The social side of innovation

User Involvement in the radical innovation process

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Preface

This bachelor thesis was written as part of the bachelor programme International business at the University of Tilburg and is concentrated on user involvement in the radical innovation process. In this thesis user will be used as a synonym for consumer or customer.

I would like to thank my supervisor Dr. Marco Furlotti for his constructive comments that helped shape this thesis.
Management summary

This thesis sheds light on the discussion on what role user involvement can play in the process of radical innovation. Innovation and especially radical innovation can be a way for firms to circumvent the current economic crisis. Therefore it is important to determine what role user involvement can play in order to positively influence the outcome of the radical innovation process. Being a much debated subject between scholars it is striking to notice that there is a lack of a sound definition of radical innovation. By building upon previous definitions to construct it's definition this thesis had made a step forward but we are far from the finish. When considering the role of the user in the innovation process one cannot ignore the social side of the story. The theory of socio-technical systems can be seen as a useful addition to the field of innovation to that respect. It enables us to incorporate the social aspect of innovation that seems to be neglected in other theories of the innovation process. The combination of a sound definition with a fitting theory on the process of radical innovation may possibly enable firms to identify those innovation projects that are radical in nature and at the same time take notice of the social factors in the innovation process. Important lessons can be drawn by looking at the theories and techniques currently used by firms and industries. Reviewing them by combining literature on radical innovation shows that these theories and techniques are far from complete and therefore calls for a reassessment of the role that user involvement can play in the radical innovation process. A sound definition supplemented with clear guidelines is the first step towards coherence in the field of radical innovation. Adding theories on how the innovation process should be designed, when to involve users and how to identify those users may clear the way for user involvement to play an important role in the success of a radical innovation.
Chapter 1: Introduction

1.1 Problem indication

In the field of innovation people have made various distinctions on the types of innovation. Two types of innovation that are regularly stated are incremental and radical innovation. Dewar and Dutton described radical and incremental innovations in the following way: "Radical innovations are fundamental changes that represent revolutionary changes in technology. They represent clear departures from existing practice. In contrast, incremental innovations are minor improvements or simple adjustments in current technology.” (Dewar & Dutton, 1986: 1422). More simply stated; in the process of incremental innovation, the focus lies on improving an existing product/process whereas in the process of radical innovation a completely new product/process is being created. When looking at the role of end-users in these two types of innovation and especially their involvement there are contrasting views in the field. In the incremental innovation process involvement of the end-user is common, because their input is seen as valuable in improving the existing product or service. Previous studies have however identified a more passive role of the consumer concerning the radical innovation process. The assumption is made that certain barriers withhold the consumer for making valuable contributions. In his study Christopher Lettl (2007) Identified 2 barriers that might explain the reason for this passive role. The Cognitive barrier arises out of the fact that the user is cognitively limited and therefore simply has no valuable knowledge to contribute to the innovation process. The second barrier is based on the fact that the user is not willing to contribute to the innovation process which might be the result of high anticipated switching costs and fear that existing knowledge will become obsolete. When considering how to involve users in the innovation process these barriers are a cause of dilemmas. On the one hand it is important for companies to stay consumer focused; if you lose contact with your users a new product may very well end up as a failure. On the other hand involving users in the radical innovation process is discouraged by the barriers that innovation literature describes.

In recent years there have been scholars who claim that user involvement can have positive effects on the radical innovation process but only up to a certain point. Callahan and Lasry, E. (2004) found that the importance of consumer input was related to the market newness of a product. They concluded that in general the connection between market newness of a product and consumer input has an upward trend up to a certain point before entering into a
downward trend caused by very new products. For technological newness they found that increased consumer input only had positive effects.

User involvement is still a subject of debate in innovation literature and we are yet to determine what role user involvement can play in the development of a radical innovation. There are however examples in history of successful user involvement in the innovation process. One of those examples is the development process of the Boeing 777. The Development process of the 777 was unique since for the first time users were involved. Before the 777 airline manufactures developed aircrafts with minimal customer input. The 777 turned out to be a major success because it succeeded in capturing market needs and customer preferences. The airplane received numerous awards and is still one of the most popular aircrafts up to today. This example shows us that the involvement of customers can be beneficial to innovation and therefore it is of the upmost importance to determine what role user involvement can play in the radical innovation process.

1.2 Problem statement and research questions
The problem statement of this bachelor thesis will be what role user involvement can play in the development of a radical innovation. To answer this problem statement each of the subsequent chapters will revolve about the following research questions.

(1) How do we define radical innovation?
This thesis will start with defining radical innovation in a way that leads to a clear identification of innovation events. In the literature on innovation there is still debate on how to label innovations. Garcia and Calantone (2002) demonstrate this via an extensive literature review showing that the terms radical, very new and incremental innovation are commonly used while in certain cases the distinctions between these types are vague and maybe even incorrect. Their conclusion is of the upmost importance to this bachelor thesis; “How innovations are labeled is important if researchers want to increase their understanding of the development process of different types of innovations.” (Garcia and Calantone, 2002:127) Considering the current debate a sound definition of the term radical innovation that helps us to identity radical innovation projects ex-ante can help to determine what kind of user-involvement is needed and may very well open doors to the increased use of user involvement in the process of radical innovation.
(2) **What theory is the most appropriate theory for the radical innovation process?**
Throughout the years scholars like Schumpeter (1943) and Kline and Rosenberg (1986) developed their theories about the innovation process. Because these theories have contrasting views this research question will attempt to give an overview and determine how firms should approach the process of radical innovation.

(3) **How do particular firms and industries involve consumers in the innovation process and what roles do they play?**
User involvement is routine in certain firms and industries, by taking a closer look at these cases and the theory behind them, it will be possible to determine what roles users play in the innovation process and to derive useful insights with respect to the problem statement of this thesis.

(4) **How can user involvement impact the radical innovation process?**
The final chapter will concentrate about the current debate on how user involvement can have an impact on the radical innovation process.

**1.3 Research methods**
Both radical innovation and user involvement have been a subject of debate in the innovation literature. The definition of radical innovation has been subject of debate as well as the role of user involvement in the process. Because the two are interconnected in this bachelor thesis a sound definition of radical innovation may very well shed another light on the role of user involvement in the radical innovation process. There is a need for a deeper understanding of the term radical innovation and the interconnection with user involvement. To achieve this an exploratory research will be conducted through a literature overview.

**1.4 Academic and managerial relevance**
From an academic perspective it is interesting to research why there are contrasting views referring to user involvement in the innovation process. Why is it for instance common that in the incremental innovation process but hardly applied in the radical innovation process? It seems that there is little knowledge of the role that user involvement can play with respect to radical innovation and this may very well be the result of the lack of a sound definition for radical innovation.

The managerial relevance is that when user involvement can have positive effects on the radical innovation process it might very well contribute to the successful implementation of a new product/service. In the global economy that we live in today competition is fierce,
intense and given the current economic crisis firms are struggling. O’Conner and Demartino (2006) emphasise the crucial role that radical innovation can play in this situation by boosting economic growth through the creation of new lines of businesses and the possible creation of entirely new markets. Innovation is seen as a crucial factor to a company’s competitive strength and survival.
Chapter 2: Defining Radical innovation

2.1 Innovation
In the early days Schumpeter described innovation as; “a historic and irreversible change in the way of doing things,” and “creative destruction” (Schumpeter, 1947). Throughout the years innovation has been a subject of much debate and its definition was altered by multiple scholars, therefore it is important to accept a definition that is recognised universally.

The Oslo Manual (2005) gives us the following definition; “An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.” (Oslo Manual, 2005:46).

2.2 Distinction incremental innovation/ radical innovation
When we make a distinction between radical versus incremental innovation the key difference between those two types of innovation seems to be the knowledge involved. Whereas radical innovation encompasses for the most part new to the world knowledge incremental innovation encompasses existing knowledge. There is a need to make a distinction between incremental innovation and radical innovation because in innovation literature it is argued that they require different forms of user involvement, this will be covered in the subsequent chapter.

2.3 Definition of radical innovation in current literature
Tushman and Anderson (1986) define a radical innovation by the following criteria:

1) It shows a significant increase in performance on a important performance measure
2) The increase in performance is achieved by changing the product or process design; it is a clear departure of existing designs.

Applying these criteria however poses some difficulties because they lead to identification of a relative small set of radical innovations. Reason for this is that they primarily focus on one performance dimension; technological performance.

Leifer et al. (2000) defined a radical innovation as; “an innovation with the potential to produce one or more of the following:

1) It encompasses an entirely new set of performance features
2) Improvements in known performance of five times or greater
3) A significant (30 percent or greater) reduction in cost. ” (Leifer et al., 2000:6)

Radical innovations identified by these criteria encompass those innovations that are able to transform existing markets, industries or even create new ones.

Problem in current literature however is that the definitions developed are for the most part only able to identify a radical innovation ex-post. There are however a few scholars who claim to have developed criteria through which we are able to identify an innovation as radical ex-ante.

Dahlin and Behrens (2005) developed 3 criteria that an innovation has to fulfil in order to be considered radical:

1) The invention must be novel: it needs to differentiate itself from prior inventions
2) The invention must be unique: it needs to differentiate itself from current inventions
3) The invention must be adopted: future inventions must be influenced by it.

They claim that when an innovation meets criteria 1 and 2, it is possible to classify it as a radical innovation ex-ante. While criteria 1 and 2 are concerned with classifying an innovation ex-ante, criterion 3 is added to evaluate an innovation ex-post. If an innovation meets criterion 3 it is possible to classify it as a change agent which means that it brought about a radical technological change in the industry.

2.4 Defining radical innovation

In order to determine what role user involvement can play in the radical innovation process, a definition is needed that identifies an innovation as radical ex-ante. In this way it would be possible to determine what kind of customer involvement is needed. This view is shared by Dahlin and Behrens (2005) who argue; “Generating a stable definition and a consistent operationalization is necessary if we are to compare and contrast findings and better understand the role of radical change in restructuring industries” (Dahlin and Behrens, 2005:718).

Definitions about radical innovation revolve for the most part about the changes that it brought about in the industry structure. Ehrenberg (1995) identified 3 dimensions in studies on the relationship between technological discontinuities and changes in industry structure. These dimensions seem to be the basis where definitions on radical innovation are based upon.
1) Change in competence that is necessary for dealing with the innovation and additional resources needed in designing and producing the innovation.
2) Changes that are physically made in the product
3) Changes in price and performance

Whereas earlier definitions given by scholars like Tushman and Anderson (1986) primarily focus on one dimension of the changes a radical innovation brought about in the industry structure, later definitions given by scholars like Leifer et al. (2000) and Dahlin and Behrens (2005) seem to use combinations of these dimensions.

Therefore for an innovation to be considered radical it needs to qualify for multiple dimensions. A result is the combination of criteria in order to be able to identify a radical innovation.

1) Improvements in multiple performance features
2) Brings about a change in the competence and resources of a company
3) Differentiation from prior and current inventions

The first criterion measures an innovation on multiple performance features in order to be able to identify a relatively ample set of innovation events. Reviewing Tushman and Andersons criteria Dahlin and Behrens (2005) argued: “A single performance dimension is rarely sufficient to describe and capture the evolution of a particular product technology….it is not clear that Tushman and Andersons ‘criterion of a contemporaneous large increase in performance will allow for the identification of many radical innovations” (Dahlin and Behrens, 2005: 720). By measuring innovations on multiple performance features the problems that arise with the criteria proposed by Tushman and Anderson (1986) that only focus on one performance feature seem to be resolved, this was also proposed by Leifer et al. (2000) who introduced this fact in their criteria by measuring on multiple performance features.

The second criterion is inspired by the first dimension of Ehrnberg (1995) and is supported by Vercauteren (2008); “Capabilities in terms of developing, producing, marketing and adopting technological innovations often need to change drastically in order to allow for radical innovation. ... If more of the activities need a different approach, for example because of new technology involved, then this gives an ex-ante indication of the potential of the innovation project to lead to radical innovation(s) as end result.” (Vercauteren 2008:9) By applying
criterion 2 we are able to identify those projects that look promising with respect to their capability to develop into a radical innovation.

The third criterion was first influenced by Tushman and Anderson (1986) who stated that in order for an innovation to be considered radical it needed to be a clear departure of existing designs. They focused on one performance feature namely technological performance. A clear departure of existing designs in the light of technological performance could be viewed as a characteristic of a radical innovation. The importance of this one performance feature to identify a radical innovation ex-ante is underlined by Vercauteren (2008); “Technological novelty is one of the factors that can give ex-ante indication of the potential to radically innovate”. (Vercauteren, 2008: 9). Important thing to note is that technological novelty is but one of the factors and therefore it would be useful to consider the criterion of Dahlin and Behrens (2005). This makes sure that an innovation that is identified as a radical one is truly novel and unique with respect to prior and current inventions. On its own this criterion is a rather arbitrary one, but combined with the other two criteria it is a useful addition in order to identify a radical innovation.
Chapter 3: A theory on the innovation process

3.1 Introduction
In one of his earlier works, one of the most important scholars in the field of innovation Schumpeter argued the following; “It is, however, the producer who as a rule initiates economic change . . ., consumers… are, as it were, taught to want new things, or things which differ in some respect or other from those which they have been in the habit of using” (Schumpeter, 1934: 65). Schumpeter characterized innovation as an internal process initiated by firms to achieve monopolistic advantages. According to Schumpeter, diffusion of innovations was caused by imitations of rivalry firms following the innovating firm.

Throughout the years different theories describing the innovation process have been developed. Edquist and Hommen (1999) argue that innovation policies can be classified as either demand-side oriented or supply side oriented. Consequently they classify theories of the innovation process as either being linear or systems-oriented.

3.2 The linear model of innovation
The linear model was one of the first models developed describing the innovation, Godin (2006) depicted it graphically as follows:

The central notion behind the linear model of innovation is that research leads to the development of a technology, the development leads to its production and is followed by the diffusion of the technology.

Major criticism on the linear model of innovation is for the most part based upon the fact that the model does not include feedbacks and trials. Kline and Rosenberg (1986) argue; “Radical, or revolutionary, innovation prospers best when provided with multiple sources of informational input. Ordinary or evolutionary, innovation requires iterative fitting and trimming of many necessary criteria and desiderata. In either case, feedbacks and trials are
essential.” (Kline and Rosenberg, 1986: 286) Following their argumentation the linear model of innovation seems unfit to describe both the incremental as the radical innovation process.

3.3 Systems theory of innovation

Since according to scholars as Kline and Rosenberg (1986) the linear model of innovation contains flaws that inhibit it from explaining the radical or incremental innovation process, a more applicable theory for these processes is necessary. The linear model of innovation can be seen as a logical consequence of Schumpeter’s theory in that it can be classified as mainly a supply-side driven theory. In the light of this thesis that tries to determine what role user involvement can play in the radical innovation process, systems theory of innovation is of particular interest. According to Edquist and Hommen (1999) the systems theory of innovation places great importance on the demand side of innovation and differentiates itself from the lineal model of innovation by recognizing: “the potentially complex interdependencies and possibilities for multiple kinds of interactions between various elements of the innovation process.” (Edquist and Hommen, 1999: 65-65).

3.4 Theory of Socio-technical systems

By looking at organizations as socio-technical systems, focus is not only placed on the production of innovations but also on the use and functionality of the technology. According to Appelbaum (1997) the theory of socio-technical system design is based upon the conception that an organization or a work unit within an organization is comprised out of technical and social parts and that it is open with respect to its environment. Pasmore, W. et al. (1982) describe the technical parts consisting out of techniques, procedures, skills, knowledge and machines used by the members of an organization in order to achieve the goal of that particular organization. In manufacturing companies the technical parts can be seen as those who concern converting input into output. The social parts in an organization are comprised out of the people working in an organization and the relationships between them. By considering these two components at once, the theory of socio-technical systems differentiates itself from traditional innovation studies. In traditional innovation studies the main focus lies on the technical parts of an organization, focus to the other parts is shifted towards the end in an attempt to integrate these concepts. Appelbaum (1997) argues that this often leads to average outcomes at high social costs. The theory of social-technical systems strives for a joint optimization of the technical and social parts within an organization. Cherns (1976) concludes that in this way it exploits “the adaptability and the innovativeness of people in their in attaining goals instead of over-determining technically the manner in which these goals should be attained.” (Cherns 1976: 3)
3.4.1 Innovation and the theory of socio-technical systems

The theory of socio-technical systems has evolved throughout the years whereas in the beginning it was used as a theory to improve the quality of work life. Through the years the reach of the theory of socio-technical systems has widened to other disciplines including the field of innovation studies. With respect to innovation studies another perspective as stated by Griffith and Dougherty (2002) applies. This perspective is more theoretical in nature and provides critical insights for the understanding of relationships between the technology, people and the organizational outcomes.

The theory of socio-technical systems developed out of open systems theory which states that organizations must interact with their environments in order to be able to survive. The result of this is the open system perspective apparent in the theory of socio-technical systems. Pasmore, et al. (1982) described this perspective as follows; “The open system perspective implies that the social and technical subsystems of organizations must be designed not only in relation to each other, but also with reference to present and future environmental demands” (Pasmore, et al. 1982: 1186). Furthermore they add that because in traditional innovation theories emphasis is placed on the technical parts of an organization, organizational designers potentially miss out on opportunities to redesign technologies in order to meet the needs and demands of customers.

That the problem of placing the emphasis on the technical parts in an organization is not only a problem in innovation studies but also encompasses other disciplines is argued by Geels (2004); “Evolutionary economics, business studies and innovation studies tend to focus mainly on the production-side and the creation of knowledge and innovation (e.g. learning within firms, organizational routines, knowledge management), while the user side has received less attention.”(Geels 2004:902).

The relation with the environment that is apparent in the theory of socio-technical systems is of particular importance to innovation. By increasing its communication with its environment a firm will be more effective in generating, developing and implementing an innovation according to Utterback (1971). In the case of successful innovations he concluded that discussion and personal contact were two measures most often applied by firms in the transfer of information.

Adaptation to the socio-technical system theory more or less stresses the need for an organization to align innovation activities with the environment in which an organization acts. The theory of socio-technical systems can thus be seen as a complement to organizational
theory and innovation studies. Griffith and Dougherty (2002) argued; “A central challenge to technology and innovation management researchers is to keep their understanding of technology and work real and grounded in actual practice, while also pushing our thinking about relationships and social interactions”. (Griffith and Dougherty 2002: 211)

3.4.2 Lessons for user involvement in radical innovation

Lessons derived from the theory of socio-technical systems may very well make way for an increase in the involvement of consumers in the radical innovation process. Pioneering work to this respect is taking place in the software industry.

Traditional design of information systems can best be classified as a supply driven process. To that respect it resembles the theories of Schumpeter (1934) and the linear model of innovation. Through the years this design method received a lot of criticism as a result of many problems and failures caused by inadequate designs. Bostrom and Heinen (1977) describe conditions which are the major causes for an information systems design process to result in an inadequate design. Their critique is primarily based upon the fact that the traditional design method neglects the social parts in an organization and the interaction with its environment. A solution to these problems was offered by the theory of socio-technical systems.

By applying the theory of socio-technical systems in the design of information systems user involvement was drawn into the picture. The end user is seen as an important participant in the design process. Scacchi (2004) describes the system as follows; “The system includes the network of users, developers, information technology at hand and the environments in which the system will be used and supported.” (Scacchi 2004:2). Scacchi (2004) recommends involving users during design, introduction and diffusion of information systems.

Mumford (2006) noted that socio-technical design contributes two important things. First it tells designers of information systems that the rights and needs of the employees of an organization are as important as the non-social parts given technology or organizational structure changes. Second is the involvement and encouragement of employees decisions are taken that may possibly effect them.
The theory of social technical systems was historically meant to improve working conditions but gives us critical insights on how to successfully involve people in everyday practices. According to Geels (2004) a socio-technical system involves mutual adaptations and feedbacks between the production and the demand side and can therefore be seen as an improvement of the linear model of innovation. In a way the theory of socio-technical systems acts as a bridge between separate views in literature concerning the innovation process. Geels (2004) argues; “It takes the inter-organizational community or field as the unit of analysis, and focuses on the social infrastructure necessary to develop, commercialize and use innovations” (Geels 2004: 900).

It is the social infrastructure that is often neglected when considering the radical innovation process. Although scholars like Lettl (2007) identified barriers that trouble the involvement of users in the innovation process, firms have to keep the social aspect of innovation in their line of focus. Shifting the focus to socio-technical systems opens firms up for more active user involvement because the social aspect of innovation will have a higher value in the innovation process. Following Callahan and Lasry (2004) we see that some scholars in the field are already integrating a more socio-technical perspective.

A recommendation given by Scacchi (2004) tells us that users need to be involved during different phases in the innovation process to positively influence its outcomes. Although Mumford (2006) concentrates on employees his remarks are also important for user involvement if we take in mind that the theory of socio-technical systems places importance on a firms’ environment. Taking the socio-technical approach teaches us that when we are in the process of radical innovation equal importance must be placed on the needs and demands from users as on the technical side of the story. Focus lies not only on the aspect of innovating but also incorporates usability and functionality.
Chapter 4: User involvement in firms and industries

4.1 Users in the innovation process

In certain firms and industries it is routine to involve customers in the innovation process, before we look at what is done there we first need to determine how users can play a role in the process of innovation.

4.2 Market research

The most common method of ‘involving’ customers into the innovation process is through market research. Market research is an instrument through which firms try to identify market trends, the potential of markets that they will possibly try to enter, monitoring of competitors and most importantly to map customers’ preferences.

In the process of radical innovation there are a lot of uncertainties that cannot be addressed by market research. “... because the process is so long and dynamic, the market and technology for the radical innovation may look entirely different at the end of the process than it did in the beginning”. (Lynn et al., 1996:27). This reasoning might explain why in some cases results derived from market research can be misleading and if followed through can end up in product failures. In the case of incremental innovation however much is known in advance and market research can be a useful tool to support the innovation process in determining what is right for the product/service.

Although some of the results collected through market research prove to be useful in some cases of radical innovation, many scholars argue that market research is of greater value in the case of incremental innovation. In their study Song and Montoya-Weiss (1998) found that in the case of incremental innovation market research was an important factor to determine the profitability or to put differently the success of a product. In the process of radical innovation however the opposite is true; “customers’ needs are often not well-defined and competitor capabilities are often not clearly established. As a result, detailed market studies are not of great value and can be exorbitantly costly”. (Song and Montoya-Weiss, 1998:132).

Von Hippel, Thomke and Sonnack (1999) argued: “...if you want to find users that are actively exploring and testing new ideas, it is a waste of time to survey users in the center of the target market. Instead, you must develop methods to seek out users that are at the leading
edge with respect to needs that are important to that market “(Von Hippel, Thomke & Sonnack 1999:9)
They were referring to the lead user approach which will be covered in the next paragraph.
It seems that where the incremental process is much more analytical the radical process is much more experimental in nature because of the uncertainties that are present. As O’Conner (1998) puts it: “The marketing tasks are much more creative, proactive and perhaps inductive in their orientation than under the scenario of incremental change”. (O’Conner, 1998:152)
One important thing to note however that market research is only one method for involving customers in the innovation process.

4.3 Users
When selecting users to involve in the innovation process a firm carefully has to decide which users it wants to involve in the process. Key in this decision is the desired outcome of the process.

J.M. Bonner and O.C Walker (2004) make a distinction between homogenous and heterogeneous customers. Homogenous customers are customers that exert for a large part the same needs, ideas and are in a sense alike. Selecting this type of customers is likely to result in success when a firm is focussing on incremental innovation. “Involving homogenous customers enables a firm to gain deep understanding of specific customer needs and the validation of those needs, which can lead to superior incremental product advancements” (J.M Bonner and C. Walker, JR., 2004:165). Heterogeneous customers on the other hand represent a diverse mix, which exert different needs, ideas and cannot be seen as alike. “Heterogeneous customers bring new and diverse viewpoints and expertise into the new product development project, which then spurs dramatic increases in innovation” (J.M Bonner and C. Walker, JR., 2004:165). It seems that firms that desire to develop radical innovations should select a heterogeneous group of users to involve in the process. There are however still questions about which specific users to involve because only selecting a diverse heterogeneous group of users is not a premise that these users will provide valuable inputs in the innovation process.

Firms therefore need to develop their capabilities in order to select those specific customers that can make valuable contributions to their innovation process. According to Christopher Lettl (2007) firms need to identify two dimensions in order to determine which users to involve in the innovation process. The subject dimension contains knowledge about user characteristics. Having distinguished this dimension makes firms more effective in their search for valuable user input in the distinct phases of the innovation process. The interaction
dimension revolves around the appropriate interaction patterns with users “the personal level of interaction, the number of users, the temporary extent of interaction, and the network competence of the user interaction personnel.” (Lettl, C., 2007:55). Both the subject dimension as the interaction dimension change during the innovation process. The innovation process is comprised out of different phases, because each phase is comprised out of different activities and tasks, involvement of users differs throughout these phases.

User involvement in the innovation process

In innovation literature Von Hippel (1986) has been one of the most important researchers that devoted much of his work on building a theory for integrating customers into the innovation process. Commonly cited is his Lead-user approach which aims to identify and involve users in the idea generation and development phase of innovations. Lead users share the characteristic of facing needs months or even years before they will become general in the marketplace. By obtaining a solution to those needs these ‘lead users’ can benefit significantly. For firms entering into an innovation process ‘lead users’ can offer useful inputs in the development process of a new product. So why should firms focus on the innovative ideas from lead users instead of relying on conventional marketing techniques to identify users needs and develop ideas internally?

The first reason is that user need information is often tacit. Grant (1996) identifies tacit knowledge as ‘knowing how’ this knowledge is not directly accessible to firm; “it can be
appropriated only through its application to productive activity. (Grant 1996: 111). Therefore transfer of this kind of knowledge is costly and time consuming. A firm with competence in the interaction dimension of Lettl (2007) should be able to recognize this fact and build upon appropriate interaction patterns with these users because different types of knowledge require different interaction patterns. Through user involvement the transfer of tacit knowledge from customer to manufacturer becomes obsolete since the customer becomes part of the innovation process.

Second reason is that innovative users are far greater in number than a firm’s internal R&D team and because of that are able to generate and test a lot of different ideas. Furthermore Rohracher (2005) argues that compared with ordinary market research methods focusing on lead users in the process of innovation is often faster and cheaper.

**NOVEL PRODUCT CONCEPTS FROM “LEAD USERS”**

![Diagram](image)

(Von Hippel, E (1986))

What is common in the literature however is that firms must be careful when selecting users to involve in the innovation process. The development of an innovation is also a process that has to happen in a cost-effective way and this is especially true in the world that we live in today. Problems that arise with the lead user approach in practice are that firms simply fail to identify their lead users.

This is demonstrated in Von Hippel, Thomke and Sonnack (1999) study on 3M. 3M used screening surveys; a conventional market research method, to find lead users. It turned out that with limited time and budget they were unable to find their respective lead users. Although the lead user method may be a useful tool for companies in their quest for involving
customers in the radical innovation process, there is a need for a clear description of these users. In 3Ms case networking turned out to be a helpful technique in order to identify lead users but unfortunately the appropriate method differs from case to case. Lettl (2007) therefore questions whether a firm applying the Lead-user method has really developed competence in the subject dimension and finally whether the lead user approach is suitable for the development of radical innovations.

4.4 Case study

**Medical industry**

*Case taken from von Hippel, E., Thomke, S., & Sonnack, M. (1999)*

The medical industry is of particular interest to researchers because of the fact that the end-user typically plays a significant role in the invention and development of an innovation.

An example of this is a study in medical imaging. Focus in the medical industry when considering medical imaging lies on being able to detect the smallest anomalies possible in human bodies. In this way it is possible to detect tumors in their very early stages and as a consequence treatment of patients can commence sooner, something which can very well save human lives. For this reason a team of lead users began to study this subject and through networking they found radiologists who were using machines not yet available in the market. Confronted with problems these radiologists had developed their own innovations. Another interesting finding was that these lead-users were linked to other lead-users outside of the medical industry. Lead-users in the military industry for example had come up with innovative methods concerning imaging that proved to be of value in the medical industry.

Von Hippel (2005) provided an example on how firms can more efficiently profit from these innovating lead-users by providing them with a platform. This was done by General Electric who realized that nearly all major commercially improvements made to medical imaging machines were made by lead-users or by competitors. As a response they created a platform by supplying costly imaging machines at very low prices to scientists. In this way identified user innovations are more easily and faster commercialized because they are based on GE’s technology which gives the firm an advantage to their competition.
4.4.1 Case comments

If we consider the theory, the lead user approach is not directly applicable to this industry because these particular users can’t be specified as typical lead users. The needs these users faced were also faced by other users in the industry but these were unable to develop solutions to their problem. This finding is in contrast with the lead user approach that states that lead users face certain needs months or even years before they will become general in the marketplace. Lettl (2007) studied various cases in the medical industry and concluded that these users cannot be classified as lead-users because they do not possess the characteristics as proposed by Von Hippel (1986). He added however that they exhibited certain similarities like their motivation to solve problems. He argued that these users could be labeled as extreme users and that lead-users frequently appear among extreme users.

Another important finding in this case is that those users that were innovating were linked to other users outside the target market. As J.M. Bonner and O.C Walker (2004) argued that in order for a firm to develop radical innovations they should select an heterogeneous group of customers with different needs and ideas, this heterogeneous group could further be diversified by lead users outside of target markets which is proving to be successful in the medical industry.
Chapter 5: User involvement in the radical innovation process

5.1 Approach to radical innovation
User involvement in the radical innovation process has advocates and opponents and still much research is to be done. Christensen and Bower (1996) concluded in their study that the reason for firms to lose their position of industry leadership is because they listened to carefully to their customers. Customers were seen to place limits on a firm’s strategy which withhold those firms to further develop those promising technologies that turned out to be radical in nature. Firms were primarily focused on fulfilling current customers’ needs in order to protect their market shares. This strategy was also perceived to be less risky since the customers were already there in contrast to the radical technologies which had unpredictable prospects of demand.

From the theory of the previous chapter however it can be argued that these firms might have targeted the wrong customers for their radical innovations and in addition to that used inappropriate marketing techniques. There is still unused potential to profit from customers contributions. Therefore there is a need for a different approach to product innovation that enables firms to identify and select the right customers.

Interesting to that respect is the concept of probe and learning studied by Lynn et al. (1996). In probe and learning firms choose an experimental approach, in the first phase an early version of the product is introduced in a potential market. Reason for this approach is that the firm can learn about the technology, the potential of the market, the promising segments of the market etc.. In a way this circumvents the problems that arise with the application of conventional marketing techniques to radical innovation and collects the data in practice. After this first phase the firm modifies the product and the marketing approach through what it has learned and enters the market again. This process is continued until the product matches its market. Through learning each step is a step forward in performance, clarifies the market and facilitates the acceptance of the product idea.

Looking at the cases in Christensen and Bower (1996) the approach of probe and learning could have been a useful tool for those companies limited by their customers. In fact the industry entrants who overthrew the dominant market position of the industry leaders were successful applying the probe and learning approach.
5.2 Critical user characteristics

Christopher Lettl (2007) described certain barriers concerning the involvement of users that might explain the passive role users have in the radical innovation process. The theory of the previous chapters shows that firms need to target specific users that can have a valuable input in the innovation process. The lead user approach from Von Hippel (1986) has received a lot of attention to this respect but remains rather abstract about how to identify these users. Besides the lead user approach it might be useful to determine critical user characteristics that a user has to possess in order to have a positive impact on the radical innovation process.

Conclusion following Kristensson and Magnusson (2005) is that firms that are in the process of developing a radical innovation should involve intrinsically motivated and technology unrestricted users because they are a source of radical ideas. Users that only exhibit a high motivation but are restricted when it comes to technology are likely to be a source of incremental ideas.

Following Scacchi (2004) on the theory of socio-technical systems Lettl (2007) proposed that the innovation process is comprised out of three different phases: idea generation, development phase and the testing phase. He identified key characteristics for each phase of the innovation process that a user has to possess in order to have a valuable contribution in the development of a radical innovation:

In the idea generation phase firms should target those creative users that are motivated to solve the problem that the innovating firm is seeking a solution for. Furthermore these users have to possess in-depth knowledge and need to be open towards new technologies. Users with strong intrinsic motivation and those that have access to interdisciplinary know-how plus the resources to spend time on research are of particular interest.

In the development phase users need to be involved who can act as co-developers. In order to be able to fulfill this role they must have made either prior or active development contributions in the user domain or technical development contributions in the user domain. Besides their contributions these users also differentiate themselves from the users in the idea generation phase because they also possess characteristics as imagination, a high competence in their own domain, tolerance of ambiguity and technological competencies. These characteristics differ however related to which contributions these users made.
Users in the testing phase obviously have to be open towards new technologies. Furthermore they have to be willing to take some risks and to experiment with the respective innovation.

5.3 Transfer of information

In order for customers to have an impact on the process of radical innovation the transfer information to the firm is crucial. As pointed out in chapter 3 the preferred methods for the transferring of information are discussion and personal contact. Utterback (1971) proposed two mechanisms to which so called boundary transfers can occur. The first mechanism is what he calls two-step flow of communication. In this two-step flow of communication someone inside the firm acts as a communication link between the firm and its external environment. Because this person is knowledgeable about technical side of the story, he/she is able to communicate with technical sources outside the firm. He then acts as a translator to other employees within the firm. The second mechanism that Utterback (1971) is placing personnel outside the boundaries of the firm. In case of user involvement this can be achieved by placing personnel in the customers ‘organization.
Chapter 6: Conclusion, Discussion and Recommendations

6.1 Conclusion

Reviewing the literature on innovation tells us that the success of an innovation is primarily constrained by its ability to recognize the needs and demands of consumers. Striking to that respect is the fact that the radical innovation process seems to focus primarily on the technical side of innovation. This is in contrast with theories on the innovation process in general who seem to have evolved throughout the years by incorporating more social aspects. The theory of socio-technical systems acts as a useful addition to theories concerning the radical innovation process by placing more importance on a firm’s environment and especially the demand side of innovation. It teaches firms to incorporate usability and functionality in their innovation processes by involving users in the various stages of the innovation process. User involvement can thus be seen as a tool to integrate the social aspect of innovation back into the radical innovation process and align outcomes better to the needs and demands of consumers. Important to that respect is the acceptance of an universal definition of radical innovation that enables scholars to generalize findings across the field. The definition provided in this thesis builds upon previous definitions and is therefore one step forward towards that end goal. With an universal definition firms are able to distinguish between radical and other types of innovations. Consequently they are able to determine the appropriate level of user involvement and the techniques to involve those users. When it comes to radical innovation firms need to adapt their techniques and methods to involve users into the innovation process. The lead user approach brought forward by von Hippel (1986) can act as a starting point. There is however not one ideal user to involve in the process of radical innovation. Users that are to be involved differ per firm, per innovation and per phase of the innovation process. This calls for a more complete picture of the critical characteristics that an user has to possess vary. Particular interest has to be placed on users that are linked to other users outside the target market since this brings together a heterogeneous group of users something which spurs innovative ideas as argued in literature by J.M. Bonner and O.C Walker (2004). Firms need to develop capabilities in order to select those users who are able to provide their firm with valuable inputs hereby overcoming the barriers that can withhold users from transferring information. This will however all be in vain when the transfer of information from those users is neglected. Theory on user involvement in the process of radical innovation can act as a guide towards the right direction but it is up to the firms to fully reach user involvements potential.
6.2 Discussion
An explanation for the contradictory findings in literature considering the role of user involvement in the process of radical innovation can for the most part be attributed to the lack of an universal definition of the term radical innovation. The bulk of the papers researched in this thesis developed their own definitions of the term radical innovation. By building upon previous definitions to construct it’s definition this thesis has made a step forward. The lack of an universal definition in the field however prevents the conclusions drawn in this thesis to be generalized.

Through the years it has become clear that the process of radical innovation requires a different approach than the process of incremental innovation. For a lot of firms however the innovation process still remains an internal process. A consequence of this are the failures resulting from applying inappropriate techniques in the process of radical innovation. Drawing conclusions based on these failures causes some contradictory findings.

6.3 Recommendations
In order to be able to generalize findings across the field and truly assess the potential of user involvement an universal definition of radical innovation has to be adopted. Future research may concentrate on developing clear guidelines for this universal definition since identifying radical innovation through criteria still remains rather arbitrary. What is seen as a radical innovation by one scholar may be contested by others and in fact resembles the current situation where no universal definition applies. It is described in literature that firms need to develop capabilities in order to be able to identify those users that are able to provide valuable inputs in the radical innovation process. Little research however has been done on how firms can successfully develop those capabilities. Furthermore research on the boundaries of user involvement in radical innovation process can further guide firms in their quest to successfully innovate.
References


