Chapter 1
Innovation Management: Limits of Planning and New Challenges

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In the past, the organization and management of companies concentrated on production. Innovation was assigned to special departments, professional groups and separated from other departments. With innovation management on the other hand, innovation processes are integrated in a company's organization as a whole. Fundamental principles from the management of industrial production play a key role in this respect: planning, steering and controlling. However, there is a risk that uncertainty and indefiniteness are dispelled from innovation management. Uncertainty and indefiniteness are, however, a fundamental characteristic of innovation. The effort to dispose of them may mean that innovation is not promoted, but impaired and restricted. There is therefore a need for innovation management, which sees the limits of planning not as a shortcoming, but as having a potential to successfully produce innovation and uses them correspondingly.

1.1 Production Versus Innovation

Marx and Engels describe the capitalistic economy as a production method based on "continual overthrow" (Marx and Engels 1972). In other social theories of the nineteenth and twentieth century, significant characteristics of modern industrial

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societies and differences to traditional pre-industrial societies are also attributed to dynamics and transition.[1]

The term Industrial Revolution particularly emphasizes the powerful effect of technical, scientific inventions and new political-social orientation. At the same time, it draws attention to another side of dynamics and transition: the development and creation of a new order and stability. Descriptions of industrial production and society, which are based on these other aspects of dynamics and transition, also exist correspondingly. Sombart (1919) considers the difference between industrial production compared to traditional handicrafts and agriculture to be "calculation" and the "creation of calculability" and Weber (1956) characterizes modern bureaucratic administration by rule observance and predictability. With "scientific management", so-called "Taylorism", these characteristics of industrial production and administration become powerful models for corporate organization and the underlying maxims of management.

The organization of companies and management is primarily geared towards production in this respect (cf. Bürgermeister 2008, p. 54 et seqq.). As a result, this did not primarily concern creation and achievement, but the realization of innovation,[2] whereupon the transition was in part steered into ordered, planable and manageable tracks. Examples of this include continual rationalization through the optimization of technical methods and adherence to certain developmental paths in product development and associated incremental innovations.[3] The question as to how innovation originates has been for the most part banished from the sphere of responsibility of organization and management.

In keeping with Schumpeter (1934), one considered the main source of innovation to be "innovation personalities" such as the inventor or entrepreneur (cf. Hauschildt and Salomo 2007, p. 212 et seqq.). The search for personality traits attributed to creativity continues with this notion in further discussion (cf. Mittelstraß 2008). The focus is therefore on the question of who brings about innovation. Questions as to how innovation occurs and what becomes the object of innovation do not appear to be something that has to or could be clarified in greater detail. The fact that departments and professional groups dedicated exclusively to research and development are created primarily in large companies also reflects this. Such departments and professional groups have their own position and are separated from production and administration (cf. Graham 1985; Rammert 1983).

In developments after the Second World War, increased efforts to systematically apply principles of industrial organization to innovations can be observed in science and in practical application in contrast. The "How" aspect concerning scientific

[1] This applies to the sociological theories of societal modernization attributed to Comte and later Parsons as well as theories of economic development such as those of Rüstow (cf. Joas and Knöbl 2004; Wehling 1992).

[2] Cf. Chap. 4 regarding the innovation term.

[3] Cf. Chap. 4 to distinguish between incremental innovation and radical innovation.

and practical preoccupation with innovation has therefore become an area of focus. This therefore concerns the "invention of the method of invention" (Whitehead 1926, p. 141) as at the core of "second industrial revolution" in the transition to the twentieth century (cf. Wolf 2011). Project organization is an organizational "response" to the one-of-a-kind nature of specific innovation processes versus re-production of industrial products. It developed in the Second World War in connection with military research and development (cf. Madauss 2000, p. 12).

Project management developed in connection with project organization (cf. Madauss 2000, p. 12 et seq.). This resulted in an approach that explained how innovation processes emerged, whereupon the question of "Who" does not disappear, but is given new impulses. At the same time, the question as to "What" no longer exclusively concerns product innovation. In addition to product innovation, project and innovation management now also concerns process innovation, organizational innovation and social innovation (cf. Howaldt and Jacobsen 2010; Hauschildt and Salomo 2007, p. 9 et seqq.; Vahs and Burmester 2005, p. 72 et seqq.).[4] Contrary to production that focuses on re-production of what is already known, innovation management is confronted with other circumstance and requirements: Planning and the creation of the ability to plan, which are characteristic of industrial production, cannot be readily transferred to innovation processes.

1.2 Uncertainty and Limits of Innovation Planning

Research on innovation identifies uncertainty and the limits of planning in innovation processes in a variety of manners. They are[5]:

- The goal of innovation is to replace or supplement what is known with what is not yet known and is therefore uncertain. Innovation is therefore generally characterized by openness with respect to the result (cf. Rammert 2008, p. 294; Erdmann 1993; Wegner 1995, p. 88; Lazonick 2005). It cannot be exactly determined ex ante as to whether an innovation is successful due to a number of material, social and cultural factors and interdependencies (cf. Wegner 1995, p. 189; Mistri 2008, p. 299 et seq.). The success of innovation can often only be defined ex post as it is not apparent in advance as to which problems innovations are capable of solving and which effects are possible (e.g. Siebel et al. 2001, p. 530 et seq.; Pavitt 2005, p. 100 et seqq.).
- Innovation processes do not have a sequential-linear, but an iterative course. Success or failure determines the direction of subsequent steps. As innovation processes have to diverge from what is known, neither their barriers and resistances nor their factors of success can be entirely anticipated in advance

[4] Cf. Chap. 4 for the innovation object.

[5] Also see Wolf (2011), Kädtler (2009) and Böhle (2011) for an overview in this respect.

(cf. Pavitt 2005, p. 106 f.). Increasing parallelization of innovation activities and innovation projects and/or sub-projects has been observed for some time within the innovation process (cf. Bürgermeister and Schambach 2005; Brockhoff 1999, p. 43 et seqq.). This results in a considerable increase in complexity within the innovation process.

- Due to their one-of-a-kind nature, innovation processes progress differently depending on the subject matter, technical-organizational and personal boundary conditions, problems, barriers etc. and therefore have to be configured individually based on such influential factors (cf. Pavitt 2005, p. 95 et seqq.; Nippa 2007; Coopey et al. 1998, p. 279 et seq.). Innovation processes therefore not only proceed in accordance with standard models and best practices.
- Creativity can neither be commissioned, nor regulated or controlled (Amabile and Gryskiewicz 1989; Schuler and Görlich 2007; Kanter 2006).

These aspects of innovation processes occur more frequently, the more comprehensive innovations are and the less they are restricted to product innovations and instead also include process innovations as well as organizational and social innovations. Furthermore, innovation is not only a special task of individual persons and professional groups, but is often part of the work of every employee in companies and, beyond the confines of a company, it is also the work of customers, suppliers etc. (cf. Moldaschl 2007; Chesbrough 2003). The experiential knowledge of employees in operative processes is therefore an important resource for innovation (cf. Kocyba 2000, p. 50 et seqq.; Ortmann 2009, p. 208 et seqq.).

1.3 Planning-Oriented Innovation Management

Although innovation management addresses the unique character of innovation, fundamental principles are derived from industrial production management and transferred to innovation: planning, management and control. The predominant concepts of innovation management primarily focus on minimizing uncertainty and limits of planning to the furthest extent possible and maximizing planning, steering and control. A possible reason for planning-oriented innovation management is underestimating the uncertainty and the limits of planning per se and regarding innovation as comprehensive or at least capable of being extensively planned. On the other hand, planning-oriented innovation management may be based on replacing uncertainty with risk, whereupon uncertainty is replaced by objective and subjective probabilities of occurrence and transferred to planning.[6]

[6] Cf. Heesen (2009, p. 19 et seq.) as well as Perridon and Steiner (1999, p. 99 et seqq.) for differentiating between the terms uncertainty and risk.

Multiple periods of innovation management are apparent in the history of developments (cf. Trott 2008; van der Duin and den Hartigh 2007):

- Linear innovation processes were adapted from the 1950s to 1970s and are characterized by sequential flows, strict delineation of process phases and relatively simple cause and effect relationships.
- Links between linearly allocated phases of innovation processes are recognized and considered to an increasing degree in the 1980s.
- Beginning in the 1990s, innovation in networks and knowledge associations and/or "open innovation" become a topic of increasing popularity (Chesbrough 2003).

Works by von Ahsen et al. (2010), Heesen (2009), Vahs and Burmester (2005) as well as Cooper and Edgett (2008) and Cooper et al. (2002a, b) provide interesting reference points for the current discussion of scientific concepts involving planning-oriented innovation management. Von Ahsen et al. (2010) and Heesen (2009) provide, among other things, an in-depth analysis of analytical instruments for selecting project ideas to be pursued further in connection with "evaluating innovation in small and medium-sized business" and/or "innovation portfolio management". For example, a cost benefit analysis and budget and time control procedures are recommended, additional target costing and calculations based on the net present value method in connection with the decision-tree process are recommended for the advanced selection (cf. von Ahsen et al. 2010, p. 46 et seqq.; Heesen 2009, p. 104 et seqq.). With respect to duplication of the invention as another aspect of innovation management, Vahs and Burmester (2005, p. 249) refer to the substantial relevance of concepts involving computer integrated manufacturing (CIM) today: "The use of CIM strategies facilitate going live of production in a large number of companies today. The benefit of computer-integrated manufacturing is particularly apparent in that the individual modules are networked for sharing data and therefore permit integrated planning and implementation of the product innovation." Finally, Cooper and Edgett (2008) and Cooper et al. (2002a, b) present a highly-regarded stage-gate concept for innovation controlling. Stage-gates are allocated between the elements of the innovation process (cf. Heesen 2009, p. 72). They indicate points in time for the evaluation of innovation activities and results in order to decide whether the innovation activities will be continued after every element of the innovation process (cf. Heesen 2009, p. 72).

The picked points of innovation management focus on creating a planned progression of innovation processes. This does not rule out that uncertainty is also considered and the applicable concepts of innovation management address this (cf. Vahs and Burmester 2005, p. 52; Heesen 2009, p. 19 et seq.). At the same time, however, there is a tendency to regard the main task of innovation management being the creation of the ability to plan. As a result, Heesen (2009, p. 20) "assumes that the decision-makers in an innovation process are capable of specifying at least subjective probabilities for the occurrence of subsequent environmental conditions". It can also be observed that the applicable starting points for innovation management tend, in practice, to be subjected to strictly quantitative orientation, which rules out uncertainty to a large extent. An important aspect is that the experiential knowledge of employees is often not considered at the applicable

location when it comes to dealing with the limits of planning. This corresponds to results of a study by Wühr et al. (2011) concerning dealing with stage-gate models in the innovation practice observed in machine building, which provide an example of planning-oriented innovation management in practice at this point: "In empirical evidence, it has been shown (. . .) that unequal treatment results when substantiating and legitimizing the gate decisions at the core of the process: Only those who do not intend to pass through the gate, are obligated to provide reasons for this while those who 'wave through' are not concerned – a learning experience that many of those surveyed went through very quickly. Open discussions about upcoming decisions in the gate meeting are hardly conducted; the meetings and the process itself are considered to be a farce. (. . .) Involvement of the innovation participants and basing planning and decision-making on factual, jointly compiled evaluation criteria in terms of quality and costs are suggested by the process; however, this turns out to be merely superficial in innovation reality. Estimates of time requirements and resources based on the experiential knowledge of innovation participants are ignored in most cases as well as, in many cases, the tangible necessities of a complex technical innovation process. This results in plans, which innovation participants consider to be unrealistic from the very beginning – which proves to be correct often enough. Nonetheless, they are adhered to" (Wühr et al. 2011, p. 156; see also Pfeiffer et al. 2012). Overall, such shortcomings of planning-oriented innovation management are forced in a particular manner by the tendency towards increased "economization" of innovation processes based on the classical principles of controlling (cf. Wolf 2011).

1.4 Uncertainty and Approaches to an "Other" Kind of Innovation Management

Studies on research and development in companies show that the "organization" of innovation which emerged independent from innovation management in practice is in no way a mere expression of arbitrariness, coincidence and inefficiency. Rather, forms of work and organization, which have a high level of individual responsibility, self-direction as well as limited bureaucratic controls and processes, are found here. They have characteristics that are presently considered typical and necessary for knowledge work and post-tayloristic work and business organization (cf. Wolf 2011; Hage 1999, 2000; Burns and Stalker 1994). Furthermore, there are also approaches in the scope of innovation management that consider uncertainty and limits of innovation planning a structural characteristic. However, these approaches tend more to border the mainstream. Uncertainty and limits of planning thus do not appear to be a defect that should be reduced to the greatest extent possible. The "organizational concepts" referred to as "laissez-faire laboratory non-organization" that were propagated in the 1950s are an example of this (cf. Shapin 2008, p. 140; Wolf 2011). The self-discipline of employees and trust on the part of management are considered decisive for the "organization" of

innovation processes. As result of recent developments, companies are given the following recommendations: first to refrain from excessively strict controlling when monitoring budgets and deadlines as this stifles innovation; secondly, to include divergences from planned figures in calculations as innovative ideas cannot be expected from employees who only perform assigned tasks; and thirdly, to support the exchange between employees from different departments as well as the exchange with business partners and customers as the new combination of different knowledge pools is decisive for innovative approaches (cf. Kanter 2006).

Alternative approaches to project management are also apparent particularly in software development. This results in new approaches to organization and the management of innovation processes in turn. The new approaches essentially concern not defining goals and results of innovation processes and how they are achieved in advance, but instead investigating them and defining them during and as a result of the development process. The concepts of agile and evolutionary project management are an example of this (cf. Peters 2011). Different developments are furthermore found in research on cross-company innovation regimes and networks. In addition to a "specialized and standardized system of coordination", a "fragmented and fluid order of interactive networking" also becomes apparent (cf. Rammert 2006). The considerable importance of informal processes and implied knowledge (tacit knowing) are characteristic of the latter.

Such developments in the organization and management of innovation are based on the finding that uncertainty is a structural characteristic of innovation. They therefore refer to the risk that attempting to plan and create the ability to plan to the greatest extent possible does not promote innovation, but impairs and blocks it. In order to promote innovation, it is therefore necessary to recognize uncertainty and planning limits when it comes to innovation. They should not be considered a deficit that has to be done away with, but a potential for promoting innovation. This does not mean that concentrating on the "Who" of innovation should again be the area of focus while removing the "How" from the responsibility of management. Rather, a "different" kind of management is needed, which promotes innovation on the basis of uncertainty. This book describes this kind of innovation management. It is based on findings from the KES-MI research and development project (cf. Chap. 2).

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