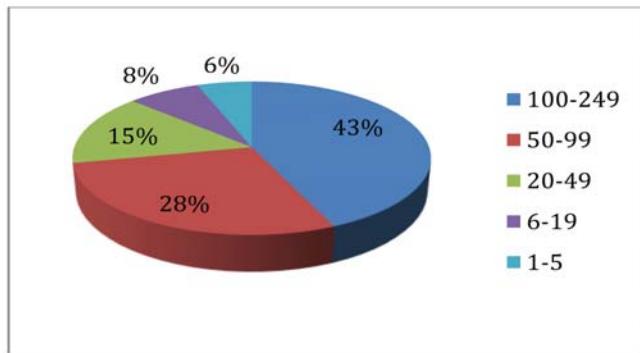


Figure 5. Interest in implementing open innovation by company size

Out of 186 interviewed companies 53 companies have interest in the implementation of open innovation. Furthermore as shown in Figure, 43% of the interviewees have a size of 100-246 employees and 28% employ 50-99 workers. 15% count between 20-49 workers and 8% between 6 and 19. Companies with 1-5 employers are 6% of the interviewed firms.

Most of the asked people are from the marketing fraction or from the public relations department, which have an interest in open innovation.

Social media is practiced by 133 enterprises. Communities have the most shares with 43%. Then followed by intranet and blogs. 46 out of 53 companies want to use the Web 2.0 in the future.

(d) Key results

The following conclusions and key statements can be drawn from the telephone interviews:

- Only eleven out of the 186 companies already actively use open innovation methods.
- Most SMEs, no matter what industry and size they indicate have interest in the integration of external players.
- A lot SMEs integrate customers and suppliers into the company. But to be innovative and to apply the open innovation approach correctly, it needs more. Independent research institutes, universities and competitors are not mentioned yet.
- The term “*open innovation*” is not well known by SMEs, although most companies are interested in integrating external entities. Larger SMEs with more than 50 employees generally knew the term.
- The larger SMEs showed the most interest in the implementation of open innovation especially in the media and communication industry and service sector.

5.2 Expert interviews

5.2.1 Research Layout

To gather deeper insights into the stage of adoption, the chasm and possible barriers to widespread diffusion, four expert interviews were conducted.

The questionnaire guiding the expert interviews was split up into three blocks where each part consisted of three to five open questions. The first part contained general questions about open innovation and the actual status of adoption. The chances and risks of OI (including views on the chasm) were discussed in the second part. The third part contained questions regarding the integration of external players in the innovation process. The interviews had a length of 45 to 90 minutes.

5.2.2 Interview Partner Demographics

The experts were from four different consulting firms which are specialized in open innovation as well as from companies which already use open innovation.

5.2.3 Key results

Summarized the following conclusions and quintessence's of the expert interviews are demonstrated.

- The actual term “*open innovation*” is widely regarded as a buzzword. However the content and the strategy of the concept are relevant and will be important for every company no matter what size.
- The main inhibiting factor for the integration of open innovation is the “*loss*” of company internal know-how, specifically when sharing knowledge regarding competitive advantages.
- The culture of the company plays an important role for the adoption of OI. Before implementing such concepts is necessary to find out whether the corporate culture is ready for such a step or can be changed accordingly.
- SMEs have an interest in open innovation. However, they have a lack of information about open innovation and the implementation. Therefore awareness training is needed.
- Open Innovation can be used in every industry and company to some extent.
- A lot of companies claim to integrate open innovation, but they just integrate it in a certain (mostly limited) way. In some cases a customer survey is already seen as an open innovation process.
- Mostly the customers and suppliers are integrated in the innovation process with the help of the lead-user method. The idea competition is slowly picking up pace.
- The “*Chasm*” has already been bridged. Companies which do not adopt OI mechanisms into their innovation processes will fall behind their competitors.
- Within the next five years open innovation will be permanently adopted by companies. Therefore SMEs need to open their innovation process and should actively promote the open innovation approach.

6. Summary of Findings

6.1 Findings of the telephone interviews

The telephone interviews brought up that SMEs have strong interest in the involvement of clients, suppliers and other external players. The term and the strategy of open innovation are more popular in larger SMEs. The most interests in the involvement of external entities with open innovation have enterprises from the media and communication industry and enterprises with more than 50 workers. This suggests that open innovation has already gotten grip in the German SME market. We can conclude that we left stage 1 behind and are right into stag 2.

6.2 Findings of the expert interviews

The expert interviews brought up that “*open innovation*” is widely regarded as a buzzword. However, the underlying concept is of utmost importance. The implementation will play a big role in the future in the innovation process in enterprises of all sizes. There is also a difference in the understanding of innovation in small, medium and large (SME) companies. Large SMEs already accept the opening of the innovation process and integrate open innovation in their strategy and business culture.

However, it also needs to be noted that there are different barriers, which are described in theory. A major barrier is the loss of internal knowledge if competitive advantage is at stake. A central problem is the corporate culture as it widely does not value sharing information with the outside world.

Nevertheless, OI is here to stay and innovative companies either incorporate external players into their own innovation processes or they will fall behind competition.

7. Limitations and further research

The findings of this study reflect the current status of OI adoption in German SMEs. Obviously the findings cannot be transferred to other countries or non-SME corporations.

The selection of the study participants was randomly, however, they cannot claim to be statistically representative. Especially due to the number of respondents which cannot generally reflect the whole market.

Also it needs to be kept in mind that the expert opinions are “*only*” opinions. These points of view were not quantitatively founded even though the experts have exposure to a wide range of SMEs and thus claim to have a good overview of the market.

Further researches should explore the barriers to adoption more intensively. Special focus should be on corporate culture, the not-invented-here-syndrome and legal questions. These risks should be evaluated in connection with other scientific disciplines. In addition to the innovation culture in enterprises which not yet implemented open innovation there should be a comparative focus on the corporate culture of the companies which already use open innovation successfully.

8. Conclusion

This study was set up to answer two questions: (1) What is the current status of adoption of open innovation by German SMEs and does this comply with the suggested staged diffusion model? (2) Did the German SME market already bridge the chasm and what are the main barriers to OI adoption?

For this propose a survey with 186 German SMEs in Germany was arranged. Followed by four expert interviews to confirm the findings and engage deeper in the discussion on barriers.

In summary, the study underlined the significance of open innovation for SMEs in Germany. However, the status of adoption is still mixed, this supporting the hypothesis that the German SME market is in stage 2 of the described adoption process model. However, it also became apparent, that the market is likely to enter stage 3 later than the anticipated date of 2012.

The findings indicate that OI can be successfully applied by SMEs, however, certain conditions must be met. These conditions result mainly from corporate culture issues. It is imperative that existing strategies, processes, methods and structures within the company need to be adjusted with regard to the implementation of open innovation.

Open innovation has gained importance during the last years and experts' consensus is that the concept is here to stay. SMEs either adopt to this new way to produce innovation or the lag behind the market leaders and will vanish from the market. Therefore, the idea of open innovation needs to be communicated more broadly and support to integrate the concept into the internal processes is necessary.

9. Outlook on Open Innovation

A first step to support open innovation in SMEs is the project OpenAlps funded by the European Union. The project, under accompaniment of the IHK Scharzwald-Baar-Heuber (a public agency to specifically support SMEs), started in July 2011 with an anticipated duration of three years. The budget is 2.9 Mio Euro and supports several OI projects. The aim of the project is, to support SMEs around the Alps (Austria, France, Germany, Italy, Liechtenstein, Slovenia, Suisse) on their way from closed to open innovation. For this purpose several offerings are provided to the companies, amongst others a web based open innovation platform for innovation seekers and innovation provider. In addition there are several support centers which support the participating SMEs to connect with the regional work groups and research institutes [27].

The opening of the innovation process is a central element to design the product development more effective and efficiently. Due to the rise of global competition, increasing R&D costs and shorter product life cycles SMEs have to change their innovation processes and open them.

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