Innovation Commercialisation: Processes, Tools and Implications

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Abstract

Innovation commercialisation is a new direction in the literature. The challenge in these commercialisation-related activities is that they must simultaneously take into account the processes of generating innovations, developing products and services based on these aforementioned processes and then forming a business model around the product-service system. We see innovation commercialisation as a process that aims to create and implement a feasible business model for an innovation-based product-service system in the surrounding business ecosystem. This view builds on the literature on business model innovation, where the business model is seen as a value-creating subsystem in a complex system of business models, that is, within the business ecosystem. In our chapter, we describe a process that is used in over 40 innovation commercialisation projects. The process has been developed and modified to serve the different needs of various innovation development groups. The process is iterative and has been divided into two parts: 1) proof of relevance and 2) in-depth development. We highlight the targets in the distinct stages of the process, the specific challenges related to the stages, tools and processes to tackle these challenges and the best practices based on the cases we have been investigating. Finally, we conclude the lessons learned, bringing them together into managerial implications that show how to get the best results out of innovation commercialisation projects.

Introduction

Commercialisation-related activities have to simultaneously take into account the processes of generating innovations, developing products and services based on these aforementioned processes and then forming a business model around the product-service system. Therefore, it is necessary to take a multidisciplinary approach toward the commercialisation process by combining the views of technology and innovation management (Koen et al., 2001), new product development (Cho & Lee, 2013), business model innovation (Foss & Saebi, 2017), marketing (Aarikka-Stenroos & Lehtimäki, 2014) and complex system approaches (Fleming & Sorenson, 2001).

Innovation commercialisation is a process that aims to create and implement a feasible business model for an innovation-based product-service system in the surrounding business ecosystem. This view builds on the business model innovation (BMI) framework, where the business model is seen as a value-creating subsystem in complex system of business models (Foss & Saebi, 2017). BMI has four separate research streams: 1) conceptualising BMI, 2) BMI as a change process, 3) BMI as an outcome and 4) the consequences of BMI (Foss & Saebi, 2017). In this chapter, we focus on the process view of creating new business models that are based on technological innovation.

There are many identified challenges in effective commercialisation. The lead time in the innovation commercialisation process has to be short enough to obtain a rapid response to the identified market gap. However, it is also essential that products, services and the entire business model be developed simultaneously. It is difficult to get different competence areas together for cooperation in the different stages of the commercialisation process. The stages of the process are seldom understood similarly between actors in the process, which makes communication difficult. Framing the stages of the commercialisation process is therefore needed to clarify the needed competences, collaboration and tools to finish different stages in the process. Most importantly, there is the need to concretely highlight different stages in an effective innovation commercialisation processes.

Generating solutions and business models for industrial ecosystems

The key target of any high-technology commercialisation process is to guide the building of the initial innovation through a systematic process toward a business model based on customer needs while fitting it into the target ecosystem. To succeed in this, the process has to have several aspects. We highlight here the background that we build our process on.

It has been argued that creating customer value is the essence of a business' existence (Bowman & Ambrosini, 2000). In this sense, customer value refers to what the customer wants, given certain limitations such as time and money resources. Customer value creation involves integrating the customer into the development activities at an early stage (Thomke & von Hippel, 2002) . To build a business model based on customer needs, it is essential to understand the customer's business goals, requirements, purchasing criteria, problems faced and so forth. In other words, it is essential to know the target customer's business so that the innovation team can help the customer better utilise the developed solution.

One key aspect of a commercialisation process is that it concentrates on integrating multiple value-adding products and services as solutions to customers' problems. Solutions are defined as systems of physical products, services and knowledge designed to fulfil customer-specific needs (Epp & Price, 2011; Roehrich & Caldwell, 2012). Solutions are jointly built through an evolving relationship between the providing company and the customer (Tuli, Kohli, & Bharadwaj, 2007). The development of a solution is based on the product–service system (PSS) methodology, according to which a company's product and service portfolio is mapped as a modular, interconnected system that supports the structure of an integrated solution (Dahmus, Gonzalez-Zugasti, & Otto, 1999; Geum, Lee, Kang, & Park, 2011; Ulrich, 1995). The key principle of the system is its functional structure: the decomposition of its products and services into service functions that describe what the products and services do, not what they are (Ulrich, 1995). One product or service may enable one or several service functions, and conversely, one service function could be enabled by several products and services (Geum et al., 2011). According to this logic, value is not delivered via the product or service itself, but via the solution that is based on these functions (Alonso-Rasgado, Thompson, & Elfström, 2004).

To connect the solution's functional structure to a larger context, we need to extend the systemic analysis from the solution to business level. The *business model* is a particularly useful conceptual tool for this purpose in that it describes the architecture of the business system in terms of products, services and information streams (Timmers, 2000) connecting the solution to the company's processes and stakeholders. From the company's perspective, *business-model innovation* requires the capability and processes to innovate and redesign the solutions (Chung, Yam, & Chan, 2004). If the process is successful, it may even help the company redefine or refine the "rules of the game" in the markets (Tidd & Bessant, 2013). The creation of a business model also clarifies the earning logic of the company and helps to design the financial feasibility of the business.

Because solutions and business models are provider–customer-specific constructs, the industry-level approach must examine the holistic system of which the solutions are a part. To understand the complex solutions, the business network must be described on the levels of product-driven interdependencies, process-related ties and firm-to-firm interactions. In this relational view of business networks, the basic building blocks of the network are product components, production activities, resources and organisations that control activities. Because of the multilevel structure and ecosystem, the integrator of the complex solution must establish common rules, shared responsibilities and maintain fluid relationships among sequentially pooled and reciprocally connected stages of networked activities (Dubois, Hulthén, & Pedersen, 2004; Karatzas, Johnson, & Bastl, 2016).

The actors in the ecosystem can either share resource pools through the market mechanism or acquire specialised actors, depending on the costs of governing transactions where the goal is to stimulate growth or value creation potential (Holcomb & Hitt, 2007). From the aspect of commercialisation, the diverse resource and capability requirements of the complex solutions are the drivers for change, which leads to business start-ups if the new actors are able to create self-reinforcing capability-building loops (M. G. Jacobides, 2005). Later, however, the ecosystem tends to turn toward consolidation when commercialisation, market expansion and coordination of the platforms becomes relevant for the firms in an ecosystem (Andersson & Xiao, 2016; Michael G. Jacobides & Winter, 2005).

Many innovation activities in the development and production stages require the capabilities and technologies of other companies. This has influenced the need to extend the traditional single organisation focus toward a value chain view of the innovation activities, which requires understanding the positioning of the company in the product or service value chain. The value chain (Porter, 1985) emphasises joint processes, capabilities and efforts on finalising the customer solution. In other words, the value chain describes all the value-creating activities required for producing a customer solution in the most efficient way. This being said, it is necessary to design the flows of the activities, and it is also essential to establish collaborative relationships with the right partners and suppliers. According to Doz and Hamel (1998), alliance relationships differ from the traditional market transactions in that they can be characterised as strategic collaborative relationships with companies; they state that alliance relationships are essential in global competition because they allow the sharing of complementary resources between organisations.

In addition to the strategic partnership in the development stage of the product-service systems, the production design of the supply chain must be considered. Selection of the right suppliers for subcontracting may provide economies of scale and scope for the production. Supplier companies with high manufacturing volumes and capacity combined with flexible manufacturing systems make it unnecessary to heavily invest in production facilities at the early stage of the commercialisation process.

Commercialisation experience in the field of high-technology innovations

Case description

Innovations based on high technology require hard work and a systematic approach, which if done right, still will take a long time to come to fruition. Often, the work is based on extensive research, for example, in universities. To boost the utilisation of promising new technological innovations, universities have been building different models. This is especially true of the technical universities around the world, which are more and more aiming to make an impact by attempting to commercialise their innovations. In Finland, this trend has been ongoing for a couple of years, and the models and processes are currently being built.

Universities typically have an administrative process for innovation commercialisation activities, for example, help in finding funding, patenting, legal issues and even a capital investment company to support the seed phase of spin-off companies. However, there are several challenges, including the idea itself and the innovation team needed to meet before they can approach the funders and markets related, for example, to the feasible business model. The challenge in the process often is that the innovation team has a very strong technical background but not so much experience regarding the aspects of commercialisation.

Since 2012, we have been working in close collaboration with the university innovation process and the technical innovation teams attempting to provide a process and tools that can help teams strengthen the business aspects of their innovations and build a business model to commercialise the innovation (see Figure 19.1).

During this time, we have been evaluating over 40 concepts in the proof of relevance (PoR) phase and leading over 10 full-scale business model development (BM development) processes for innovations that have passed the PoR phase. The duration of a PoR analysis is usually less than a week, and the full-scale BM development process runs from four to six months. The typical areas of the innovations and technologies are related to energy provision, Internet of Things, chemistry applications, industrial process improvement and others.

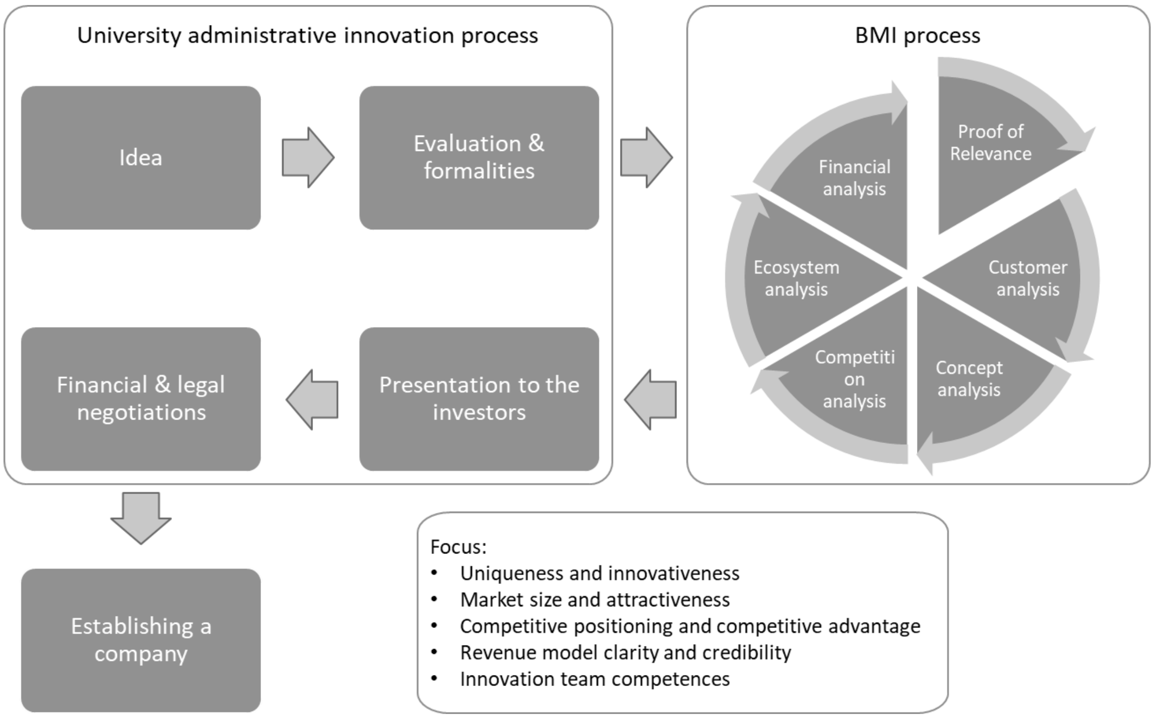

Figure 19.1. The BMI process as part of the university innovation commercialisation process

BMI process description

In the following, we describe a process that is used in our innovation commercialisation cases in the technical university context. The process has been developed and modified to serve the unique needs of innovation development groups. The process is iterative, and it has been divided into the following two parts: 1) proof of relevance and 2) BM development. The aim here is to build a business model for the idea and innovation. The general BMI process is illustrated in Figure 19.1.

Challenges in the process stages and lessons learned

Here, we highlight some of the most common challenges related to the phases of our process. We also list the key issues that must be solved and highlight some examples of analysis tools and methods in the BMI process stages, including proof of relevance, customer analysis, concept analysis, competition analysis, ecosystem analysis and financial analysis.

Proof of relevance

The BMI process usually starts and ends with the PoR phase. The target of the PoR phase is to find out if there is value potential for the innovation and where the potential would be the largest and most rapidly achieved. This phase often determines whether the process should continue. If there seems to be remarkable value potential within a reasonable time to market, the project can continue; otherwise, the decision should be to not continue the process. This PoR phase in often good to repeat after the BM development process to see if the chosen track is still relevant.

The major challenge in the very beginning of the commercialisation process of a technological innovation is that the technology itself can solve several problems, depending on the solution area. When seeking major business potential, the technology is usually not the solution, but rather, it is usually a piece of a solution. This means that one can plan a technology for a customer-specific problem, but outside this problem area, the options to utilise the technology are limited, and the business model created based on a single problem is usually not scalable. Bigger business possibilities lie in the solutions that the technology is a part of. By recognising the solution areas where the innovation can be a part of a solution and evaluating the value potential of the innovation in each solution area, as well as the potential market size and the time to market in those areas, the relevance of the business idea can be pointed out. For example, the innovation can be a new construct of a heat measurement sensor that provides quicker and more accurate measurements and that is smaller and more durable than the existing ones on the market. According to the innovation team, the heat sensor can be used inside marine diesel engines, for measuring the energy losses of different buildings and also for measuring the energy consumption of an athlete. The solution, however, would be very different for these solution areas, and it would utilise very different features and attributes of the innovation concept.

The items to be solved are as follows:

- The problems, use cases, solution areas and so forth to which the innovation can contribute.
- What is the mechanism of the innovation's value provision in these areas?
- What is the value creation potential, market size and time to market in these areas?
- The design requirements in the innovation concept and solutions for different solution areas.
- The optimal (financially and technically) solution area and solution combination to continue with.

When mapping the contribution of the innovation, it is useful to have expertise from many different sectors. One way to obtain multiple perspectives on the possibilities of the new technology is a brainstorming workshop. These kinds of workshops are useful when organised with a structured and goal-oriented agenda that is supported with a group-decision support (GDS) system. A GDS system could, for example, be an online platform that allows facilitated processes for simultaneous and anonymous input of ideas for a group of people (e.g., Meetingsphere, Thinktank). It also allows the grouping of the ideas and voting or rating the items generated. This kind of system enables a fast and efficient process for generating and selecting ideas for later analysis.

To illustrate the structure and results, we present a PoR workshop for a heat measurement concept that we organised with six specialists (experts in the technology itself, the heat measurement industry, applied electronics, control engineering, digital systems and innovation management). In this kind of workshop, the optimal size of the group is between five and 10 people. First, the participants identified interesting potential solution areas for the technology in a brainstorming session. Second, the participants were asked to identify how quickly the business could be established in these areas, assess how large the value potential of the innovation in a solution area would be and estimate the market size of the solution areas on a 7-point scale (with specific instructions on how to use the scale). Because of these rounds, 23 new solution areas for the technology were identified (see Table 19.1), three of which were selected for further study.

Table 19.1. Example of solution area identification

		Time to market		**Value potential**		**Market size**		
Nr	Item	Mean	SD	Mean	SD	Mean	SD	Mean (row)
6	Internal combustion engine control	4,6	0,13	5	0,26	6	0,11	5,2
10	Combustion engine control systems	4,4	0,13	5,4	0,29	5,8	0,12	5,2
7	Emission minimisation control for ICE and power plants	4,6	0,17	6	0,11	5	0,35	5,2
2	Diagnostics, monitoring and control of cooling systems	5	0,15	5,2	0,19	5,2	0,16	5,13
1	Diagnostic and control of thermal machines and power plants	5	0,11	5,4	0,23	5	0,24	5,13
11	Condition monitoring for heating systems in buildings	4,4	0,13	5,6	0,13	5,4	0,23	5,13
4	Heat exchangers	4,8	0,19	5,2	0,19	5	0,15	5
5	Boilers conditon monitoring	4,8	0,27	6	0,18	4,2	0,32	5
8	Smart house energy system	4,6	0,17	5,4	0,17	4,6	0,31	4,87
14	Thermal behaviour and loss behaviour of power converters	4,4	0,29	5,6	0,2	4,6	0,34	4,87
3	Gas and steam turbines	4,8	0,19	5,2	0,12	4,4	0,27	4,8
17	Computer speed acceleration	3,4	0,17	4,8	0,32	6	0,18	4,73
12	Feedback signal in industrial chemical processes	4,4	0,17	4,6	0,17	5	0,35	4,67
9	Thermal management consulting	4,6	0,31	5,6	0,13	3,8	0,24	4,67
20	Electronics lifetime extension	3,2	0,12	4,8	0,27	5,6	0,25	4,53
13	Heat measurement in data centers	4,4	0,25	5	0,28	4	0,21	4,47
16	Measuring heat in consumer electronics	3,8	0,24	3,2	0,32	6	0,21	4,33
21	Heat management of GSM base station electronics	3,2	0,24	4,8	0,24	4,6	0,34	4,2
22	Thermal sensor for security systems	3,2	0,24	4,6	0,17	4,6	0,13	4,13

15	Precision heating equipment	3,8	0,22	4,8	0,29	3,2	0,31	3,93
23	Sports monitoring	3	0,15	3	0,28	4,6	0,31	3,53
19	Multiphase flow measurement	3,4	0,29	4,2	0,12	3	0,21	3,53
18	Robotic hand tactile/thermo sensor	3,4	0,23	3,2	0,16	3,4	0,13	3,33
24	Body heat loss measurement	2,4	0,08	2,8	0,31	4,2	0,41	3,13
	Mean (column)	4,07	0,19	4,81	0,21	4,72	0,25	

Based on the results the further development was targeted towards the industrial applications in combustion engines and thermal control.

Third, a new round of brainstorming was conducted to identify potential customer companies and to recognise their special business areas. Usually, a requirement identification session is also implemented in the PoR phase.

Customer analysis

The extensive BM development part of the BMI process after the PoR phase starts with a customer analysis. The target of the customer analysis phase is to find out, select and understand the potential customers for the selected solution areas. The essential part of the whole BMI process is that the innovation must be treated as a part of a solution to a problem. The more customer companies that have similar problems can be found, the bigger the market potential is. Also, to eventually create sales, it is essential to know the purchasing criteria of the customer group.

The typical challenge in this phase is that the innovation team knows that the solution can help the customers solve their problems, but they do not necessarily know how to articulate this to the customers. Also, customers usually can see the benefits in general, but it can be unclear how the solution actually works in their processes. By bringing a group of potential customer experts and the team into the same workshop, both parties can learn from each other. This helps the team understand the problems of the customers and adapt the innovation to become a solution for these problems.

The items to be solved are as follows:

- The innovation, problem and solution must be set into a certain business context.
- The most attractive customer or customer group with this problem must be identified and selected.
- The target customer's business model must be analysed to understand their business goals.
- The target customer's problems in pursuing their business goals must be analysed.
- The customer's business goals must be translated into the decision criteria they would use when rating their investment or purchasing decisions.

For example, a 2-hour workshop we held to solve the problems related to this phase was done for an advanced automatic welding system that adopted neural networks to optimise the welding results. We used a three-phase GDS process and an online GDS system with a group of 18 experts from different potential customer companies. The first stage was to collect the problems the experts faced in the productivity in their current production process. The question was formulated as follows: 'What are the key questions and problems in achieving the productivity goals in production?' We obtained 15 ideas in 5 minutes. Then, by discussing the ideas and simultaneously categorising them, we ended up with nine key themes of problems affecting the productivity in the customers' production processes. The second stage aimed to spot the problems related to achieving quality in the production process. The question was formulated as follows: 'What are the key questions and problems in achieving the quality goals in production?' In this phase, we obtained 31 ideas in 5 minutes. In the discussion, we ended up with 18 key themes of problems affecting quality in the production processes. The third and final phase was to rate the problems to find the biggest obstacles the customers faced. We divided the production into three general phases to see what part of the production process the problems were affecting. The general phases were preparation, production and post-production check-up. The rating of the nine productivity-related problems and 18 quality-related problems was done with guiding statement: ‘Assess the impact of a problem in the three stages of production’. The scale of the impact was from 0 (no impact) to 5 (huge impact).

To see whether the innovation concept could solve the problems of potential customer problems in production, we selected 10 major problems based on the previous phases. We also added two themes that the expert group suggested to bring into consideration at this stage of the process. The question was as follows: ‘How well does the concept solve the current problems in the production?’ The scale was from -2 (considerable negative impact) to 2 (considerable positive impact). This helped the team to focus to the real customer problems in their concept development work.

Concept analysis

The target of the concept analysis phase is to construct a streamlined and efficient solution around the innovation. In the earlier phases, the innovation concept was treated as a general solution, but this phase analyses what the innovation concept actually does to solve the customer problem and how it does this. The problem we face again and again in our commercialisation cases is that the solution is defined as a bunch of technical attributes and features that are all equally important in the solution. The need for a customer, however, is how the innovation solves the problem on a detailed level, and maybe more importantly, what the innovation does not solve.

Of course, the technical attributes are important, but defining the solution as a set of functions helps the team see what is essential in the solution design and also the customers see how their problems are solved in detail. Using the sensor example, the customers would be interested in knowing how the sensor solution will solve their problem. The technical details would come into discussion in the later stages of negotiations. The functional structure in the consumer solution company case would probably lead to a result where the consumers need quicker and more accurate measurements fitted from a device that can fit into a wristband. Durability is not an issue for them. With this information, the team can proceed with the customer-relevant design and the innovation's technical attributes. The solution can be made more efficient for the purpose also by leaving out functions (e.g., extra durability).

The items to be solved are as follows:

- The functional structure of the solution must be mapped.
- The fit between the innovation concept functions and the target customer's decision criteria must be solved.
- The creation of a 'minimal functional design' of the solution based on the customer's requirements.
- A value proposition based on the functions of the solution.

To map the functional structure, we use the value flow mapping technique. The value flow map is an input–output map where the value streams are based on the products and services, describing what is being transferred, where the transaction originates from and to whom it goes (an example is shown in Figure 19.2). The product or service stream often includes indirect and complementary value streams, which are revealed in the analyses of the actors and customers. The analysis also reveals new actors, customers and value streams that are not visible until the process is underway. The solution should be designed so that it has relevant value streams that can deliver these benefits to the customer. We use the quality function deployment (QFD) matrix to assess the value of concept for customer segments. QFD is a method for converting customer demands into quality characteristics and for developing product designs by systematically deploying the relationships of customer demands and product characteristics. The prioritised customer value attributes from the customer analysis are connected to the functions of the concept by applying the QFD matrix. The analysis shows the importance order of solution elements in delivering the value for the customer. The QFD analysis also reveals the most sensitive customer requirements compared with the elements of the offering. The example of the results of a QFD analysis is presented in Figure 19.2.

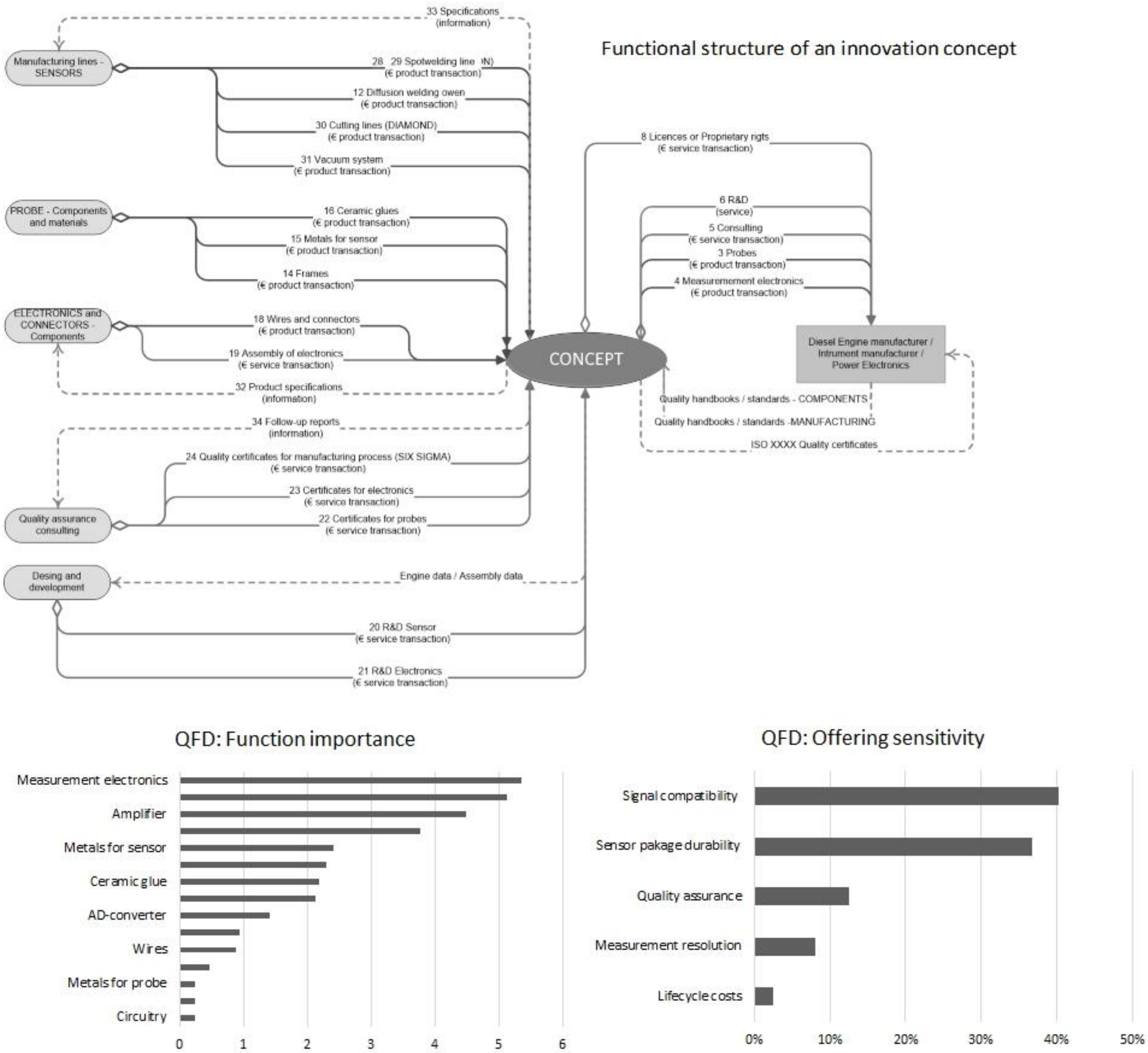

Figure 19.2. Example of a functional structure and the QFD results of an innovation concept

Competition analysis

The target here is to find out the true competing solution for the one under development and to figure out the areas where the rival concept can be beat. The competition must be understood quite broadly in the commercialisation process. Also, the competition must be treated not only as competing concepts or companies, but also as being connected to the competitive advantage of the innovation concept.

The challenge in many cases is that although the innovation can be scientifically ground-breaking, the customer problem still might be already solved. E.g. the patent analysis shows that there are no similar technologies yet patented, and initial analysis of competitors reveals no company that does exactly the same. The customer problem might have been solved using a totally different concept that did not show in the technology-based search for patenting. It might be that although the innovation in hand is technically outstanding, more common solutions are still ruling the market as the dominant design. A quite common case is that even though, the customer has a problem and the solution is the dream fit to the problem, it is just not the time to invest. So the biggest competitor is not always a fancy competing technology but may just be the old technology in the form of an existing investment. For example, in the mining industry, a new filtration solution could significantly reduce energy consumption and related expenses of the sub-process. The companies, however, have low willingness to invest into process upgrades due to the very difficult situation in global economics.

The items to be solved are as follows:

- What are the real competing concepts for the solution under development?
- What is the dominant design in the target customer's industry?
- On what dimensions are the created concept better than the competing concepts, as reflected in the target customer's preferences?
- How should the competitive advantage be argued to the customer?
- How should the non-investment barriers in the target industry be overcome?

An example case of a competition analysis is based on a competitive advantage analysis of the solution. The aim here is to clarify how the developed solution is better than the competitive solutions in relation to the customer requirements. The analysis utilises the results from the customer analysis phase. The customer purchasing criteria are weighted using the analytic hierarchy process (AHP) model. The process is implemented in a workshop consisting of a group of technology and business experts in the field. In this case, first, we brainstormed the voice of the customer (VoC) model based on the purchasing criteria. The VoC consists of customer requirements that are grouped into categories. In this case the categories were: production related requirements, product related requirements and customer company's requirements. Each category consisted of three to four requirement attributes. After this, we first assessed the importance of the attributes from the customer's perspective by using a pairwise comparison technique to obtain a weight of the attributes of the priority tree. In the second phase, we assessed the performance of our concept and two competing solutions in the VoC attributes and in the categories, also by using a pairwise comparison technique. The analysis revealed the overall performance order of the alternative solutions and also how they perform in the unique attributes. This helped the teams to develop the solution further for the lower performing areas and to communicate the strengths better to the customers.

Ecosystem analysis

The target of the ecosystem analysis is to position the business model to the target customer's value chain and the ecosystem around the solution. The aim is to clarify the industry's functional structure, business models, key players and financial and owner structures to position the solution into the existing structure with a business model that is designed to fit in the structure. Here, the fitting process can follow either an adaptive strategy or a disruptive strategy. The analysis focuses on the product architecture and the business ecosystems, including application areas, product concept and suppliers related to product. The aim is to recognise the opportunities for the potential start-up and the complementary technologies and services needed for the core concept.

The main challenge here is that the innovation is usually intertwined around the integrated, established technologies. For example, a high-speed generator technology that can be connected to any existing process utilising steam power (named HERGE in the figure 19.3) is in the development phase and facing this kind of a problem. The nature of the concept connects it as a part of smart grids, which have particular requirements regarding connectivity, control and demand forecasting. Therefore, the commercialisation of the innovation faces challenges where parts of the concepts are located in a diverse set of business clusters.

The items to be solved are as follows:

- The solution’s position in value chain must be analysed.
- The business model’s combinations must be solved.
- Identifying the supplementary business models needed to operate the main business model should be done.
- Differentiating partners and customers between business segments must be done.
- A business strategy must be built.

An approach to assess the ecosystem of a start-up is based on four phases of analysis: 1) activity mapping and specification, 2) interface specification between activities, 3) network modelling and 4) product strategy assessment. At first, the activity mapping and specification phase define the main structure of the activity network by the final offering and explain the prerequisites for the alternative business models. Second, the interface specification between activities handles the search operation, information, legal and co-operational linkages between recognised activities within the ecosystems. The linkages include both the direct and indirect strong relationships between activities, creating a framework for information exchange between actors and describing the phases of production activities. The third phase, network mapping analyses the activities of the network's position (by centrality metrics), clustering and visualisation of the network to deliver a comprehensive view of the ecosystem. The fourth phase, the strategy assessment, reveals alternative ways to renew structures through actor specialisation or by new business models and to manage the uncertainty related to component technology or markets within the ecosystem.

To illustrate the issues in ecosystem analysis, we present a case of a high-speed generator technology and the mapping of the ecosystem for this innovation.

The key proprietary rights and technology developed in the commercialisation project considered the core parts of the generator concept itself, which provide the premises for product-focused business models, either manufacturing or systems selling. The high-tech device manufacturing or assembly-based businesses are, however, complicated for a new entrant. Here incumbents have significantly better capabilities to invest in new products. Looking the innovation in a broader scope there are, however, also other possibilities. The start-ups can build their businesses around digital products based on 'the energy efficiency as a service' mindset. These monitoring and production control services are located in the small-scale generation cluster of the ecosystem, which is expected to grow in the future, being driven by the megatrends in the energy industry. In this kind of a business, interfaces define the digital service platform that enable connecting the solution as part of smart grid services and provide a framework for sellers of systems to search new supplementary businesses (e.g., maintenance and product support).

Indeed, start-up companies tend to become too dependent on focal products because of the narrow portfolio. The system selling business provides the start-up an alternative to get rid of manufacturing-specific investments, which increases flexibility for business planning and product variants. The new challenge here is a drastically increased need for effective supply management and the capability to manage product information. Compared to subsystem manufacturing, the system sellers are recognised as creating business value if they share information to supplementary service providers. The example of this analysis is highlighted in the Figure 19.3.

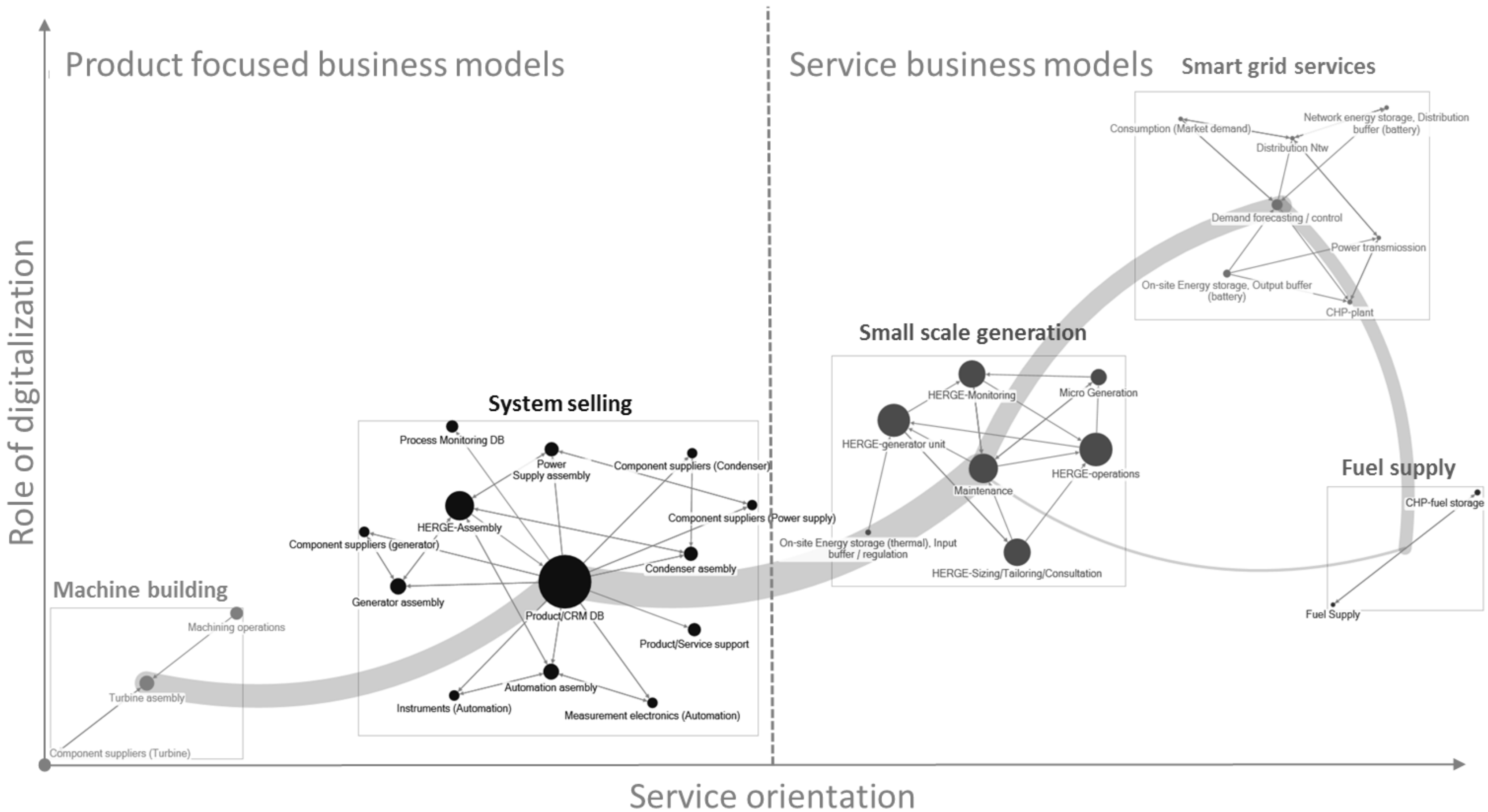

Figure 19.3. Business cluster in the smart energy ecosystem

Financial analysis

The feasibility of the business model at the end depends on its potential to create revenue. The target of the financial analysis is to calculate and simulate the main assumptions about the income flows and costs associated with the business model. The challenge of the financial analysis is that very often, no exact historical data about the business model's financial flows is available for calculations. It is also sometimes considered challenging to include the risks and uncertainties associated with the input variables into financial calculations. The most obvious task of the financial analysis is to address the possible risks associated with the commercialisation project. The financial analysis may also trigger business model innovation. Sometimes, an original idea about the income flows of the business model changes during the commercialisation process. Therefore, it is essential to consider business innovation from the financial model point of view. In many cases, the financial analysis part has triggered novel ideas about possible revenue streams or cost-reduction opportunities. Therefore, whole teams should take part in the financial analysis process.

In a financial analysis, it is necessary to demonstrate and concretise the financial potential of the projects, for example, by providing concrete examples of the benefits of selected customer target groups (e.g., savings in EUR per year) and estimates of customer volumes. The financial analysis could also include a cash flow statement of revenue and expenditure of a commercialisation project (e.g., 5 years) and calculations of project present value (Net Present Value). Sometimes, it would also be useful to include product and production cost calculations for alternative production methods and material solutions.

The items to be solved are as follows:

- The revenue and cost streams of the business model must be identified.
- Best assumptions about the variable values must be judged and defined.
- Variables with uncertainty should be defined as distributions (e.g., normal, triangular, uniform)
- Calculate the financial outcome of the model by using appropriate software (e.g. @Risk, Crystall Ball).
- Interpret the result with the team and test different assumptions about the business model's financial streams.

Because exact historical data about the business model's financial flows are not often available, it is possible to use expert ratings and Monte Carlo–based simulation approaches for calculating the financial outcomes of the business model, as illustrated in Figure 19.4. An advantage of the method is that input assumptions of the variables in the financial model can be defined as distributions (e.g., min, most likely max). This allows us to put inherent uncertainty into the financial model and analyse the probability of risks and opportunities. Here, an outcome of the financial potential of the model is shown as a probability distribution, as illustrated in Figure 19.4. This allows us to identify the probability of the revenue generated by the business model and identify the probability of loss.

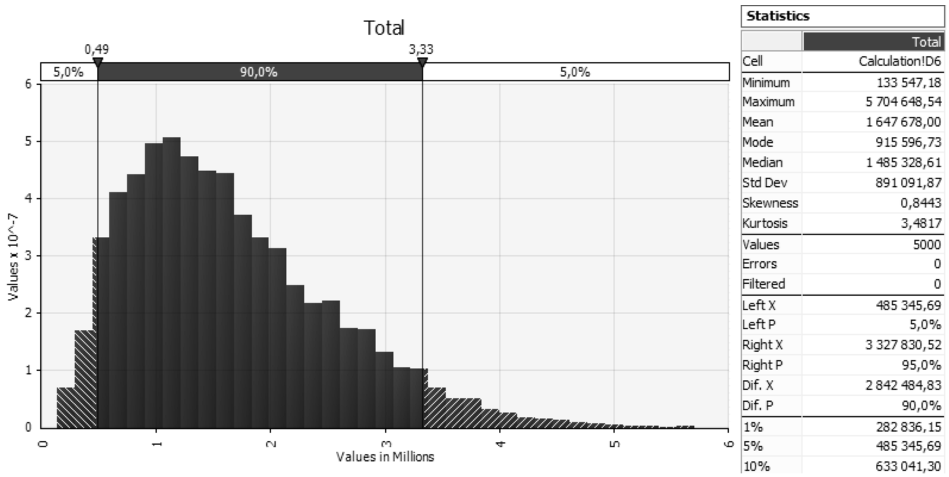

Figure 19.4. Example of a Monte Carlo–based simulation for net present value of a business model

The potential for commercialisation of new business ideas needs to be evaluated at the early stages of research and development. This includes understanding the economic realities of the project, the funding required by the project, the competence of the core group and the risks of the project.

The commercialisation potential of product-service systems depends on the optimal design and management of the sales and costs factors. Sales can be connected to the market size, customer benefits, competitive positioning, pricing model and product market potential. Costs may be associated with the cost of the product structure, manufacturing cost, distribution cost, installation and maintenance cost and administrative costs.

Implications

We have presented a BMI process that aims to streamline the building of business models for commercialising high-technology innovations. In Table 19.2, we present the key challenges and key implications in BMI process phases.

Table 19.2. Key challenges and key implications in BMI process

BMI phase:	**The key challenges:**	**The key implications:**
Proof of relevance	Technology itself can solve several problems, depending on the solution area, and is usually not the solution but rather is a piece of a solution.	Find out the value potential for the innovation and where the potential would be the largest and most rapidly achieved.
Customer analysis	The innovation team and key customers do not have a common view of the solution's possibilities.	Find out, select and understand the potential customers' problems in the selected solution areas.
Concept analysis	The solution is defined as a bunch of technical attributes and features that are all as important in the solution.	Build a streamlined and efficient solution around the innovation that actually tells what the innovation does to solve the customer's problem and how it solves this problem.
Competition analysis	The innovation can be scientifically ground-breaking and unique, but the customer's problem still might already be solved by a rival concept from another domain.	Find out the true competing solution for the solution under development and figure out the areas where the rival concept can be beat.
Ecosystem analysis	The innovation is usually intertwined with the integrated and established technologies and companies.	Clarify the industry's functional structure, business models, key players and financial and owner structures to position the solution into the ecosystem.
Financial analysis	Very often, there is no exact historical data about the business model's financial flows that are available for calculations.	Calculate and simulate the main assumptions about the income flows and costs associated with the business model.

Conclusion

This chapter highlighted the typical challenges we have noticed in the BMI process phases and the lessons learned when dealing with these challenges. We have tested the BMI process in a technical university context, putting it to the test with over 40 ideas and 10 BMI projects. The presented process is a systematic and modularised toolset for building a business model based on an innovation, and it consists of the following six phases: proof of relevance, customer analysis, concept analysis, competition analysis, ecosystem analysis and financial analysis. We have emphasised how the collaborative nature of the process can add to the reliability of the results.

The BMI process helps executives and researchers lead the commercialisation processes of high-technology innovations. We see that even though our case environment is based on university innovation commercialisation, the process is well suited for other areas of commercialising high-technology innovations. The process also helps universities streamline their commercialisation processes and make them more systematic and efficient.

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