Innovation, Product and Technology Management

Dr. Peter Laier

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1st edition 2022

Bibliographic information of the German Library

The German Library catalogues this publication in the German National Bibliography;
detailed bibliographic information can be found on the Internet website: http://dnb.ddb.de.

Laier, Peter:
Innovation, Product and Technology Management

1st edition
Munich: TCW Transfer-Centrum für Produktions-Logistik und Technologie-Management GmbH & Co. KG, 2022
ISBN: 978-3-947730-31-5

Publisher:

TCW Transfer-Centrum für Produktions-Logistik und Technologie-Management GmbH & Co. KG, Munich

Preface I

“The only constant in life is change.” What held true some 2500 years ago, when ancient Greek philosopher Heraclitus first coined the expression, today has become an even more integral part of human existence and the everyday lives of billions of individuals. The degree of change, however, that must already have had appeared as rather complex from Heraclitus’s perspective, has reached a whole new dimension in recent years. Following tremendous advancements in digitization and global interconnection, we witness developments such as rapidly changing market conditions, technologies evolving with an unprecedented agility and also the ever-ongoing emergence of new breakthrough products.

When failing to find the right measures in reacting to these developments, even the largest and most successful companies are in jeopardy to fall victim to disruption. Consequently, decision makers at the top-executive level have a duty to develop the adequate approaches to a) correctly assess risks, b) develop operative solutions and c) ideally even benefit from the changes in the strategic long term. Especially the proper management of innovation and the product portfolio is of great importance, playing a key role in the long-term survival of an enterprise.

As this demanding task requires a sophisticated and strategical approach, I am delighted, that Dr. Peter Laier, an expert in the field for many years, decided to share his profound knowledge on the issue. Dr. Laier undoubtedly is equipped with valuable experience and highly competent in the field of business innovation and product management. In my eyes, he is a very much appreciated individual, who exhibits an impressive vita with several mandates at multicorporate enterprises in leading positions - including being the

head of R&D, Chief Technology Officer and Chief Operating Officer. At his most recent milestone Dr. Laier served as a member of the executive board of Knorr-Bremse, where he showed responsible for the global truck division. For his business unit he set the course to an adjusted product portfolio in an innovative manner, thereby empowering the division to a significant increase in revenue and overall profit.

Even when undoubtedly being very busy serving as a member of the board, Dr. Laier has found time to pass on crucial parts of his knowledge to future generations of managers. At TU Munich he is a popular lecturer hosting an insightful and comprehensive seminar on the topic of innovation and its management. And where a seminar already goes a long way in distributing knowledge to individuals who are eager to learn, we all should be thankful that Dr. Laier has managed to pour his refined knowledge into a book as well. Within this book, he is able to break down the complicated process of innovating and developing new products into small steps, that he describes in great detail, while always keeping an eye to the big picture. Furthermore, he demonstrates how the actual realization of a new innovation is done by showing the strategic decision making involved. This way, he is able to clarify the topics that should be considered when deciding on the implementation of an innovation. In doing so, he provides the reader with a solid set of tools when dealing with “Make-or-Buy”-decisions or the complicated steps of an “M&A”-process, for example. Thanks to the detailed presentation, the reader receives a comprehensive view on the subject and is able to realize all coherences. From a didactic point of view, Dr. Peter Laier succeeds excellently in presenting individual aspects. For instance, the reader is supplied with in depth methodology, which can be applied in the innovation process and in the evaluation of the

product portfolio. In order to further supplement such efforts, a case study is presented at the end of each chapter. In other words, each chapter is rounded off with a snapshot of reality that helps to cross the border from the world of theoretical frameworks over to the everyday environment of practitioners. In bridging this divide, the book allows for a deep and profound understanding of its contents.

All in all, by publishing his work Dr. Peter Laier managed to display a coherent approach on a pressing issue, which is backed up by his knowledge and experience in the industry.

As a university professor in management and Dean of TUM School of Management, I am particularly pleased, that some of the contents could be refined during the often-passionate discussions with our students. For them, such deep insights from the industry represent a crucial building block of their studies at the interface of management and technology. Not only for this reason I strongly recommend this book to decision-makers in the fields of business administration and engineering, as well as to students of the respective subjects, who would like to broaden their horizon and get a deeper understanding of the creation and implementation of business innovation.

To conclude with the initial heraclitean thought: In this ever-changing world, I wish Mr. Laier and this book that it inspires many generations to think anew about the important topics of innovation, product and technology management.

Munich, February 22nd, 2022

Gunther Friedl
(Univ-Prof. Dr., Dekan)

Preface II

Managing innovation is an art and a science. Dr. Peter Laier masters both sides. This book reflects his profound knowledge of the relevant concepts and tools of innovation management, as well as his extensive experience in applying them. It provides insights into how innovation actually happens in large industrial firms, lightened up by numerous real-life examples.

This book is based on the lecture series, “Product and Technology Management,” that Dr. Laier has been teaching at TUM School of Management since 2019. Since then, hundreds of students benefitted from Dr. Laier’s comprehensive knowledge and practical experience as a manager, presented in a structured and interactive way. The School is highly appreciative of this important addition to the our teaching offer.

Munich, February 28th, 2022

Joachim Henkel
(Univ-Prof. Dr.)

Preface III

The globalization of markets, increasingly similar products as well as growing market transparency lead to an increase in the homogeneity of competition. The associated interchangeability of the products offered, as perceived by the customer, represents a central challenge for today's companies. Many successful firms counter the reduced unique selling proposition of their product and service portfolios by differentiating themselves from competitors through innovation. They continuously improve their products and technologies to compete on cost, time and quality. This requires increased efforts for managing innovations and sustaining development.

Innovation is only feasible when companies understand innovation management as an independent and targeted management task. To compete successfully, companies must adapt their product and service portfolios ever more quickly and renew them substantially more frequently. Innovation management has thus developed into a success-critical discipline of entrepreneurial activity. This is also reflected in the extensive business research on innovation management, expressed in an almost explosive increase in the number of publications in recent years. Innovation management is therefore itself the subject of continuous change.

Against this background, Dr. Laier provides the readers of this book with methods and procedures for the management of products and technologies from a practice-oriented perspective. He precisely addresses the described issues by structuring innovation management in terms of content, anchoring it theoretically, and providing real world examples. He raises problem awareness, systematically presents the state of knowledge and makes theoretically and

practically sound statements on the successful management of innovations and products.

His book deals with fundamental strategies of innovation management, i.e. current concepts, future development trends and efficient instruments. The concepts, instruments and methods are illustrated by case studies and company examples. This provides the foundation for suggestions to shape the value of services and products and strengthen innovative capability.

Munich, March 2nd, 2022

Horst Wildemann
(Univ.-Prof. Dr. Dr. h. c. mult.)

Preface IV

One of the basic requirements for the existence, growth and overall success of businesses is innovation, which allows to adapt products, services or business models to the expectations and demands of the customers or to create new demands. Companies use innovation to distinguish their products and services on the global markets. In connection with the shortening of product life cycles found in many markets, it has become even more important to systematically plan, manage and control innovations. Today's specialists and managers must be qualified in directing these innovations and the resulting products and technologies. The product and service portfolio of a company needs to be constantly renewed and the needed technologies as well as the related investments and resources need to be planned and managed. These challenges of judgment, planning and prioritization become demanding as more disciplines are added to one's area of responsibility. For managers and experts who are constantly dealing with new tasks and disciplines and the corresponding leadership responsibility, this results in the need for easy access to the most important terms, contexts, methods and examples.

Over the last decades I had the chance to gain experience in innovation, product and technology management in many leadership positions in different global players. In the past years I have discussed the challenges arising in this context with students in lectures at the Technical University of Munich and have been able to help shape proposed solutions. The experience with technological upheavals in the past and the knowledge in discussing target-oriented solutions in detail form the basis for this – it is not a matter of providing recipes, but rather providing a comprehensive overview of the strategies, principles and methods to be applied.

To this end, I have organized the subject area of innovation, product and technology management into a generic yet wholistic framework – from the general definition of innovation and the different fields and areas, over market approach strategies, innovation partnership strategies, technology life cycle models to innovation as well as product and technology portfolio analysis tools and finally strategic planning, decision making as well as make or buy and M&A strategies. The work is thus intended to provide quick orientation for the technical and business management issues that typically arise in developing and manufacturing companies.

The book is addressed both at specialists and managers from the respective disciplines as well as to the corresponding experts on the interfaces between the disciplines. However, it is also aimed at students of engineering and business administration who want to review their learning content in a condensed and application-oriented manner. The book reflects the current state of research and practice and offers a wide range of examples and case studies to further deepen the understanding of the described processes and tools.

My sincere thanks go to Prof. Dr. Gunther Friedl, Prof. Dr. Joachim Henkel, Prof. Dr. Dr. h. c. mult. Horst Wildemann, Lydia Sorge and Gabriele Wilhelm for their contribution to the creation of this book. In addition, I would like to thank my wife Patricia and my sons Philipp and Maximilian for their motivational support and inspiration during the creation phase of this book.

Munich, January 31st, 2022

Dr. Peter Laier

Contents

1. Innovation Management – Managing New Products

1.1 The Definition of Innovation

The definition of an invention is perfectly described by one of the important economists of the 20th century, Joseph Alois Schumpeter. He defines innovation as "an implementation of a new technical, organizational or market-based solution" (Schumpeter, 1911). Schumpeter stated, an innovation is an invention which is afterwards successfully introduced or pushed into the market, meaning it should be implemented, used and subsequently monetized (Schumpeter, 1911). He persists that the leading force of any progress is imbalance or the structural change. So, the problem that is hindering economies to develop further is not the unbalanced development, but rather to remain in its stationary state. Since an innovator is the one who brings this change and dynamics into the system, an entrepreneur who takes the role of an innovator is the key player of any economy (Schumpeter, 1911).

In Schumpeter's opinion, the core of any modern economic system is innovation, which brings growth and pushes economies forward with imbalance being its main lever.

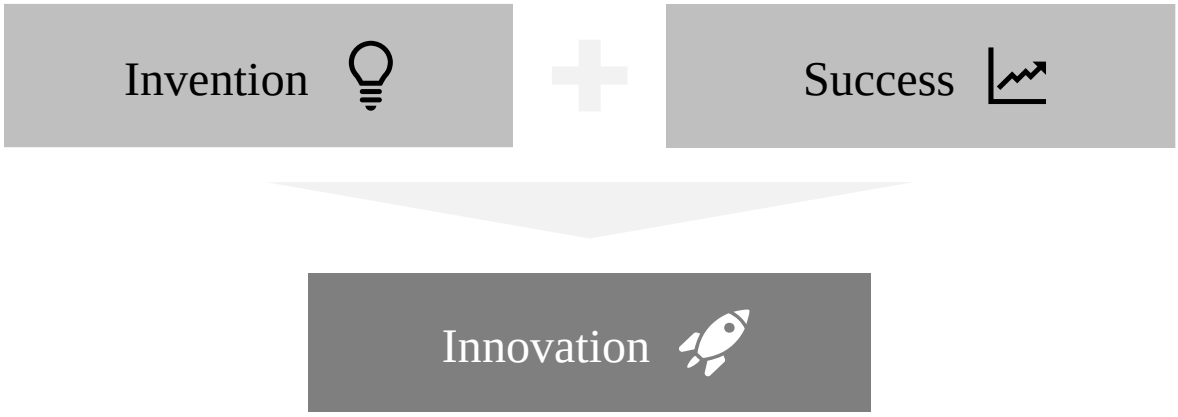

Figure 1: The definition of innovations as inventions pushed commercially successful into the market

In his view, innovation leads to creative destruction described as the dismantling of traditional economic practices to propel new ones (Schumpeter, 1911). Based on this assumption, profit of a company has primarily one goal - financing future innovation. Generating profits enables businesses to invest in innovation and maintain their existence in the long run. This makes profit essential for a company's future and without it, no innovation is possible. And without innovations a company usually has difficulties to stay profitable. Moreover, Schumpeter is distinguishing between an innovator and a standard entrepreneur. The first one pushes innovations into the market and achieves high margins what in some cases may evolve into a monopoly at least for some time. The latter ones gain only lower margins, as they just follow and copy the innovation. Another role, that plays an important part in the economic development, is the role of the capitalist who provides funds by bearing financial risks and gaining the corresponding returns (e. g. in the form of interest or dividends). Nonetheless, it is the innovator who has the final decision on the capital allocation (Schumpeter, 1911).

In summary: an innovation is an invention that differs significantly from what exist before and which is commercially successful pushed into the market. Innovations are crucial for an over average commercial success of a company.

1.2 Fields of Innovation

Innovation can arise in a variety of different fields. Typical fields of innovation include products, services, business models and processes (Hauschildt, 2005, p. 25; Schuh and Bender, 2012, p. 1). While all innovations are similar in their principal nature, the book at hand primarily focuses on product innovation gives an overview of the other innovation fields, all of that illustrated by examples.

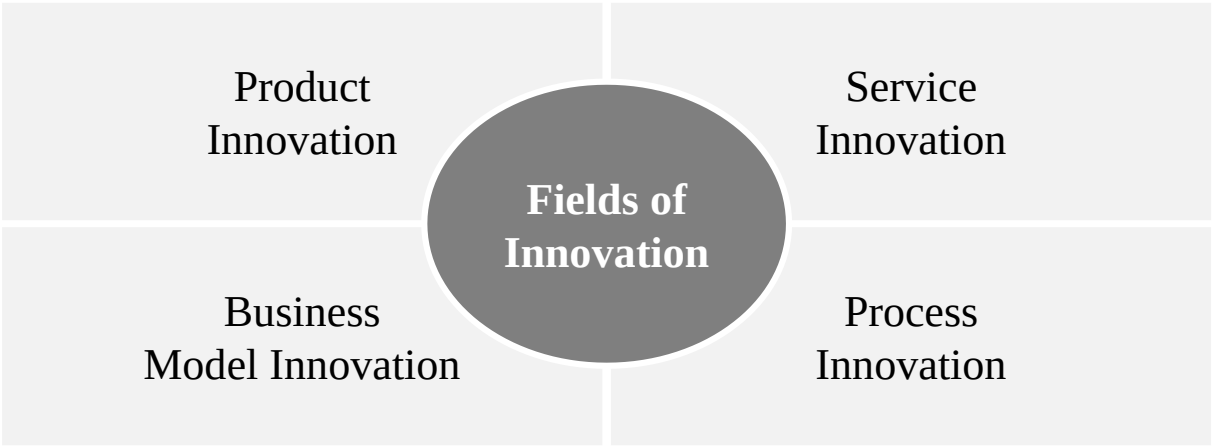

Figure 2: Fields of Innovation

Product Innovation

Product innovations are totally new or significantly improved products based on research and development (R&D) or using existing technical solutions for new purposes. A product innovation can be initiated by a screening of market demands by the own company, by customer demands or by an innovative new technology (Trott, 2005, pp. 17–26). As well as other innovations a product innovation is a critical differentiator and a margin generator for any entrepreneur and requires in many cases above average R&D investments and a rigorous control of the whole R&D process which ensures the proper allocation of the invested funds.

A classic example for product innovation is the transformation of traditional mobile phones used specifically for telephoning into smart devices with many further functions, a new look and feel and Human Machine Interface concept and an entirely different concept of use. For example, after many prior innovations which fueled the innovation process this innovation has finally turned a company like Apple into one of the world’s most profitable and innovative enterprises.

Furthermore, let us take the example of light-emitting diodes (LED). Although they were invented at the beginning of the 20th century as a part of a physical experiment, only from the 1960s to 1980s the technology was further developed, and different colors could be obtained. While LEDs were able to display a wide range of colors, it was still difficult to produce a spectrum of blue. This problem was tackled at the end of the 1980s by a small Japanese company called Nichia that invented a blue LED and added yellow luminescent to it, which built the foundation for the white LED light known in all areas of illumination today. Not only did this invention change the business of light itself, but it also turned Nichia into one of the biggest LED companies up to the present day and majorly shaped the lighting industry. Thereafter, leading conventional light industry players and other global players invested in LED.

Service Innovation

Apart from products, innovation can happen as well in the field of services. A service innovation provides new services, additional features of services, better access to services, service improvement or a remarkable change of service costs (Schuh and Friedli, 2005).

A practical example for a service innovation is Apple's iTunes which was an utterly new way to provide media services: at first music, and subsequently videos and podcasts via an online portal. A completely new practice which was not used before and transformed irrevocably the music, the video and the entertainment industry. Moreover, Apple combined this service approach with its product innovations such as iPods and later iPhones and iPads. This combination of product innovation and related services out of one hand was another combined innovation and paved the way to the unique success of this innovation approach.

Another decent example for an innovation in the service area is UBER that provides driving services by people with their own cars and an easy-to-use app-based service as an alternative to taxis. This was a great first step to position itself, although UBER's final target originally has always been to provide a fully automated driving service. Netflix is another brilliant innovation that comes to mind when thinking about service innovations. Starting out as a mail order video and DVD rental provider which turned into the online streaming platform we know today, Netflix is one of the pioneers changing the way we consume movies at home.

Business Model Innovation

Business model innovation is happening by creating new/additional customer values mainly around monetization of products and services (Gassmann et al., 2014, pp. 3–9; Lindgardt et al., 2009). Amazon with its continuous innovation is a perfect example of innovation in business models. It started as a relatively focused innovative idea of online bookselling. Gradually, Amazon created the western world's biggest online shopping platform, which resulted in huge financial success and market dominance which is recently fueled further by the global COVID-19 pandemic. Afterwards, Amazon expanded into further areas such as cloud service, web service, food delivery, logistics services and drone delivery. This suggests that Amazon's ongoing innovation model enables the company to bolster its profitability level by generating new innovative ideas which ultimately turn into successful business models (Dumaine, 2020; Gassmann et al., 2014, p. 5).

Another interesting example is one of the big tech companies: Google. It started with an idea to have a search engine and provide all possible opportunities for advertisements which are customized to

the user. Google improved this business model further by creating auction ads, meaning the one who places the highest bid, attains the first position in the search engine. Likewise, it implemented further services such as Google Maps, Google Earth, Google Street View, Google Mail, Google Cloud and so on. Furthermore, Google had anticipated the emergence of smart mobile phones and, as a result of early market research, acquired Android in 2005 and developed Android OS to one of the most frequently used mobile operating systems. This way Google was able to influence the mobile phones as well as the search engines.

Another example for very diverse innovations by Alphabet, the parent company of Google, is Waymo; one of the world's most innovative companies for automated driving in passenger cars, as well as in trucks. By investing heavily in artificial intelligence combined with high computing power, related sensorics and consequent gaining of test miles results Waymo outpaced well-established industry players in the development of automated driving technology.

Process Innovation

Finally, process innovation is another area of innovations. Superior operating processes can considerably influence the success of a product or a service. Ford can be taken as an excellent illustration for that. Mr. Henry Ford developed a vehicle which was called Ford Model T in 1908. It was indeed a well-designed car but certainly not first of its kind on the market. However, Mr. Ford made a difference regarding the cars' manufacturing process. He developed the conveyor belt for manufacturing which enabled the first mass production of automobiles. Now Ford was able to generate economies of scale and a higher speed of production, significantly

reducing the vehicle's manufacturing costs. With the establishment of a unique process innovation combined with a reduced number of options Ford was able to define a new market price level for automobiles and via the lower sales prices significantly increase sales volumes was able to step into a previously non-existent margin pool. The production of Ford's model T was the first larger implementation of mass production based on the invention of the conveyor belt and standardization of the product. Mr. Ford was even quoted saying: "You can order my Ford Model T in any color, but with one condition: The color needs to be black" (Hauschildt, 2005, p. 26; Schuh and Dölle, 2021, p. 2; Wille, 2016, pp. 19–20).

Toyota is another notable example for an innovator in all the areas previously discussed but specifically in innovation of processes when we think of TPS, the Toyota Production System. In the 1980s, hundreds of Western top-level managers travelled to Japan to comprehend how Toyota differentiated itself. In a nutshell, the TPS consists of two basic pillars which are the just-in-time production and the quality control where anyone can cease the manufacturing line at any point of time in case any deviations arise.

In addition, failure avoidance is offered via different approaches such as small devices and features (Poka Yoke) that do not allow to mix incompatible parts or assemble it in an erroneous way. In such a well-thought-through overall process they have been able to enhance the quality level of Toyota vehicles to such a degree that today whenever somebody is asked in any part of the world about Toyota's most important brand DNA characteristic the first answer would presumably be superior quality. Such a market perception of reliability is a unique selling point that endows Toyota with the access to larger profit pools in the market (Liker, 2020; Schuh and Dölle, 2021, p. 2).