Radical and Open Innovation: The Challenge for Established Firms

By

Charlotte LEROY

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Signature of Author: Signature redacted

MIT Sloan School of Management
May 9, 2014

Certified By: Signature redacted

Michael A. Cusumano
SMR Distinguished Professor of Management
Thesis Supervisor

Accepted By: Signature redacted

Michael A. Cusumano
SMR Distinguished Professor of Management
Program Director, M.S. in Management Studies Program
MIT Sloan School of Management

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ABSTRACT

Past research has shown that breakthrough innovations are often prevalent in the context of entrants rather than incumbents. There are many challenges associated with radical and open innovation initiatives for established firms. Innovation theory provides insights into one main challenge which is the definition of innovation and innovativeness itself especially with regards to its level of radicalism. The shift towards the paradigm of open innovation described by Chesbrough has made it even harder for established companies to set a strategy for managing innovation. This thesis draws on academic research as well as practitioners of innovation management recommendations to prescribe innovation strategies together with key success factors. It focuses on the case of "Innovation centers" - pockets of innovation-minded employees embedded in the larger structure. These innovation centers encompass different types of initiatives such as incubation and acceleration, rapid prototyping, identification of strategic partnerships, trend watching and ethnography. This thesis provides an illustration of innovation centers through a study of the organizational setup and challenges encountered by four innovation centers.

Thesis Supervisor: Michael A. Cusumano
Title: SMR Distinguished Professor of Management - Program Director, M.S. in Management Studies Program, MIT Sloan School of Management

"I came to the conclusion long ago that limits to innovation have less to do with technology or creativity than organizational agility"

Ray Stata

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1 Introduction

Established companies tend to lose their edge for radical innovation. Indeed, they rely on processes that are designed to optimize current businesses rather than exploring disruptive offerings. However, to stay ahead of competitors and satisfy shareholders' expectations, large companies need to innovate on a radical level (Christensen, 2003). Indeed, investors discount into the present value of a company's stock price the rate of growth they foresee the company achieving. Therefore, even if a company's core business is growing, the only way its managers can deliver a risk-adjusted rate of return that is above market average is through growing faster than what the market expects. The magnitude of the market's bet on growth from new lines of business is in general based on the company's historical ability to radically innovate. Even though incumbents usually possess more research capacities and financial resources than new entrants, they are often not as well positioned to innovate. Therefore, C-level executives are always looking for ways to make their company more innovative. Several of these strategies are discussed in this paper with a focus on the establishment of innovation centers.

The second section provides a review of innovation theory. It introduces the challenges associated with defining innovation itself as well as a typology (Garcia & Calantone, 2002; Henderson & Clark, 1990; Christensen, 1997, 2003) of different degrees and types of innovations. The historical evolution (Zhao, 2013; Rothwell, 1994) towards the current paradigm of open innovation (Chesbrough, 2003) that most firms are trying to adopt is introduced. The demand-side (Rogers, 1995) of innovation is discussed.

The third section describes how companies can successfully innovate despite the various obstacles that they face. Providing recommendations for firms to better innovate is very difficult especially as innovation is very hard to measure (Shapiro, 2006). Some have provided frameworks (Dyer,

Gregersen, & Christensen, 2011; Boly, Morel, Assielou et al., 2014) including based on patents, financial premium analysis and percent of revenue from new product. In the Open Innovation age described by Chesbrough (2003), frontiers between a firm's research and innovation capacities and the outside world must be very porous. Moreover, companies can adopt different types of innovation strategies (Jaruzelski & Dehoff, 2007) which would imply mobilizing different kind of skills at different stages of the innovation chain (West, 2006). Practitioners of innovation management recognize that the main issue with increasing firms' innovativeness is often cultural (Kingdon, 2012). Therefore, different steps can be taken to help the company on its cultural evolution from closed to open innovation.

The fourth section introduces one of such initiatives - "innovation centers" - pockets of innovation-minded employees embedded in the larger structure. These innovation centers encompass different types of initiatives such as incubation and acceleration, rapid prototyping, identification of strategic partnerships, trend watching and ethnography. This paper provides an illustration of innovation centers through a study of the organizational setup and challenges encountered by four innovation centers.

This study identifies how innovation centers can stem from different approaches to innovation: market compared to research oriented, top-down or bottom-up approach, organizationally centralized or decentralized. One of the main challenges encountered by innovation managers is to demonstrate the efficiency of their center as traditional metrics are often irrelevant. This does not come as a surprise as innovation itself is extremely hard to measure due to its ever-changing nature (Shapiro, 2006). The conclusion that is drawn from academic publications analyzed and the qualitative study performed in this paper is that the main goal for setting an innovation center is to change the main organization's culture.

2 Innovation theory review

When reviewing innovation theory, one must first realize that defining innovation itself proves a challenging task. The first section gives a definition of innovation as well as a typology of different degrees of radicalism and types of innovations. The second section provides a view of innovation at the center between technology and the market where the historical evolution of innovation management towards the current open innovation paradigm is described. The section ends with a discussion of the demand-side of innovation.

2.1 Defining innovation

Innovation is a well-researched topic with great avenues left to explore. According to Schumpeter (1934), the "process of creative destruction" allows incumbents to hold only temporary monopoly power until a more innovative product or service, which is usually delivered by fresh entrants, disrupts the market and overthrows the incumbent. Even large firms need to embrace "creative destruction" or disappear.

Defining innovation in itself proves to be a challenge as Garcia and Calantone (2002) show. To address this issue, this paper will follow the Organization for Economic Co-operation and Development's (OECD) Oslo manual. The OECD (2005) defines innovation as "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".

Moreover, the OECD (1991) insists on two key points for innovation. First, the innovation process comprises the technological development of an invention combined with the market introduction of that invention to end-users through adoption and diffusion. Second, the innovative process is iterative in nature and thus, automatically includes the first introduction of a new innovation

and the reintroduction of an improved innovation. It is important to note that this iterative process implies varying degrees of innovativeness and therefore necessitates a typology to describe different types of innovations.

Garcia and Calantone (2002) suggest a typology of innovativeness based on distinction of newness on a macro level or micro level. Incremental innovations incorporate product improvements into innovations using existing technologies targeted towards existing markets. On the contrary, really new product innovations result in either market discontinuities or technology discontinuities but not both on a macro level and both types of discontinuities on a micro level. Radical innovations are very rare and imply discontinuities in both the existing market structure and the existing technology structure.

In the innovator's dilemma (Christensen, 1997), two types of innovations are opposed: sustaining and disruptive. A sustaining innovation targets high-end customers with better performance than what was previously available. On the other hand, a disruptive innovation does not bring better product to customers in existing markets. Rather, it brings products or services that are not as good as existing products but but offer other benefits- convenience, simplicity or lower price. Therefore, disruptive innovations appeal to new or less-demanding customers.

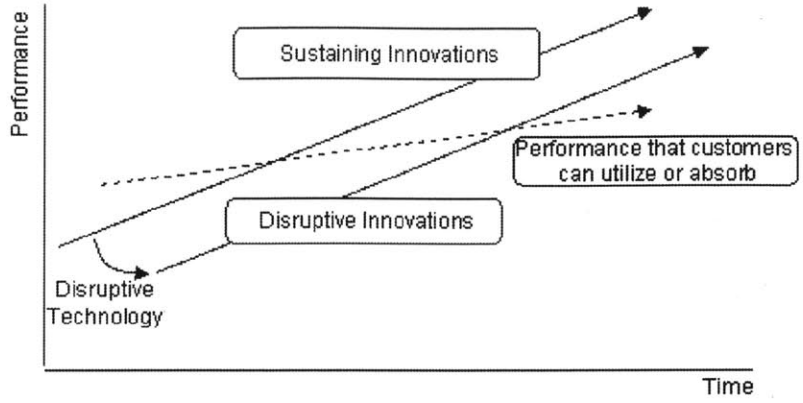

Figure 1[1]: The disruptive innovation model

In the innovator's solution (Christensen, 2003), value networks are described as the context within which a firm establishes a cost structure and operating processes and works with suppliers and channel partners in order to respond profitably to the common needs of a class of customers. The third dimension in the figure below represents new value networks - new contexts of consumption and competition. Christensen identifies two types of disruptive innovation: new market disruptions which create a new value network and low-end disruption which attack overserved customers at the low-end of the value network.

Incumbents generally succeed in sustaining innovations whereas succesful disruptions are often launched by new enterprises. Indeed, disruption does not suit industry leaders whose resource allocation processes are perfected for sustaining innovation. They have an incentive to go up-market and no incentive to defend the new or low-end markets that the disruptors find attractive. Christensen calls this phenomenon asymetric motivation.

[1] Source: 12manage.com

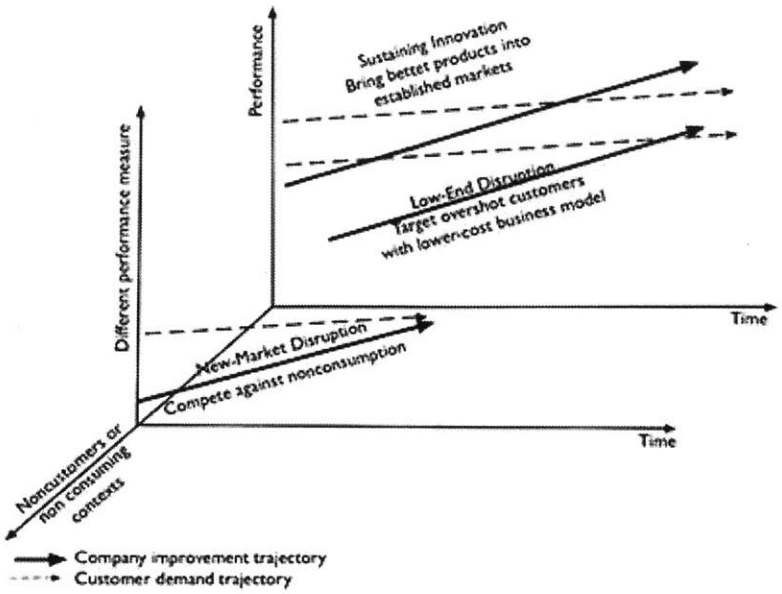

Figure 2[2]: The third dimension of the disruptive innovation model

Henderson and Clark (1990) introduces a different typology for defining innovation. The idea is described in the following matrix where the horizontal axis captures an innovation's impact on components while the vertical dimension captures its impact on the linkage between components. Therefore, an architectural innovation reconfigures an established system to link together components in a different way whereas a modular innovation changes the core design concepts.

[2] Source: http://www.proclivis.com/Blog/tabid/321/categoryid/1/Default.aspx

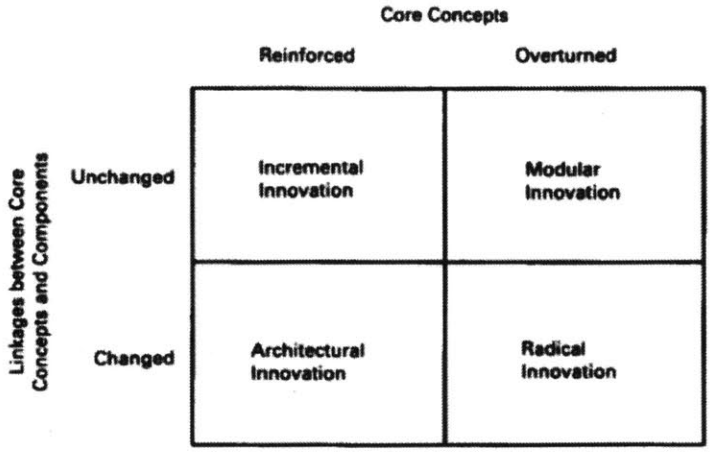

Figure 3[3]: A framework for defining innovation

An important point about innovation that is recurrent in the literature is that an invention does not become an innovation until it has processed through production and marketing tasks and is diffused into the marketplace (OECD, 1991; Layton, 1977; Smith, 1996). An innovation differs from an invention in that it makes a positive economic contribution to the firm. Innovation includes not only basic and research but also product development, manufacturing, marketing, distribution, servicing and later product adaptation and upgrading (Smith, 1996).

Finally, the difference between process and product and process innovation must be clarified. The primary focus of process innovations is the efficiency improvement of the production process for product innovations according to Utterback (1996).

2.2 Science, technology and innovation

A traditional view of the relation between science and technology (Brooks, 1994) is that the innovation process follows a 'pipeline' process where technological progress stems from advances in science and then follows a progression from applied research, design, manufacturing and finally

[3] Source: Henderson & Clark (1990)

commercialization and marketing. This model is most probably derived from some of the most notable successes from World War II including the atomic bomb, the radar and the proximity fuse. A consequence of this is confusion in the public view between science and engineering and an equating of organized research and development (R&D) with the innovation process itself. The content of R&D is treated as a black box that yields profits almost independently of what's inside it (Brooks, 1993). Nelson (1992) defines innovation as "the processes by which firms master and get into practice product designs that are new to them, whether or not they are new to the universe or even to the nation". Therefore, newness in context is more important than newness to the universe. Indeed, the activities and investments associated 'technological leadership' in the sense of absolute novelty differ much less than is imagined from those associated with staying at the forefront of best practice.

2.2.1 History of the innovation process

ERAS	INNOVATION TRENDS	OUTCOMES
First Generation (1950 - 1965) Post- War Industrialization	Technology Push	Pro-active R&D New industries No improvement on innovation processes Linear R&D approach: more R&D resources
Second Generation (1965 - 1970) A shift towards demand	Market Pull	Reactive R&D Increase manufacturing productivity Innovation based on existing technologies A shift towards demand Emphasis on marketing Technological incrementalism Public policy procurement
Third Generation (1970 - 1985) Birth of Intrapreneurship	"Coupling" Model of Innovation (Rothwell and Zegveld, p50)	Start of empirical innovation studies Increasingly complex innovation process Innovation as multi-factored approach Intrapreneurs at heart of success
Fourth Generation (1985 -1990) Integration & Parallel Development	Emphasis on Technology Strategy	Pushed Economic Recovery (Peters and Waterman, 1982)
	IT-based manufacturing	Improved manufacturing strategy (Bessant, 1991) "Design for manufacturability" movement
	Global Strategy Emergence	External networking effect
	Shortened product life cycles	Creation of time-based strategies (e.g., JIT in Japan)
Fifth Generation (1990- 1995) Technology-enabled Innovation	Increasing resource constraints	Emphasis on control of product development speed and "fast innovation" to accelerate product development. Design for Manufacturability
	Lean Innovation	Systems Integration and Networking (SIN) Increased Corporate Flexibility & Responsiveness Networking (joint and collaborative strategic alliances) Parallel (real time) Information Processing
	Concern for the Environment	Intensified regulations

Table 1[4]: Five generations of innovation processes

Rothwell (1994) describes five generations of innovation processes (Table 1) in recent history from the 1950's to the mid-1990's. For each of these generations, he identified opportunities and constraints that impacted how firms and industries innovated. During the Post-War II era (First Generation), R&D was considered as an input that generated linear product performance output. The

[4] Source: Zhao (2013) and Rothwell (1994)

model was one of technology push. Market pull only appeared in the second generation which emphasized product marketing rather than product development. In this new model, R&D focused on improving existing technology through incremental innovation. At this time, the US government started to include innovation boosting in its public policy. In the 1970s, the intrapreneurship shift took place and firms began to understand that their innovation success depended on skilled and passionate individuals. Rothwell (1994) also theorized that many factors were crucial to perform innovation in a "balanced and well-coordinated manner". The fourth generation was led by Japan which introduced new manufacturing processes such as Just in time (JIT) manufacturing. The focus was on integration and parallel development as supported by academic work which made innovation processes more complex. Lean Innovation as introduced by Rothwell (1994) began in the 1990s as a practice to create and preserve value for customers by using an optimized amount of resources (Claus & Sonnenberg, 2011). Lean innovation means that as few resources as possible are used to provide the same amount of value to the consumer. This generation intensely leverages advances in technology such as CAD, integrative IT and digital databases. Moreover, innovation started to become a global and open process with companies leveraging an external network of partners including academic groups and other R&D firms.

Henry Chesbrough (2003) introduces the theory of a "paradigm shift" (Kuhn, 1962) from closed to open innovation. In the closed model, successful innovation requires control. He defines open innovation as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology". In a world of distributed knowledge, the paradigm stipulates that innovation should move more freely inward and outward of the company. Indeed, the company cannot rely entirely on its own R&D and should buy or license innovation from others. Moreover, innovations that are not useful to the company should be taken outside the company through licensing, joint-ventures or spin-offs. Innovation networks can include users, rival companies and academic institutions. Chesbrough takes the example of the PARC

group at Xerox which produced high potential technologies which were eschewed by Xerox because they did not fit the company's business model. Some of these innovations were subsequently taken out of the firm by the engineers and reached large market valuations. This example illustrates the potential loss of value for shareholders due to not having established processes to scout promising technologies.

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all of the smart people work for us* so we must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop and ship it ourselves.	External R&D can create significant value: internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We don't have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is better than getting to market first.
If we create the most and best ideas in the industry, we will win.	If we make the best use of internal *and* external ideas, we will win.
We should control our intellectual property (IP) so that our competitors don't profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

* This maxim first came to my attention in a talk by Bill Joy of Sun Microsystems over a decade ago. See, for example, A. Lash, "The Joy of Sun," The Standard, June 21, 1999, http://thestandard.net.

Table 2[5]: Open versus closed innovation

The table above states the principles of Open Innovation as opposed to Closed Innovation. Open innovation includes different types of initiatives:

- Product platforming involves introducing partially completed products that users can innovate upon. This concept strongly relates to the user innovation introduced by Von Hippel (2005) which stipulates that more innovations are generated by end users than by manufacturers.
- Idea competitions (MacCormack, Murray, & Wagner, 2013) involve incentivizing contributors to compete at innovating by rewarding the best submissions.
- Customer immersion which is often called ethnography by innovation agencies such as IDEO[6] and Continuum[7] involves extensive customer observation.

[5] http://sloanreview.mit.edu/article/the-era-of-open-innovation/
[6] http://www.ideo.com/
[7] http://continuuminnovation.com/

2.2.2 Demand dynamics: the diffusion S-curve

Users in a social system don't adopt innovation at the same time. Instead, they adopt it in an over time sequence. The following figure shows that the cumulative share of adopters over time usually follows a S-curve (Rogers, 1995) with more and more users adopting the innovation until the curve reaches an inflection point and the adoption rate decrases until the market reaches saturation.

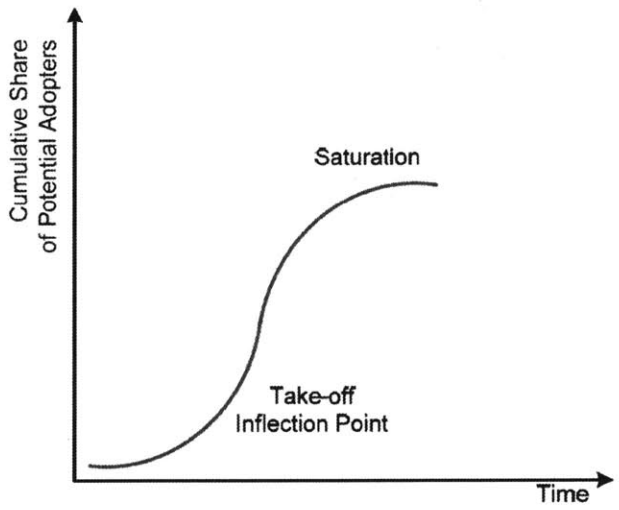

Figure 4[8]: The market S-curve

The same data when plotted in terms of number of new adopters for a new technology follows a bell-shaped curve over time. It is called the technology adoption life cycle model. It introduces a psychographic typology: a mix of psychology and demographics that makes each user group's response different from the other group. The key to a successful marketing campaign is to be able to ride the wave from one user group to the following from left to right. High-tech enterprises manage disruptive innovations (or discontinuous innovation according to Moore's terminology) routinely. Therefore, the technology adoption life cycle marketing model which fits perfectly this type of innovation has been

[8] Source: Rogers (1995)

adopted as an industry reference. However, sooner or later, all industries are exposed to disruptive innovations. Therefore, all industries can benefit from this model.

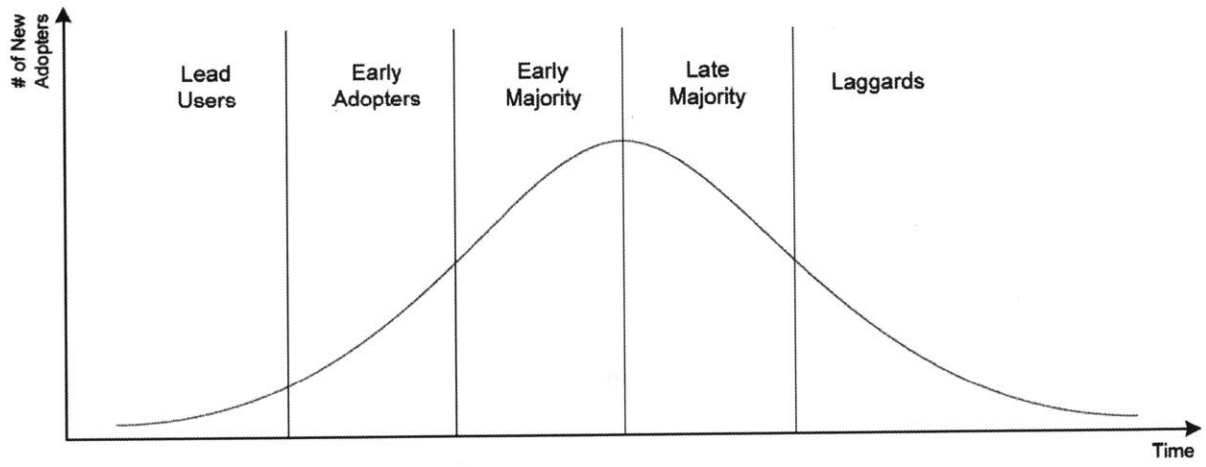

Figure 5[9]: The standard Technology adoption life cycle model

The main issue is that one of the characteristics from those user groups or market as they are defined in Crossing the chasm (Moore, 1999) is that markets reference among themselves which means that they mainly use feedbacks from other users within the same group as reference point. Therefore, there is a gap in adoption between each of the markets. However, the biggest gap- which is called the chasm- is between the early adopters and the early majority. Indeed, the early majority group is looking for references within the group before adopting the technology. However, as each member of the group has the same reasoning, it takes a lot of skills to cross the chasm. Crossing the chasm is essential to any business as the early majority and late majority group each make up for one third of the total potential customers.

[9] Source : Rogers (1995)

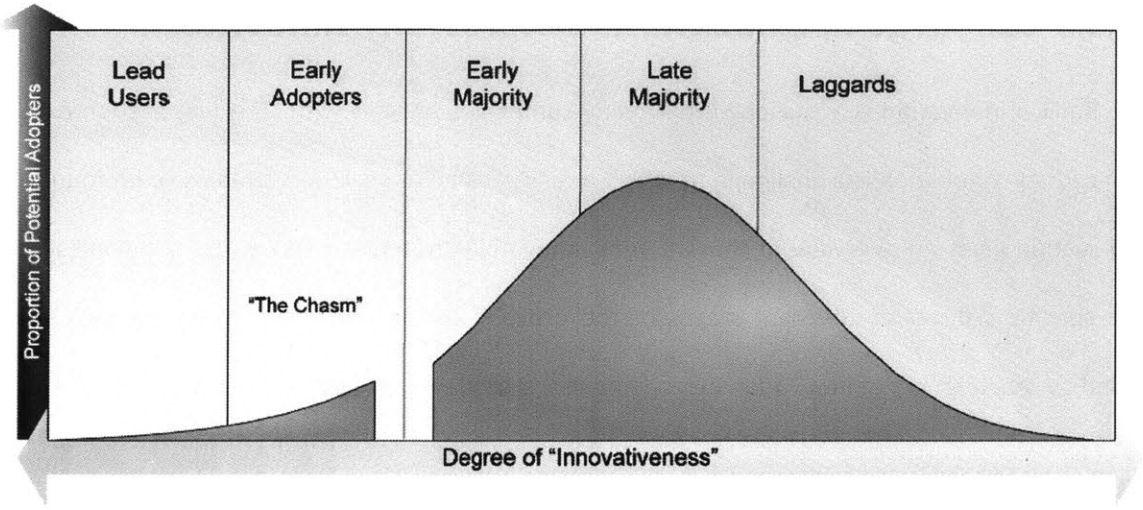

Figure 6[10]: Crossing the chasm

[10] Source : Moore (1999)

3 How can large organizations successfully innovate?

Radical innovation is a challenge that many companies struggle with. The first section explains how measuring innovation is a challenge to which a fully satisfactory solution remains to be found. The second section gives an overview of the different innovation strategies followed by companies which require specific skillsets at different stages of the process. In the third section key success factors identified by practitioners of innovation management and academic publications are discussed.

3.1 Measuring innovation

3.1.1 Patents

From a researcher's standpoint, patents are an attractive way of measuring innovation because data is publicly available. However, there are several flaws which arise from using patents as a measure of innovation. First, patents measure mainly the idea generation phase[11] of the innovation process (Rosenberg, 1976, 1982, 1994). Smith (2005) points out: "Patents also of course have weaknesses, the most notable of which is that they are an indicator of invention rather than innovation; they mark the emergence of a new technical principle, not a commercial innovation. Many patents refer to inventions that are intrinsically of little technological or economic significance." Chesbrough (2006) adds: "Technologies acquire economic value when they are taken to market with an effective business model. When research discoveries are driven by scientific inquiry and are not connected to any business purpose, the commercial value of the resulting discoveries will be serendipitous and unforeseeable." Another drawback of using patents as an indicator of innovation is that they do not pick up innovations in services, business processes and business models (Chesbrough, 2006) as well as in small and medium enterprises (Macdonald, 2004). Kleinknecht and Mohnen (2002) make the following observations: "It is obvious that the patent indicator misses many non-patented inventions and innovation. Some types of

[11] See Section Innovation value chain

technology are not patentable, and, in some cases, it is still being debated whether certain items (eg, new business formulae on the internet) can be patented. [...] The above implies that, when using patents as an innovation indicator, we are likely to make four types of systematic mistake. First, we underestimate innovation in low technological opportunity sectors. Second, we over-estimate innovative activity among firms that collaborate on R&D. Third we underestimate the rate of small firms that innovate. And finally, we overestimate the innovation intensity of small-sized patent holders." Kleinknecht and Mohnen (2002) conclude by explaining that it is better to use a wide array of methods when measuring innovation.

3.1.2 Innovation premium

Given the unreliability of patents as a mean to measure firms' innovation, others have proposed alternative methods. Dyer, Gregersen and Christensen (2011) use a method relying on investors' ability to identify firms they expect to be innovative now and in the future. The methodology measures firms' innovativeness using their innovation premium: the difference between their market capitalization and a net present value of cash flows from existing businesses. The difference represents the educated guess that the company will be able to generate profitable new growth. However, the technique's high dependency on financial data and therefore accounting methods makes it difficult to use it to compare firms' innovativeness across sectors and size.

3.1.3 Percent of revenue from new products

Shapiro (2006) emphasizes the difficulty of measuring innovation using a universal yardstick. He says: "The essence of innovation is novelty, so it stands to reason that some innovation will elude any pre-set measuring scheme. It may even be that the most effective innovation is that which so changes the scheme of things that it makes the old measuring scheme obsolete!" Nonetheless, he suggests two possible ways of measuring innovation: percent of revenue from new products and cross-indexing with

percent of revenue from new platform. However, this definition still has some flaws such as uncertainty over the period during which an innovation is considered new and how radical the innovation needs to be to be considered new.

As a conclusion, there is no universal method to measure innovation and a wide array of techniques must be used to benchmark firm's performance along that axis.

3.2 Innovation strategies

3.2.1 Innovation value chain

The organizational behavior literature recognizes that innovation is not a singular event but a process with several phases (West, 2006). Therefore, behaviors and skills that are relevant during one phase of the process might be superfluous in the following phase. For example, creativity is crucial for idea generation but does not help with working through the solution's details (West, 2002). A helpful framework used to conceptualize innovation is the innovation value chain (Hansen, 2007; Roper, 2008). This model introduces three steps in innovation: idea generation, idea selection and testing and idea diffusion. Recent publications extended the value chain to five steps (Eggers, 2009; Management Advisory Committee, 2010). These frameworks break the idea selection step into two steps and add a conversion step for embedding the new ideas internally prior to diffusion. Kastelle (2011) emphasizes the fact that most techniques and resources focus on the idea generation phase: brainstorming, gamestorming, design thinking, crowdsourcing and the TRIZ (Teoriya Resheniya Izobretatelskikh Zadatch) theory of inventive problem solving. However, according to their research, only 5% of firms struggle with this particular phase of innovation. Tremendous resources are therefore wasted on the idea generation phase of innovation and should be devoted to other phases that are bottlenecks.

3.2.2 Typology of innovation strategies

Jaruzelski and Dehoff (2007) argue that key innovation success factors depend on firms' characteristics. More specifically, he establishes a typology of companies according to their innovation strategy: need seekers, market readers and technology drivers. Need seekers focus on current and potential customers and rely on superior end-user understanding to be first to market with new products or services. Market readers create value introduce incremental changes and capitalize on proven market trends. Technology drivers leverage their R&D to offer breakthrough and incremental changes, often tapping the unarticulated needs of their customers via new technology.

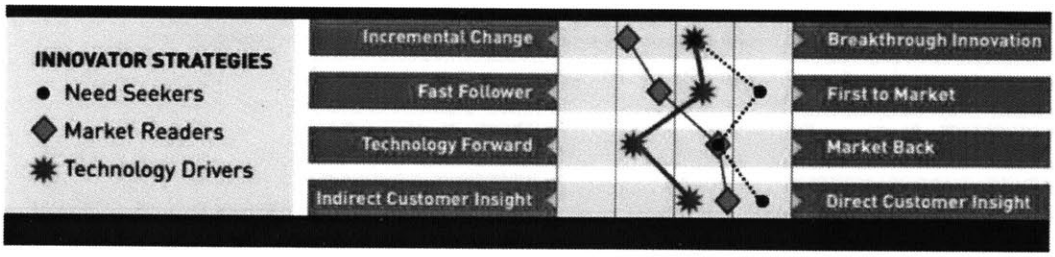

Figure 7[12]: Profile of three innovation strategies

For each of the innovation strategy categories, success depends on a different set of ingrained capabilities at every stage of the innovation value chain: from ideation, project selection, product development and commercialization.

[12] Source : Strategy+Business. Booz&Company. Issue 47

	IDEATION	PROJECT SELECTION	PRODUCT DEVELOPMENT	COMMERCIAL-IZATION
NEED SEEKERS Identify unmet customer needs through direct feedback and strive to be the first to market with breakthrough products. Example: DeWalt (power tools)	• Gather customer insights and analyze customer needs • Segment customer base	• Rigorously manage return on innovation investment	• Design products that respond to customers' priorities	• Successfully launch, position, and price wholly new products
MARKET READERS Focus on incremental changes to products and use a second-mover strategy to keep risk low. Example: Plantronics (audio equipment)	• Conduct market research • Gather competi-tive intelligence	• Maintain strong process discipline	• Bring products quickly to market with an emphasis on increased modularity and simplicity	• Carefully manage product life cycle and retirement
TECHNOLOGY DRIVERS Rely on technological breakthroughs from internal R&D efforts and seek to meet their customers' unarticulated needs. Example: Siemens (engineering and electronics)	• Scout new technologies • Map emerging technologies and analyze trends	• Manage risks	• Test rigorously for quality	• Capture customer feedback

Figure 8[13]: Essential capabilities

The top-performing companies in each of the innovation strategies, whether they are classified as Need Seekers, Market Readers, or Technology Drivers, all agree on a shared set of critical innovation capabilities, but for each of the three strategies, a distinct set of capabilities - such as resource-requirement management and supplier-partner engagement for Market Readers - ranks among the most critical.

[13] Source : Strategy+Business. Booz&Company. Issue 47

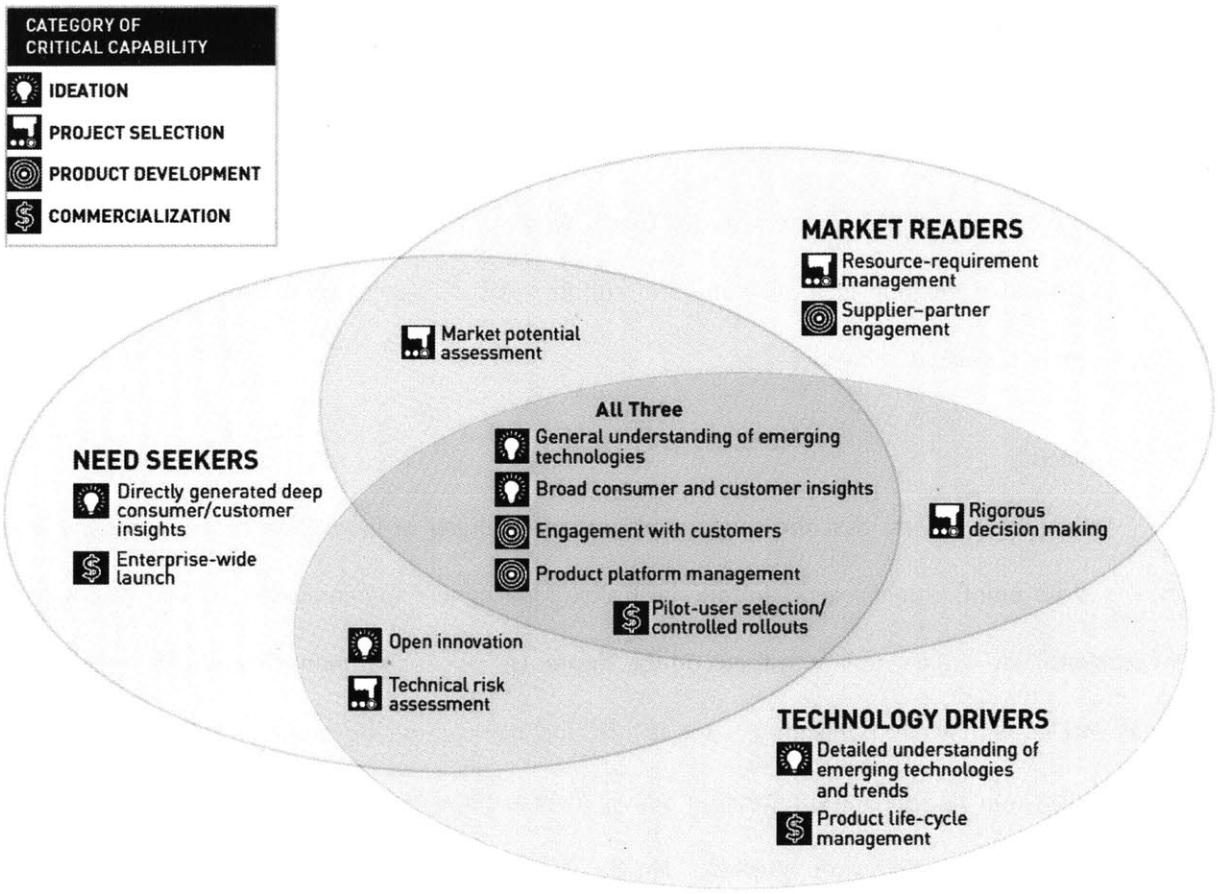

Figure 9[14]: Critical and Specific Capabilities by Strategy

McDermott (2002) introduces a differentiation on the management of radical versus incremental innovation. He breaks down the issues in terms of market scope, competency management and people.

3.3 Key success factors

The one common result about success factors leading to innovation is that there is not one single factor but rather a multitude of them. Indeed, there is no single determinant of a firm's performance. As Jaruzelski and Dehoff (2010) shows, there is no statistically significant relationship

[14] Source : Strategy+Business. Booz&Company. Issue 51

between financial performance and innovation spending, in terms of either total R&D dollars or R&D as a percentage of revenues. The following sections single out several of the main key success factors in innovation and provide recommendations based on academic research as well as advice from innovation management practitioners. From these sources, it arises that the main determinant of successful radical innovation in a company are: culture, physical space, people, organization, flexible management of financials and processes.

3.3.1 Culture

Tellis (2013) asserts that the single most important driver of innovation in any company is its culture and he points out three organizational traits: a willingness to cannibalize existing products, a risk-taking attitude and the ability to focus on the future. He argues that managers need to provide the right incentives with weak punishments for failure and high upside for success. Second, he advises companies to stimulate internal competition among diverse innovative ideas through initiatives such as idea fairs or commercialization contests. Finally, he says that innovation champions must be empowered. Most of innovation management literature recognizes that the main barrier for the implementation of an open innovation approach is cultural. For example, Ades (2013) shows it through studying the cases of Natura, IBM and Siemens in Brazil.

3.3.2 Physical space

Allen (1984) shows an exponential drop of frequency of communication between engineers as the physical distance between them increases. Moreover, he shows that this law is still valid with today's use of new communication means. "For example, rather than finding that the probability of telephone communication increases with distances, as face-to-face probability decays, our data show a decay in the use of all communication media with distance (following a near field rise). [...] We do not keep separate sets of people, some of which we communicate in one medium and some by another. The

more often we see someone face-to-face, the more likely it is that we will telephone the person or communicate in some other medium."

Similarly, Kingdon (2012) stresses the importance of physical space as a means to increase innovation. Therefore, he advises to create occasions for innovators to bump into each other through a shared kitchen or other architectural design. An example of physical space providing opportunity for interaction and thus innovation is the Infinite Corridor at MIT.

3.3.3 People

Kingdon (2012) introduces the key competencies needed to be a successful innovator: ambition, humility, confidence, collaborativeness, flexibility and being a finisher while recognizing that one does not need to score high on all of these traits to be a successful innovator. Moreover, research conducted by Dyer, Gregersen and Christensen (2011) shows that there are five "discovery skills" that distinguish the most creative executives: associating, questioning, observing, experimenting, and networking. He also found out that senior executives of the most innovative companies don't delegate creative work but rather do it themselves.

As a prescriptive analysis, Christensen (2003) explains that executives chosen to lead innovation initiatives should not be selected on past achievements but past experiences. Indeed, he argues that innovation requires a very flexible mindset. Therefore, having been successful in climbing the very structured and process-oriented ladders of an organization is not a good indicator of future success in an innovation-oriented position. Innovation leaders should be chosen on their experience with dealing with situations that required a flexible mindset. Moreover, in order to ensure that new generations of leaders emerge, younger leaders must be empowered too.

3.3.4 Organization

Kingdon (2012) explains how a big company needs safe zones where innovators can think and experiment freely. He specifies that these safe zones need "a greater degree of continuity than the wider organization is used to, genuine independence, endorsement from the top, a 'lightning rod' structure to resolve issues fast and an investment in new skills." He also recommends that the company do not parent their innovation team excessively.

3.3.5 Financials

Too much emphasis on financial metrics impedes disruptive innovation. Obviously, financial data must not be ignored but metrics such as NPV or ROI should be used as rough guideline according to Dyer, Gregersen and Christensen (2011). Indeed, ranking projects accordingly will lead to a counterproductive selection of projects because the most powerful growth strategies are aimed at difficult-to-measure-markets.

3.3.6 Processes

Ardalan, Goel and Brahm (2013) identify a gap between executives' understanding of the importance of innovation and their appreciation of their firm's innovativeness. He attributes this discontinuity to several process factors which he classifies into three types: the project portfolio, the structure of the R&D organization and the development processes employed to manage innovation.

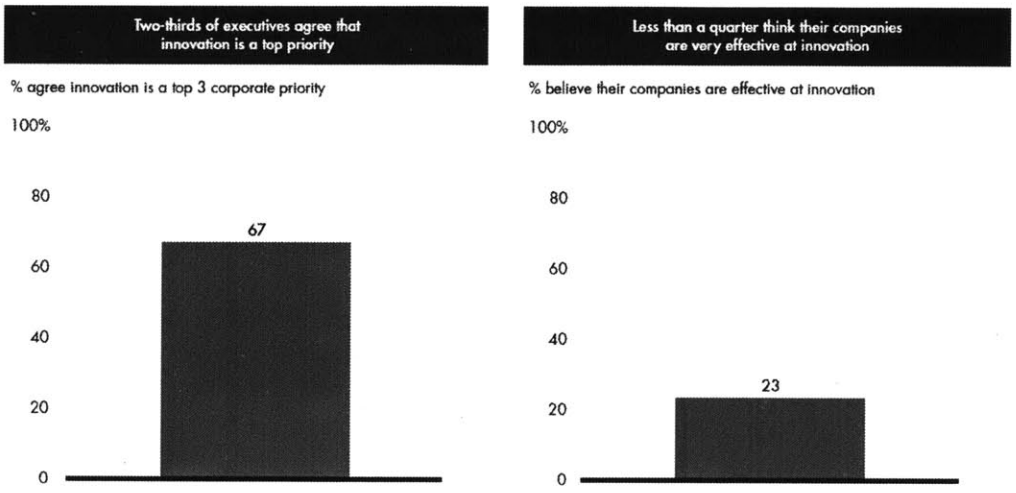

Figure 10[15]: Executives know innovation is important, but they don't believe their organizations do it effectively

Moreover, innovation practitioners recommend best practices that can be implemented in addition to the guidelines mentioned above. Kingdon (2012) mentions that the grapevine – the informal communication network between employees – plays a significant role in how initiatives are perceived inside the company and ultimately impacts their success. Therefore, he recommends that innovation leaders use it to their advantage.

He also recommends that innovation challenges be scoped. Having a debate early on with key stakeholders about what is in and out of the scope enables innovators to be creative and not to waste time and energy on ideas that will ultimately be rejected by decision-makers. Anthony (2009) emphasizes the need for "picking a playing field".

An example of a powerful process that has been introduced by IBM's CEO Sam Palmisano is Innovation Jams: "massively parallel conferences" online. They are used to unite the organization around the promotion of innovation (Bjelland & Wood, 2008; Cleaver, 2014). Top executives attend and tens of thousands of people engage at a time.

[15] Source : Bain & Company ; Ardalan (2013)

4 Innovation centers case studies

This section provides innovation centers case studies. Innovation centers stem from the principles of open innovation. The first section defines innovation centers while following sections describe innovation centers at large companies: EDF, a large consumer electronics group, Air Liquide and Orange. The information in the following sections has been gathered through conversations with leaders in those companies' innovations centers.

4.1 Innovation centers

Innovation centers are comprised of many different types of initiatives. They often combine several approaches to innovation management.

- Incubation and acceleration: Identifying startups which could be good suppliers or partners and providing them with funding and mentoring
- Rapid prototyping: Demonstrating new ideas by doing
- Potential partners identification: Identification of startups or larger companies which could be good suppliers or partners and establishing strategic partnerships
- Trend watching: Keeping up with trends through social and real-life network monitoring
- Ethnography: Observing and analyzing users activities

Depending on the company, innovation centers can focus on one of those activities or combine several of them.

4.2 EDF

EDF[16] (Electricite de France) is a French electric utility company which is 85%-owned[17] by the French government. EDF is the world's largest electricity producer[18] and it mainly produces nuclear power.

4.2.1 EDF Open Innovation Team

The Open Innovation team[19] at EDF was created from a bottom-up approach. The process was put in motion by three researchers in the EDF Energy department in Chatou (France), Palo Alto and Beijing who had begun scouting start-ups that may fill specific business units' needs. Chatou, Palo Alto and Beijing are EDF's three largest R&D centers. In 2009, this came to the attention of the new R&D head who wanted R&D to be closer to the market and in 2011, the team was officially created.

The team is comprised of three units[20]. The first one is focused on promising start-ups detection and employs ten people worldwide. It is a scattered team with three different region focuses in Asia, Europe and North America. The second unit focuses on supporting internal R&D projects commercialization. It employs three people who work in close partnership together with the Intellectual Property department. The last part of the team includes the five employees of Electranova Capital, the cleantech venture capital fund launched in partnership with Idinvest[21] in 2012. The team's last addition was in 2012 and it mostly grows internally by absorbing other entities or by hiring EDF veterans.

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[16] http://en.wikipedia.org/wiki/%C3%89lectricit%C3%A9_de_France
[17] http://online.wsj.com/news/articles/SB10001424127887323646604578404260912499092
[18] http://www.lepoint.fr/economie/les-dix-principaux-producteurs-d-electricite-dans-le-monde-10-08-2010-1223756_28.php
[19] http://www.youtube.com/watch?v=aDmhgTrHnH0
[20] http://researchers.edf.com/organisation/partnerships/team-open-innovation-94530.html&return=44342%2526page%253D3
[21] http://www.idinvest.com/en/Idinvest-Partners-in-partnership-with-EDF-and-with-the-support-of-Allianz-announces-the-first-closing-of-Electranova-Capital-communiques_31.pdf

The team also occasionally partners with the Communication team on specific projects. For example, it supports the Pulse[22] project. Pulse is a challenge that was launched in 2013 by the communication department. It is a worldwide contest designed to promote innovation and support 200 startups in the field of power and lifestyle (focusing on Home, Mobility & Health). Each of the three winning projects receives €35,000 prize money and benefits from a major advertising campaign across Europe.

EDF Open Innovation team worked with the innovation consultancy Bluenove[23] to benchmark innovation processes of competitors and MNEs.

4.2.2 Example of projects

The first project example is a partnership with French start-up Techway[24] to commercialize a technology which was developed by EDF researchers. The signal and image processing technology was first developed to solve blurring issues caused by heat in nuclear plants cooling ponds. Techway purchased a license from EDF to commercialize the technology which is used in a broader set of applications that the initial application it had been developed for: defense, avionic, medical imaging.

The second project example is Mapzero[25], a German start-up which was a 2014 Pulse awards finalist. The start-up has developed an application for electric car users that takes into consideration weather and topographical data to help users manage their electric recharging plans. The director of Electric Mobility within the EDF group was interested to integrate the application with some of their products and a partnership is now agreed upon.

[22] http://pulse.edf.com/en
[23] http://www.bluenove.com/
[24] http://www.techway.eu/
[25] http://pulse.edf.com/en/mapzero-the-app-for-electric-vehicles

4.2.3 Challenges

The first main challenge encountered by innovation leaders in the Open Innovation team is culture-related. EDF is a state-owned company which has historically been more focused on electricity production rather than capturing new markets. Indeed, its installed base of customers was captive thanks to its monopoly on electric distribution. Things have changed as the electric distribution market has recently been opened to competition. However, this innovation-adverse culture is still prominent especially amongst the baby boomers generation at EDF. Moreover, the innovation is organized around silos and specific business units have no specific obligation to work with the Open Innovation team or to give credit to the team when partnerships are secured.

The second main challenge deals with the difficulty to work with relevant metrics. Some of the metrics that are used within the group to promote the team's actions are the number of start-ups with which the team has had contacts and the number of product demonstrations. The Open Innovation team has had contacts with about 800 start-ups in its three years of existence. In 2013, there were about a hundred meetings and thirty product demonstrations of start-ups to EDF business units. However, the lack of formal structure makes it difficult for managers to promote their work on a metrics basis. For example, managers are responsible for liaising with a different number of business units in different countries.

4.3 Large consumer electronics group

The company is a leading large consumer electronics group which caters to worldwide markets.

4.3.1 Innovation Team

The innovation team was founded in the Silicon Valley six years ago. The team was originally set up as a consumer needs identification team under the marketing department umbrella in order to change the company's culture which was seen as too engineering-oriented. The team is composed of an

equal number of designers, researchers and business specialists. At the start, the process was aligned with Ideo's methodology of deep consumer research combining phases of observation, ideation and refinement. At the core, processes have remained stable but have been refined. One key point is that processes vary from product to product. The innovation center has realized that some products need more radical innovation than others. Therefore, new confidential processes have been set up to make sure the company does not provide consumers with faster horses rather than automobiles. Second, innovation managers have realized that prototyping is crucial for internal buy-in.

The innovation center has also evolved since its creation with regards to its relationships with innovation consultancies. Indeed, it used to partner with one-stop shops such as Ideo but as its needs have evolved to become more specific it now increasingly works with boutiques.

Subsequently to the initial Silicon Valley location, regional innovation centers have been set up in Europe and Asia. Indeed, the main goal for the innovation centers is to watch customers whose habits vary greatly from area to area especially in the home appliance market. Even though the Silicon Valley center supports the other centers, regional offices still have great latitude in terms of processes and metrics. For example, one of the characteristics of the European center is that the team is very multidisciplinary with innovators having backgrounds ranging from fashion to chemistry to architecture.

Metrics differ regionally but quantitative validation is not seen as an absolute necessity. Some of the key performance indicators include rate of adoption by the headquarters or the whole concept or one single feature developed by the innovation center. In the Silicon Valley, these rates are respectively 20% and 30%.

4.3.2 Challenges

The main challenge is cultural. The headquarters are located in Asia and stakeholders need to be educated about the North American innovation landscape. For example, giants like Facebook are not

well-known by top management in the home country, partly because of generational issues and partly because of cultural issues. One interesting example involves top management approach to Google's acquisition of home thermostat start-up Nest. First, air conditioning habits are very different in North America and the company's home country in terms of central compared to distributed air conditioning. Second, since the Nest device is more capable than its application's current needs, the company's engineers at the headquarters came up with the conclusion that Nest's design was poorly conceived. However, the innovation center's analysis along with leading analysts in North America recognize that Nest has been conceived to tackle more needs than its initial stated application.

The second main challenge is budget related. Indeed, innovation centers are still considered as cost centers and struggle to get internal funding. Moreover, the center is on a rolling three-year budget which raises additional challenges to produce tangible results in a limited timeframe.

4.4 Air Liquide

Air Liquide is a French multinational company which core business is to supply industrial gases and services to various industries including medical, chemical and electronic manufacturers.

4.4.1 Air Liquide i-Lab

Air Liquide's i-Lab was created after a visit of top management to the Silicon Valley. After reviewing venture capitalist modus operandi as well as rapid prototyping techniques, the management became convinced of the necessity to create an innovation cell within Air Liquide. The i-Lab is comprised of two entities[26]: a think tank and a venue for experimentation. The objective of the i-Lab Corporate Garage is to rapidly test ideas on end users and assess their economic viability. The i-fab focuses on prototyping. Connected to the global innovation ecosystem, i-Lab's primary vocation is to forge

[26] http://www.airliquide.com/en/press/press-releases/air-liquide-launches-i-lab-its-laboratory-for-new-ideas.html

partnerships with start-ups. It shares space with ALIAD[27], Air Liquide's strategic venture capital investor. ALIAD invests in technology start-ups to gain rapid and preferred access to the technologies developed. The entity employs fifteen people including three new recruits and twelve Air Liquide veterans.

4.4.2 Challenges

The first main challenge is cultural. In a large group, processes can be too cumbersome for an innovation center. At the beginning, i-Lab was located within the R&D facilities of the group. This raised practical issues such as security hassles which were incompatible with the vibrant workstyle within i-Lab. Therefore, it was relocated to an innovation district in Paris where it is closer to the start-up environment it tries to emulate. Moreover, Air Liquide - as many companies - has a strong internal informal network due to its policy of rotations. Therefore, one has to find the right mix in i-Lab between Air Liquide veterans who have the network that is necessary to make innovation happen and outsiders who bring new ideas and perspectives.

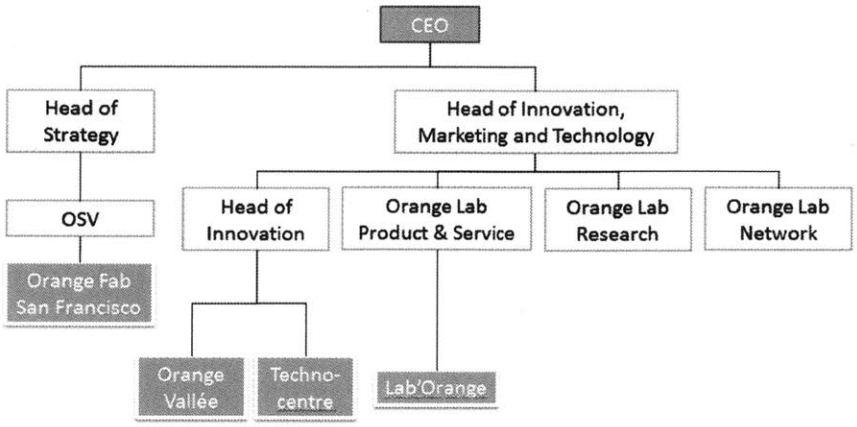
The second main challenge is related to metrics. The main metrics used by management are the number of partnerships with start-ups and the number of business line managers who have been in contact with i-Lab. Indeed, one of the vocations of i-Lab is to evangelize managers within Air Liquide to a certain number of practices.

4.5 Orange

Orange[28] is one of the world's leading telecommunications operators with 170,000 employees in 32 countries and revenues of €44bn in 2012.

[27] http://www.airliquide.com/en/air-liquide-s-capital-risk-subsidiary-aliad-takes-an-equity-stake-in-three-technology-start-ups.html
[28] http://orange.jobs/site/get-to-know-us-better/index.htm

4.5.1 Organizational chart of innovation departments



4.5.2 Orange Silicon Valley

Orange Silicon Valley[29] (OSV) is the Bay Area division of Orange. They rely on a team of 50 engineers, developers, computer scientists and social networkers to develop multiple platforms, emergent business models and innovative technologies. OSV engages with Silicon Valley's ecosystem in a variety of different ways, including:

- Partnerships and business developments with companies, start-ups and universities to introduce Orange business leaders to the latest solutions produced in Silicon Valley
- Co-development with those in the community, including early access to SDKs and alpha/beta-stage technology
- Hosting and supporting local meet-ups, trade events, and networking activities within the Bay Area's tech community
- Constantly immersed in new technologies in order to frame recommendations regarding technology and business strategy for Orange, worldwide

[29] http://orangefab.com/about-orange/

- Educating executives, global customer management teams, and policy-makers about what's trending in the IT and communication businesses

OSV includes 6 main groups working on different topics:

- B2B: issues related to Orange Business Services which is the B2B department of Orange
- Platform: data centers, big data, data visualization
- Networks
- B2C: apps
- Marketing trends
- Knowledge Transfer: Orange Institute is Orange's think-tank

4.5.3 Orange Fabs

Orange Fabs is the accelerator division of OSV. The first Orange Fabs was created in the Bay Area and subsequently replicated in France, Japan and Poland. A new Orange Fab is scheduled to open in Israel.

4.5.4 Challenges

The first main challenge is metrics related. Many different metrics can be used such as the number of applications selected or the number of deals with start-ups but they don't represent the whole extent of the transformational work that Orange Fabs are performing.

The second challenge is how to compete effectively with accelerators in the Bay area. This challenge requires a lot of internal flexibility and adaptation from Orange's culture. Indeed, to be competitive, Orange Fabs has to be able to propose the same legal and financial offers to start-ups.

4.6 Key takeaways

Innovation centers encompass many different types of initiatives including incubation and acceleration, rapid prototyping, identification of strategic partnerships, trend watching and ethnography. The four companies studied in this sample are all very large organizations. However, they differ on several parameters. They operate in different industries and different countries. Their culture is different although two of them (Orange and EDF) have in common a strong public sector history which makes their approach to innovation very interesting to analyze.

An interesting insight into innovation centers is that they come both from top-down and bottom-up approaches. Some like Air Liquide's i-Lab came from C-level executives' strategic vision while others like Orange Fabs and EDF Open Innovation teams emerged from existing initiatives.

Innovation teams are at the crossing between research and marketing and therefore it is not surprising that some of them have evolved from marketing initiatives like EDF Pulse or the large consumer electronics innovation team whereas others have emerged from researchers initiatives like EDF Open Innovation team.

Moreover, it is interesting to witness the importance of the innovative ecosystems for innovation centers. Orange Fab or the electronics group innovation centers are located in the Silicon Valley or other highly innovative locations even though headquarters are in the home country. Air Liquide's i-Lab is located in an entrepreneurial neighborhood of Paris.

Culture plays a very important role in the challenges innovation centers meet. Some of the companies studied have a strong public sector history which values performing a service for a captive audience rather than capturing new customers through innovation. The role of an innovation center in such an organization is twofold. In addition to its stated role, executives have the more diffuse goal of

slowly changing the company's culture through exposition to new ways of thinking about meeting customers' needs.

The second issue is related to metrics. Innovation leaders struggle with measuring their impact on the organization. The main reason is that measuring innovation remains a challenge. Moreover, the cultural change impact of innovation centers is hard to quantify.

5 Conclusion

The difficulty for established companies of producing and adjusting to radical innovation is widely recognized (Christensen, 2003). In the wake of the open innovation movement, C-level executives have tried to implement different types of initiatives to foster radical innovation. One of such initiatives has been the launch of "innovation centers" – pockets of innovation-minded employees embedded in the larger structure. These innovation centers encompass different types of initiatives such as incubation and acceleration, rapid prototyping, identification of strategic partnerships, trend watching and ethnography. Innovation centers can stem from different approaches to innovation: market compared to research oriented, top-down or bottom-up approach, organizationally centralized or decentralized. In many cases, metrics to measure those innovation centers' success are very difficult to define or measure. This main challenge with innovation centers does not come as a surprise as innovation itself is extremely hard to measure due to its ever-changing nature (Shapiro, 2006). The conclusion that is drawn from academic publications analyzed and the qualitative study performed in this paper is that the main goal for setting an innovation center is to change the main organization's culture.

5.1 Limitations & Future Research

This paper studies a group of four companies in different industries and countries. To produce a more quantitative assessment of innovation centers, more data points across different industries or countries would be needed. Future research could include a quantitative study of challenges met by innovation leaders as well as metrics used in innovation centers. Interesting future work could include interviewing C-level executives to validate the hypothesis that innovation centers are often set up to change a company's culture.

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