The evolution of innovation management towards contextual innovation

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Abstract

Purpose – In recent decades, innovation management has changed. This article provides an overview of the changes that have taken place, focusing on innovation management in large companies, with the aim of explaining that innovation management has evolved toward a contextual approach, which it will explain and illustrate using two cases.

Design/methodology/approach – The basic approach in this article is to juxtapose a review of existing literature regarding trends in innovation management and research and development (R&D) management generations, and empirical data about actual approaches to innovation.

Findings – The idea that there is a single mainstream innovation approach does not match with the (successful) approaches companies have adopted. What is required is a contextual approach. However, research with regard to such an approach is fragmented. Decisions to adapt the innovation management approach to the newness of an innovation or the type of organization respectively have thus far been investigated separately.

Research limitations/implications – An integrated approach is needed to support the intuitive decisions managers make to tailor their innovation approach to the type of innovation, organization(s), industry and country/culture.

Originality/value – The practical and scientific value of this paper is that is describes an integrated approach to contextual innovation.

Keywords Research and development, Innovation, Contingency planning, Management technique

Paper type Conceptual paper

Introduction

Understanding how to manage innovation successfully is crucially important in a time when innovation is an almost obligatory survival strategy ("innovate or die" (Drucker, 1999)) that at the same time is very risky because it may lead to the demise of a company (Olleros, 1986; Tellis and Golder, 1996). It is not surprising, then, that many innovation management studies have a normative nature and focus on how to innovate successfully. Given the fact that innovation management has changed over the last four decades, it appears that every time frame has its own notions of what successful or best practices are. These so-called innovation generations are descriptions "... of what constitutes the dominant model of best practice ..." (Rothwell, 1994, p. 23). However, although this historical division may have been accurate in the past, current innovation practices suggest that innovative companies do not automatically follow the best practices as prescribed by the dominant model of their time. In fact, innovation managers more often than not on how to manage their innovation process based on their specific context.

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Understanding the various innovation management approaches and their respective advantages and disadvantages is a prerequisite if one is to select the best approach in a given context. In this article, we provide an overview of the main developments in generations of innovation management over the last few decades, focusing on innovation management in large companies. We describe the context in which companies make their decisions concerning innovation management and the mechanisms that play a role in the decision-making process. Generally speaking, it seems that more and more companies are developing a contingency approach to innovation management, adapting their innovation management practices to their (business) context. We call this contextual innovation.

In the next section, we provide a historical account of the development of innovation management after WOII, by describing four generations of innovation management and their societal and organizational context, including the advantages and disadvantages of the various generations. We argue that contextual innovation, in which innovation managers adapt innovation processes to their specific organizational and societal context, is emerging as a mainstream practice in innovation management. In the third section, we introduce the concept of contextual innovation, by defining contextual factors and describing different managerial choices with regard to innovation management, and we illustrate the mechanisms of contextual innovation based on two cases. We close with a summary and a few concluding remarks.

Four generations of innovation management

Innovation processes describe the activities that are performed at each stage of the development of an innovation. Innovation management is the governance and organization of these innovation processes. research and development (R&D) management can be considered a broader term than innovation management, since it contains invention processes as well as innovation processes. However, because R&D management usually focuses on a specific approach to innovation management, innovation management may be considered the broader of the two terms. In this section, we describe the subsequent generations of innovation management, their respective societal and organizational contexts and their advantages and disadvantages (within their specific contexts).

Introducing the generations

Although innovation (management) was carried out professionally as early as the late nineteenth century, we start our historical overview of innovation management after WOII, because after the war innovation was generally considered to be essential to the economic and technological survival of nations and companies alike, which led to a widespread use of and increasing scientific research into innovation management.

The various generations of innovation management emerge in different times and in entirely different contexts, requiring different types of innovation processes. Niosi (1999, p. 117) provides a concise description of the successive generations:

> The first generation brought the corporate R&D laboratory. The second generation adapted project management methods to R&D. The third brought internal collaboration between different functions in the firm. The fourth adds routines designed to make more flexible the conduct of the R&D function through the incorporation of the knowledge of users and competitors.

Various others have identified different numbers of generations. Both Rothwell (1994) and Amidon Rogers (1996) distinguish five generations, while Miller (2001), Liyanage *et al.* (1999) and Niosi (1999) identify four generations, and Cooper (1994) three. In this article, we use a framework of four generations, because we believe that the alleged "fifth generation" is merely an implementation of the fourth generation, a view that Rothwell (1994), one of the authors distinguishing a fifth generation, appears to share:

> The development of 5G is essentially a development of the 4G (parallel, integrated) process . . . (Rothwell, 1994).

There is also some variation with regard to the timing of the various generations, in some cases more than a decade. Miller (2001), for example, places the second generation between 1950 and 1985, whereas Niosi (1999) places the same generation between the early 1960s and the early 1970s. Although it is not always clear how the various authors arrived at their verdict, the main idea is to indicate when a specific innovation management approach was considered to be the dominant (i.e. most commonly applied) best practice model. We adopt a different procedure by using hallmarks in the societal context to establish when a specific generation prevailed. Thus, we place the first generation between the end of the Second World War and the mid-1960s. In the mid-1960s, a broad awareness emerged about the potentially negative societal effects of technology (Hughes, 1975). We place the second generation between the mid-1960s and the late 1970s. The late 1970s saw a recession that had a major impact on the resources that were allocated to innovation. We place the third generation between the late 1970s and the early 1990s, at which point the internet made its commercial presence felt. The internet has played a crucial role in people's ability to cooperate at a distance and it has further stimulated the emergence of a truly global economy. The fourth generation started in the early 1990s and it continues to be the dominant approach to this day.

In Table I, we provide an overview of the generations of innovation management, their context and their (dis)advantages.

The second and fourth columns of the table represent the forces behind the evolution of innovation management:

- new generations emerge because innovation management adapts to a changing context; and
- they emerge to remedy the disadvantages of earlier generations.

Evolutionary forces lead to changes in innovation management: innovation management itself is subject to innovation.

From this historical overview we conclude that in each period companies adhere to a different set of best practices. Furthermore, these best practices evolve over time, because different economic, societal and technological contexts require different approaches to innovation management and because companies are forced to improve their innovation management due to the increasing importance of innovation.

Introducing contextual innovation management

The historical development of innovation makes us curious about what will be the next development. Indeed, it would be foolish to expect this evolutionary process to stop, simply because the importance of innovation is increasing. However, despite the effort

Table I. The innovation management generations, their context, approach and disadvantages

Period	Societal and organizational context of innovation	Innovation approach	Disadvantages of the approach
From the post-war period to the mid-1960s	*Society* Society has a generally favourable attitude towards scientific progress. Governments subsidize R&D in universities and companies to stimulate economic growth and to attain military leadership. Consumer demand exceeds the supply of goods *Organizations* Organizational strategies are generally technology-oriented and focus on innovation and growth. Most organizations are functionally organized	*Technology (science) push* The process of commercialization of technology is perceived as a linear progression from scientific discovery to the marketplace. Many R&D-departments are staff departments that are structured like scientific institutions.	*Disadvantages* Little attention is paid to the entire process or the role of the market place. Innovation processes serve no strategic goals and commercial aspects are incorporated late Professional project management practices are not applied
From the mid-1960s to the late 1970s	*Society* This is a period of relative prosperity, although economic growth slows down. Demand more or less equals supply. Many markets are becoming more competitive. Government policies tend to emphasize demand side factors *Organizations* Organization strategies generally focus on growth, to attain economies of scale, and on diversification, to reduce financial risks. Many organizations adopt a multi-divisional structure	*Market pull (need-pull)* Technological change is rationalized, needs are considered more important to innovation than scientific and technological progress. Because innovation processes are managed as projects, R&D-institutes are organized in a matrix. Divisions become internal clients that directly fund R&D Innovation is generally organized in multi-disciplinary projects. Linear sequential process in a project, starting with market need	*Disadvantages* Neglect of long-term innovation programs and because of this leads to "incrementalism" Focuses on evolutionary improvements rather than breakthroughs. Projects are individual units, strategic relationships between these projects and corporate goals are not established

(*continued*)

Table I.

Period	Societal and organizational context of innovation	Innovation approach	Disadvantages of the approach
From the late 1970s to the early 1990s	*Society* This is a period with two oil crises, inflation and demand saturation. Supply exceeds demand and unemployment figures rise *Organizations* Company strategies generally focus on cost control and reduction. Organizations become more flexible and less hierarchically organized. Responsibilities are delegated to business units	*Market pull and technology push combined* Knowledge about technology and market needs is used throughout the innovation process. To obtain this knowledge (communication) networks are formed with internal and external partners. Innovation projects become part of a portfolio of projects aligned with the corporate strategy Model of an essentially sequential process with feedback loops and interaction with market needs and state of the art technology	*Disadvantages* Focuses on product and process innovations rather than market and organizational innovations Focuses on the creation of innovations rather than the exploitation
From the early 1990s to the early 2000s	*Society* Globalization is important in this period, international competition increases. Organizations realize the strategic importance of technologies. Information and communication technologies influence internal and external business processes *Organizations* Company strategies generally concentrate on core competences. Strategic alliances, and external networking become important. Time-to-market becomes more important. More organizations adopt team-based and project-based structures	*Innovation in alliances; parallel and integrated innovation, from innovation to new business development (NBD)* Innovation management means managing research links and external research environments. Parallel processes are used to involve multiple actors and to increase the development speed. The 4th generation includes business and market models in innovation Coordinated process of innovation in a network of partners. The required coordination is often attained by system integration (with key suppliers and customers) and parallel development (of components or modules of the innovation)	*Disadvantages* Innovation processes are becoming too complex and because of this more and more unmanageable Opening up the innovation process is not suited for any industry and might in general endanger fundamental research which is many cases still the basis for innovation

Sources: Based on Liyanage *et al.* (1999); Miller (2001); Niosi (1999); Rothwell (1994)

by some authors to establish a fifth and even a sixth generation, it is our view that the idea of a single set of dominant best practices of innovation management within a specific historical period no longer holds. Even an author like Henry Chesbrough, who is generally seen as the embodiment of the fourth generation, admits that his concept of Open Innovation is not the only available option for every company or industry:

> This is not to argue that all industries now operate in an Open Innovation regime. Some industries (. . .) continue to operate in a Closed Innovation regime (Chesbrough, 2003, p. xxvii).

Indeed, it would appear that nowadays companies no longer feel obliged to apply the innovation practices of "their" generation (i.e. the fourth one), but instead adopt a more context-based approach. This is what we call contextual innovation. Below, we discuss this concept and present empirical research to support this point of view.

First of all, not every company manages its innovation processes in a formal way contrary to what is assumed in the notion of innovation generations. Many companies continued to apply intuitive and informal ways to innovate as late as the 1990s (Griffin, 1997; Nessim *et al.*, 1995), and some of these companies are (even) very successful (Griffin, 1997). Brown and Eisenhardt (1997) have shown that companies may adopt widely different approaches to innovation, even when they develop similar innovations.

Secondly, empirical research indicates that different approaches to innovation may be adopted within a single company (see Van den Elst *et al.*, 2006; Verloop, 2006). Between 1990 and 1995, the percentage of US firms using more than one product development structure increased from 53 percent to 62 percent (Page, 1993). The underlying idea is that different situations require different kinds of processes. Empirical research illustrates that they are right: a context-based approach usually yields the best results (Miller and Blais, 1993; Nessim *et al.*, 1995). This indicates that a context-dependent approach is about to become the mainstream practice. The most successful innovative companies do not succeed merely by using one innovation approach more extensively or better, but by carefully selecting the right approach within a given context (Griffin, 1997). This in itself is an indication that the concept of innovation management generations has become outdated. The idea of a single mainstream approach to innovation management is simply no longer in accordance with the facts.

Defining the context

Innovation management takes place in an internal and external environment. Strategy and organizational structure are important aspects of an organization's internal environment, and they have an impact on innovation management practices. Strategy, for example, determines whether an organization is an imitator, follower or leader, which in turn determines how important innovation is to the company. In addition, the structure of an organization, either functional or divisional, also determines the way innovation practices are organized. In organizations with a divisional structure, innovation processes may be divided among divisions, whereas a functional structure may be associated with a more central organization (Chiesa, 2001). The external environment of an organization, for example the proprietary regime in the country in which is located, also affects the way innovation is organized (Teece, 1997).

Although we acknowledge that there may be more contextual factors, to illustrate the mechanisms of contextual innovation we distinguish four different contextual factors of innovation processes, the former two of which belong to the internal environment of an organization, while the latter two belong to the external environment (Ortt, 1998; Kotler, 2002; McQuater *et al.*, 1998):

(1) Type of innovation (e.g., incremental, radical, transformational).

(2) Type of organization (e.g., centralized, decentralized, functional, organic).

(3) Type of industry (e.g., high-tech, supplier-driven, fast moving consumer goods).

(4) Type of country/culture (e.g., egalitarian, authoritative).

Table II summarizes some of the conclusions of empirical research into the separate effects of the type of innovation, organization, industry or country on the innovation approach that is chosen.

The table does not present a complete overview, because it is designed to present the idea that context refers to completely different elements, that it is possible to categorize the context, and that each of the contextual elements can be specified in greater detail. However, most empirical studies into contextual factors (as shown in Table II) only look at one contextual factor, without taking the relationships between the various contextual factors into account. Often, these factors are indeed merely determinants that have a certain impact on innovation (e.g., Evangelista and Mastrostefano, 2006). However, since innovation managers in their everyday reality are faced with all these contextual factors, this relationship should be explored in much greater depth, which is what we attempt to do in this article. Contextual innovation is not just about identifying individual factors influencing innovation (as is done in many quantitative focused scientific studies into innovation), instead, it tries to integrate the various contextual factors into a managerial framework.

Managerial decisions in contextual innovation management

Contextual innovation management implies that an innovation manager makes different decisions in different contexts. In our view, the decisions involved relate to two levels: a strategic level and an operational level. At a strategic level, decisions are made before an innovation process is started, for example whether to innovate or cut back costs and, if a choice is made in favor of innovation, whether to carry out the innovation process in-house or externally. There are intermediate options, like organizing the innovation process externally only in specific phases or in an alliance. Decisions that are made at a strategic level also involve selecting the organizations that take part the innovation project and thereby determining the project team(s). Examples of strategic decisions involve:

- Whether to innovate or to sell a business unit or to cut costs and so on.
- Whether to innovate in-house or externally.
- Whether to choose a specific type of external organization as partner.
- Whether to cooperate in an alliance with external partners, such as customers and suppliers.
- Whether to involve internal partners like R&D, marketing and manufacturing departments of the same company.

Main variables in the context	Main results (in short)	Examples (references)
Type of innovation		
Newness to the company, market, technology	The results show that three types of product newness can be distinguished: new to the market, new to the company and new to the technology. These types of newness require different R&D management practices, for example in terms of the cooperation between R&D and marketing departments	
New service versus new product	Although service development processes have much in common with product development processes, some differences are important. It has been stated that a different innovation typology is required when services rather than products are described	
	In a book review, Stahlecker writes that "tools and technologies seem to play a much weaker role in services. Another is that the intangibility of many services means that they are relatively more amenable to continuous development than physical goods" (p. 1709)	Stahlecker (2004)
Type of organization		
Hierarchical versus flat organization	Brown and Eisenhardt (1997) report how two sets of companies in the IT-industry in a completely different way develop similar innovations. The first set of companies adopt an approach in which a long-term vision is leading in the way how each company coordinates all of its innovative activities. The second set of companies in the same industry adopt an approach in which responsibilities are delegated to small teams in order to enable them to learn and adapt fast in innovation processes	Brown and Eisenhardt (1997)
Small/large organization	Small firms rely more heavily on informal than on formal in-house R&D, and use outside sources of knowledge (R&D and licenses) less frequently than larger firms, reflecting their limited capacity to absorb outside knowledge. Above all, small firms depend more on the suppliers of the machinery in which the innovations are embodied	
The firms' competencies, business opportunities, and managerial preferences	In addition to industrial context, modes of innovation are influenced primarily by the firms' competencies, business opportunities, and managerial preferences (influenced by formal strategies)	Miller and Blais (1993)
Type of market		
high-tech versus low-tech market	Success factors in new product development in high-tech and low-tech markets differ. In high-tech firms, for example, best practices include having manufacturing devote at least 10 percent of their time to new product development. Best practices in low-tech firms included having product managers from the marketing department as part of the organization for new product development	Page (1994)

(*continued*)

Table II.
Examples of contextual variables and their effect on innovation approaches

Main variables in the context	Main results (in short)	Examples (references)
Consumer versus business market	Business-product companies tend to organize more along cross-functional lines, place heavier emphasis on customers as sources of ideas, and place heavier emphasis on finding new uses or markets for their products than consumer-product companies. Consumer-product companies tend to make more use of product management and development groups, focus more on totally new products and line extensions, and more often emphasize market analysis and product positioning than business-product companies	Nessim *et al.* (1995)
Type of culture		
Legal system	Different choices on the specific form of research consortia are generally made in Europe, Japan, and the USA due to technical, competitive, and legal reasons	
Ways of cooperation	There are major differences between product development practices in Japan and the USA	

Table II.

At the operational level, decisions have a direct influence on the shape of the innovation process and can be made during the innovation process. For example: can activities be scheduled in parallel or is the innovation process essentially linear-sequential in nature? How flexible should the process be, should there be go-no go decisions after each phase, should there be room for iterations within the various phases? Other operational decisions have to do with the role of information (e.g., technology and market information) throughout the innovation process and communication with stakeholders during the process.

The relationship between contextual factors and managerial decisions

After defining the contextual factors and various types of managerial decisions, the question remains how the two can be related. We think the relationship between context and decisions is characterized by two important aspects. First, each contextual factor in many cases requires both operational and strategic decisions. An innovation that is new to the company, for example, can be developed in-house or externally (strategic decision). Moore (2002) describes how incumbent companies manage to develop completely new products once these products are wanted by their current customers. However, incumbent companies are less well-equipped to develop completely new products if these products appeal to new and unknown customer segments. At the operational level, if an innovation that is new to the company is developed in-house, the risk and uncertainty involved will require a very flexible innovation process, allowing for iterations and go-no-go decisions after each phase.

Second, contextual factors interact while affecting the innovation process. For instance, a radical innovation may require a very flexible innovation process, while the degree of flexibility that can be attained depends on the type of organization. Furthermore, in a culture that is characterized by equality and conservatism, it will be difficult to carry out risky innovation processes to develop radical innovations. These two simple examples make it clear that relationship between the contextual factors is

to a certain extent hierarchical. The nature of one contextual factor may limit another contextual factor. An organization that has adopted a "follower strategy" will not develop radical innovations. Also, in a high-tech industry the type of innovation (and the innovation process) will have a main technological component.

The hierarchical relationship between the contextual factors is not without risks when it comes to applying contextual innovation management. A general condition for contextual innovation management is that innovation managers have a sufficient degree of freedom to manage their innovation process based on their specific context. In cases where innovation managers have to adhere too closely to the guidelines that have been issued by headquarters with regard to innovation processes, they do not have the flexibility they need to adapt "their" innovation process to their specific context. This does not mean, however, that innovation managers can do whatever they want. After all, contextual innovation means that innovation managers adapt their innovation process to the specific contextual demands (in this case: industry). Nevertheless, innovation managers must have the freedom to make these adaptations and not be limited by corporate rules regarding innovation that contradict what their specific context demands.

Case 1: Shell's innovation processes for incremental and radical innovations

Shell is one of the biggest oil-companies in the world and it is a company that is involved in upstream activities, such as the exploration and exploitation of new oil and gas fields, as well as in downstream activities like refining oil. Shell's corporate mission is (simply) to provide energy, a focus that transcends traditional energy sources like gas and oil, and that also includes wind energy, solar energy, hydrogen fuel cells, etc. As a direct consequence, Shell on the one hand engages in incremental innovations in the traditional oil and gas industry, while at the same time focusing on more radical innovations in new energy markets.

The result of this dual approach is that the company needs to adopt different approaches to innovation. According to Verloop (2006), incremental innovations enhance the competitive position in the existing value chain and they are funded by a Shell business unit. These innovations are completed in-house.

Radical innovations that may create new value chains are funded at a corporate level and they are developed in collaboration with partners. In addition to these strategic aspects, Shell also modifies some operational aspects, depending on the type of innovation. As far as radical innovations are concerned, different teams are appointed to operate at various stages of the process. The reason behind this approach is that "[...] the originator of the idea needs to leave the team, because his or her exploratory mind and lateral thinking is the wrong asset in stage two, which requires analytical perseverance and sound business sense. This transfer is a bit like a mother giving her baby away for adoption" (Verloop, 2006). With regard to incremental innovations, it is good practice for the entire project to be carried out by integrated (multi-disciplinary) teams that include technical and commercial staff.

Shell has traditionally carried out its innovative activities in-house, and whenever external actors contributed to its innovation processes, they did so under strict supervision from Shell. One reason for adopting this approach is that Shell has to govern a huge integrated system of upstream to downstream activities. Because innovations have to fit into the system, many requirements have to be met. Another

reason is that Shell often operates in regions where there are no partners available. The focus on radical versus incremental innovations is understandable, because incremental innovations tend to sustain the integrated Shell system whereas radical innovations tend to disturb it.

Case 2: Philips' different (organizational) innovation processes

Philips is a multinational manufacturer of a wide range of electronic components and products for consumer and business markets. It is divided into relatively independent business units operating in distinct markets. Philips used seven different innovation approaches, each of which is applied to a specific context (Van den Elst *et al.*, 2006). The company's activities are both technology and consumer-oriented in nature.

In the business markets, Philips applies the idea of lead customer-driven innovation (Von Hippel, 1986). Lead customers are business clients with a major interest in a specific innovation. They are involved in the innovation process and they are willing to take risks and experiment with innovations in their own organization. In the business-to-business context, a large part of the turnover comes from a limited number of customers. These customers have strict requirements and demand adaptation and loyalty from their suppliers (in this case Philips). In consumer markets, Philips uses a different innovation approach. The process of consumer-driven innovation starts with societal trends, which are translated into consumer needs and changing consumer priorities. On the basis of these data, consumer products are created meet customer requirements.

Philips also tailors its innovation approach to the stage of an innovation in the technology life cycle. The company invests heavily in exploratory scientific research. In this case, the process requires a great deal of flexibility, the length of phases is more flexible, phases are completed in a more iterative way and projects may have to be re-scheduled when new information becomes available. Later on in the technology life cycle, innovations are often developed within functionally specialized business units, and a more traditional stage-gate approach is adopted, since the context consists of mature mass producing organizations that are functionally specialized and have well-defined processes for different functions, such as new product development and marketing.

Philips also operates in markets that require business alliances in the development of new products:

> Business alliances enable firms to surpass the regular frontiers of their own business and create new products and services. This is especially needed in saturated markets with commodity products, little differentiation, no growth, and changing consumer demands that cannot be satisfied by the existing offers, where other than the usual applications of new innovations are required (Van den Elst *et al.*, 2006).

Examples of innovations resulting from this type of alliance are a new Audio device, which was developed with Nike sportswear, or the Senseo Crema coffee machine, which was developed in close cooperation with Douwe Egberts (a coffee brand).

Philips also innovates with the help of a technology incubator. Some innovations that emerge within Philips cannot be accommodated by the regular business divisions. Innovations based on disruptive technologies can be accelerated with the help of an incubator, when initial markets may not be within the scope of the existing business.

Finally, Philips keeps track of external innovation processes and stimulates them through its corporate venturing unit. Corporate venturing is:

> [...] a key instrument for Philips to align more closely with leading start-up companies, to contribute to the portfolio choices of the Company, to benefit from the massive industry R&D, and to participate in the potential financial upside of their commercial relationship via minority equity stakes in these emerging companies (Van den Elst *et al.*, 2006).

We now take a look at the two cases presented above by using the various elements of contextual innovation. In the case of Shell, there is a close link between the type of innovation and the type of organization that is responsible. It is difficult to determine which came first, but if the type of organization is adapted to the type of innovation, one might even argue that the hierarchical relationship between the contextual factors that was suggested earlier is turned upside down. However, Shell is not decentralized to such an extent that innovation managers can change their organization on the basis of the type of innovation they would like to develop, which means that, if an innovation manager wants to develop a radical innovation, he or she should join the organizational part of Shell that is in charge of developing these types of innovations. Furthermore, the two (sub-)industries in which Shell operates (exploration and exploitation) also leave their mark on innovation. Because exploration is by nature a risky business, innovation processes in this area are also more risky and geared more towards relatively new innovation. When it comes to exploiting oil fields, terms like efficiency and optimization are more relevant, which means that innovation and innovation processes in this area tend to be more incremental.

The Philips case shows a dominant influence of the type of industry on the type of innovation, and even more so on the organizational structure. All business units operate in global and highly competitive markets where single companies do not have sufficient market power. This means that the company has to be able to adapt to specific (market) contexts, which includes innovation. The decentralized organizational structure of the company means that the innovation managers in the various business units are to a large extent able to adapt to their specific context. However, Philips has some difficulties in developing innovations that emerge on the crossroads of different business units. One of the tasks of Philips Applied Technologies, a company-wide innovation department, is to counter this problem. Philips' recent "conversion" to Open Innovation is interesting in this respect, because it implies a transition towards a more centralized approach to management that may not be in line with the diversity in the various industries and markets in which the company operates.

Summary and concluding remarks

Innovation management generations are considered "historical bundles" of best practices in innovation management. The historical development of innovation management is evolutionary in nature, whereby companies adapt innovation management to the changing societal and business environment to overcome the disadvantages of previous innovation management principles. The desire to overcome these disadvantages and the need to adapt to a changing environment are interrelated. For example, a technological approach to innovation (generation 1) works well when demand exceeds supply, but becomes a disadvantage when supply exceeds demand.

Rather than suggesting a new mainstream approach to innovation (i.e. a fifth generation), we propose a contextual approach of innovation. We do not imply that the innovation principles of previous generations have become completely obsolete. In fact, one might argue that, for instance, a first generation approach (technology push) may turn out to provide the best solution in specific contexts. In a way, the historical development of innovation management has "stopped" and been replaced by a portfolio-approach that offers companies a wide range of ways to manage their innovation processes.

Contextual innovation means that innovation practices and decisions have to be adapted. We draw a distinction between strategic and operational decisions, each of which is further subdivided into several decisions. In addition to the various types of decisions that have to be made, the complex interaction between the various parts of the context in their effect on the innovation approach has thus far made it impossible to identify a simple and widely applicable algorithm with regard to the application of contextual innovation. More empirical research is therefore needed, although suggesting that it would be possible to devise such an algorithm would lead to a paradoxical situation, since that algorithm would in itself be a best practice, which is something contextual innovation attempts to avoid. Although it is true that there are best practices, they vary with each different context. What is clear is that a contextual framework should meet the following requirements:

- It should contain multiple levels of detail allowing for strategic and operational decisions to be made.
- It should adopt a systematic approach, in which the various contextual factors are interrelated and which addresses complementary innovation processes simultaneously.
- It should enable more flexible processes, for instance "trial and error", and acknowledge that in many cases a linear innovation process is a much too simple view on innovation.

One of the advantages of contextual innovation is that it offers innovation managers the possibility to break away from normative approaches to innovation managers who are mainly advised by consultants inspired by normative scientific research in this area. A one-size-fits-all approach is much too rigid for a dynamic area like innovation. A meta-analysis on success factors conducted by Van der Panne *et al.* (2004) shows that it is difficult to find success factors that are valid in each situation (context), and that success factors that are indeed valid are often just too obvious, for example "Adequate timing of market introduction". The contextual nature of innovation simply means that "adequate timing" varies with each different context.

A disadvantage of contextual innovation may be that having different approaches to innovation management within a single company may make innovation processes within that company more difficult. A lead customer-driven approach (e.g., business units of Philips operating in business markets) is incompatible with a technology push (e.g., incubators at Philips). This incompatibility problem may become bigger if companies from different industries are trying to realize Schumpeter's dream of *Neue Kombinationen* (see, for example, Berkhout and van der Duin, 2007).

We see the contextual approach to innovation as a kind of contingency thinking. Contingency theories have been formed in many areas of management science, for

instance strategic management (Lawrence and Lorsch, 1967) and consumer research (Kakkar and Lutz, 1975; Kechris, 1987). A contingency approach to consumer research postulates, for example, that situational aspects are important determinants of the needs and behavior of consumers.

In general, a contingency approach in strategic management means that the best type of organization depends on how it is aligned with the market and societal environment, or "a goodness of fit between its structural design and the conditions of its environment" (Pennings, 1992, p. 268). A definition that is closer to contextual innovation is:

> Contingency theory suggests that there is no optimal strategy for all organizations and posits that the most desirable choice of strategy variables alters to certain factors, termed contingency.

And although the contingency approach has been criticized, for example for having too simple a view on organizational reality (Schoonhoven, 1981) and for displaying a lack of conceptual clarity (Fry and Smith, 1987), in our view it is a promising alternative to the kind of one-size-fits-all approaches to innovation management that are often promoted by consultants, because it can underpin the diverse practices of many organizations and innovation managers. Indeed, although earlier attempts have been made to look at innovation management from a contingency perspective, they have tended to be based on an NPD point of view (Jin *et al.*, 1997; Lynn and Akgun, 1998), the influence of factors such as leadership, work climate, and external contacts among employees on employees' innovative behavior (De Jong and den Hartog, 2007, p. 57), the type of technological change (disruptive, stable, or exploitation of existing technologies) (Drejer, 2002), or a or merely from the point of view of R&D (Balachandra and Friar, 1997). However, to bring in the contingency perspective on innovation management by designing a contextual approach to innovation management, greater insight is needed into the specific relationships between all these contextual factors. However, this should not just include the causality between these relationships, also show the dependencies between the various options regarding the organization of the innovation process. A contextual innovation management framework can provide an overview of alternatives choices in different contexts and assist innovation managers in their innovation-related decision-making process. Innovation is simply too important for an organization to put all its eggs in one basket.

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