AALTO UNIVERSITY
School of Science and Technology
Faculty of Information and Natural Sciences
Industrial Engineering and Management

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DEVELOPING BUSINESS MODELS FOR INTEGRATED SYSTEMS

Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Technology

Espoo, February 16, 2010

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This study develops business models for building-integrated photovoltaic (BIPV) systems. BIPV systems consist of energy-producing surfaces integrated into building elements, thus combining two structures into one. These systems innovatively cross two industries: traditional building element industry and solar power industry. The purpose of this thesis is to develop and evaluate selected BIPV business models and to compare their suitability for a case company that is a construction element manufacturer. The research problem was defined in the following way: *"What kind of a business model should the Case Company use to deliver building-integrated photovoltaic systems in order to create value for their existing and potential stakeholders?"*

The research method used in this thesis is a constructive case study. The study included a literature review and a single-case study. Altogether 22 interviews were conducted in the case company and with the case company stakeholders. The case company's current business models were studied through two existing business models. Three BIPV business models were selected to be developed and studied further. These selected models were component, project, and service business model. Based on the interviews, it was defined how the customers and other stakeholders view these BIPV business models. The factors that affect adopting these BIPV business models at the case company were identified and analyzed. In addition, a workshop with the case company representatives was organized to validate the developed business models and to give further insights.

The strengths and weaknesses of the three selected business models were compared. None of the three business models were the best for the case company as such. Therefore, this thesis recommends a BIPV business model that combines elements from the three studied business models. This model is a packaged component-based solution that includes some service elements according to the stakeholder needs. To increase the applicability, the recommended model should be studied further.

Keywords:	Publishing language:
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AALTO-YLIOPISTON TEKNILLINEN KORKEAKOULU DIPLOMITYÖN TIIVISTELMÄ
Informaatio- ja luonnontieteiden tiedekunta
Tuotantotalouden tutkinto-ohjelma

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Tämä työ kehittää liiketoimintamalleja rakenteisiin integroiduille aurinkosähköjärjestelmille (BIPV, building-integrated photovoltaics). BIPV-järjestelmät koostuvat rakennuselementeistä, joihin on sisällytetty energiaa tuottava pinta. Nämä rakenteisiin integroidut aurinkosähköjärjestelmät yhdistävät innovatiivisesti perinteisen rakennuselementtiteollisuuden ja aurinkosähköteollisuuden. Tämän työn tarkoituksen on kehittää ja arvioida valittuja liiketoimintamalleja BIPV-järjestelmille sekä vertailla niiden soveltuvuutta rakennuselementtejä valmistavalle case-yritykselle. Tutkimusongelma määriteltiin seuraavasti: ”Mitä liiketoimintamallia case-yrityksen kannattaisi käyttää BIPV-järjestelmille luodakseen arvoa nykyisille ja potentiaalisille sidosryhmilleen?”

Työssä sovellettu tutkimusmetodi oli konstruktiivinen. Työ sisälsi kirjallisuuskatsauksen ja yksittäisen tapaustutkimuksen. Yhteensä 22 case-yrityksen ja sen sidosryhmien edustajaa haastateltiin. Case-yrityksen nykyisiä liiketoimintamalleja tutkittiin kahden nykyisen liiketoimintamallin avulla. Kolme BIPV-liiketoimintamallia valittiin kehitettäväksi tässä työssä tarkemmin. Nämä liiketoimintamallit olivat komponentti-, projekti- ja palveluliiketoimintamalli. Yrityksen asiakkaiden ja muiden sidosryhmien näkemystä näistä liiketoimintamalleista tutkittiin haastattelemalla. Myös liiketoimintamallien sopivuutta case-yritykselle analysoitiin haastatteluihin perustuen. Lisäksi case-yrityksen työntekijöille järjestettiin ideointitapaaminen, jossa kehitettyjä liiketoimintamalleja validoitiin ja niiden case-yritykselle asettamia vaatimuksia pohdittiin.

Kehitettyjen liiketoimintamallien vahvuuksia ja heikkouksia vertailtiin. Näistä yksikään ei ollut sellaisenaan case-yritykselle paras mahdollinen, vaan lisäkehitys on tarpeellista. Tämä työ suosittelee case-yritykselle mahdollisena liiketoimintamallina mallia, joka yhdistää elementtejä kolmesta tarkastellusta liiketoimintamallista. Suositeltu liiketoimintamalli on paketoitu komponenttipohjainen ratkaisu, joka sisältää sidosryhmien toivomia palveluelementtejä. Tätä mallia tulee jatkotutkia tarkemmin sen soveltuvuuden varmentamiseksi.

Asiasanat: liiketoimintamalli, innovaatio, rakentamisteollisuus, aurinkosähköjärjestelmät, projektiliiketoiminta, integroidut järjestelmät	Julkaisukieli: Englanti

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Espoo, February 16, 2010

Jenni Perätalo

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Definitions of the terms used

Building-integrated photovoltaic (BIPV) system: A photovoltaic system that is integrated into a building element and replaces conventional building materials.

Business model: A simplified description of business logic, the way a company operates, generates revenues, and creates value for its stakeholders. It describes the offering, the customers, the value proposition for them, the capabilities and competencies needed in the organization, the revenue logic, and the position in the value network. A company can have several business models.

Component business model: The term used for a product business model in this work. The word 'component' describes the type of products that a manufacturing company in the construction business sells as products.

Integrated system: In this work, the term refers to a system that a company integrates from several components manufactured by several companies.

Offering: The products and services a company offers for its customers.

Photovoltaic (PV) system: A system that generates electric power from sun radiation by using solar cells.

Product business model: A business model type that has a strictly defined offering and short exchange process. A customer pays for each product bought.

Project business model: A business model type that is based on relatively long exchange process. The offering is not strictly defined beforehand, and a long interaction between the supplier and the customer is needed.

Revenue logic: The mechanism that is used to generate profit from the operations of a company.

Service business model: A business model type that is based on an exchange that continues an undefined time.

Solution: An offering that combines products and services in order to solve problems for customers.

Stakeholder: A person, a group or an organization that affects or is affected by an organization's actions. In project-based business, a stakeholder has an interest in a project.

Value network: A system consisting of interlinked companies that divide the value creating activities.

Value proposition: A statement of all the benefits a company promises to deliver for its customer.

PART I – Introduction and research methodology

1 Introduction

1.1 Background

Drivers, such as globalization and technological progress, are changing the competitive game, which forces companies to compete in various ways and to innovate in their business models (Casadesus-Masanell & Ricart, 2009). Kim & Maubourgne (2004) propose that companies adopt a blue ocean strategy and seek for industries that do not exist at the moment, the blue oceans. One possibility is to find an unattained market place by altering the boundaries of an existing industry (Kim & Mauborgne, 2004). This study develops business models for an integrated system that innovatively combines two industries.

Originally, a business model was perceived as the overall way a company operates to create value for its customers and other stakeholder, and to generate revenues for itself. Later, research has shown that a company can have several business models. Thus, new business models can be adopted and existing business models can still be pursued.

The business model concept derives from value thinking. In the value creation process, both the customer and the company receive value. Innovation processes often face the problem that customer and stakeholder needs are taken into account too late. The need may even have to be created. Companies may apply their core competencies to the development of products or services without actually understanding what value they provide to their customers (Kauppinen, 1999). The stakeholder needs are issues to be considered in the early phase of developing business models.

The purpose of this thesis is to develop and evaluate component, project and service business models for integrated systems in a real-life company. It is of interest to

apply the theoretical knowledge and to take a practical approach to an actual problem of a case company. The business models are evaluated from the company's stakeholder perspective and from the perspective of requirements the business models set for the case company.

Only a few of the world's leading companies perform all productive tasks in-house. Many companies have adopted the role of a system integrator. In order to adopt this role, they have developed the capabilities to design and integrate systems. (Hobday et al., 2005) Instead of taking a general view of the integrated systems, photovoltaic (PV) systems that generate electricity from sunlight are selected as a case example. More specifically, this research concentrates on business models for building-integrated photovoltaic (BIPV) systems. BIPV systems have energy-producing surfaces integrated into building elements, thus combining two structures into one without having the need to build them twice.

The case company of this study is a large manufacturing company that delivers components, systems and solutions for buildings. For confidentiality, the company is referred to as "the Case Company" in this work. The company's business models are mainly based on component and project business models, and it has some experience in acting as a system integrator. Currently, the Case Company is not involved in the solar energy business. However, the business in which the Case Company operates matches well with BIPV systems, since the company delivers façades, roofs, and other structures into which the integration of PV systems is possible. Therefore, the company is interested in developing suitable business models for building-integrated photovoltaic systems.

1.2 Problem statement and research questions

The research problem can be defined as follows:
What kind of a business model should the Case Company use to deliver building-integrated photovoltaic systems in order to create value for their existing and potential stakeholders?

Further on, the research problem can be divided into three research questions:

1. *What kind of alternative business models exist for BIPV systems that the Case Company should consider?*
2. *How do stakeholders experience the applicability of these business models regarding BIPV systems?*
3. *What are the strengths and weaknesses of these business models for the Case Company?*

1.3 Objectives

The objectives of this research consist of the following:

- To develop different building-integrated photovoltaics business models for the Case Company.
- To define how the customers and other stakeholders view these business models.
- To identify and analyze the factors that affect adopting these BIPV business models at the Case Company.
- To give concrete recommendations regarding the selection among these business models.

1.4 Scope of the study

There is a myriad of integrated systems, but this study focuses on one case example of them. The integrated system discussed in this study is a building-integrated photovoltaic system that produces electricity from the sunlight. A photovoltaic system can be integrated into building elements in several ways; the main idea is that the PV system becomes an integral part of building elements or a surface of a building. This work includes no discussion on the various technological possibilities of integrating solar energy production into building elements, since it concentrates purely on business models. However, as the technology plays no significant role, many of the findings can be used for other solar energy systems, such as building-integrated heat production systems, or with slight modifications in other systems and industries as well.

The Case Company has allocated its business activities to follow either a component business model or a project business model. In this research, they are both studied by taking one case example of both. The component business model is studied through one product that is manufactured as components. The project business model is investigated through an example project that reflects well the special features of the Case Company's project business. These examples do not cover the variety of businesses and business models of the Case Company, but they sufficiently describe the overall way of doing business in the Case Company.

Three BIPV business models were chosen to be developed and evaluated. These business models were component, project and service business models described in Chapters 8.2, 8.3, and 8.4. These are only the basic types of a business model and other ones could have also been included in the study. However, the BIPV component and project business models resemble the current business models of the Case Company; therefore, they were of special interest in this study. The service business was studied on three levels: monitoring service, maintenance service, and leasing service. Especially, the leasing service has various business model options that were addressed only briefly. These various options were not described in detail in this study, since they could be a topic of their own for further research.

The qualitative data used in this study provides information about the current state in the company and the perceptions of its stakeholders, especially its customers. This information is used to evaluate the developed business models and to compare their suitability for the company. However, most of the factors not dealing with the company and its stakeholders are left out of the scope; therefore, this study does not assess the business environment issues, such as competition, regulations, or political issues. In addition, data from the interviews is collected only in Finland due to practical reasons, thus causing limitations for generalizing the results on a global perspective. Not all the stakeholders are studied either. The nine stakeholder interviews of this study included only the most important groups of them, but many were not interviewed.

Financial aspects related to the feasibility of the BIPV business models are not within the scope of this study. It is not evaluated in this research whether the Case Company should invest in PV business instead of some other investment choices. Nor is the actual size of the markets evaluated in this connection. This decision was made due to practical reasons.

1.5 Structure of the thesis

This thesis is divided into *four parts*: the first part introduces the work, the second part describes the theoretical background, the third part analyzes the empirical case, and the fourth part concludes the work.

In the *first part*, an introductory chapter forms an overview of the topic and describes the research problem and the scope of the thesis. The second chapter provides details about the research methodology.

In the *second part*, Chapters 3-5 review the literature relevant to this study and synthesize the main findings. First, the business model concept, its elements, and types are presented. Then, a closer view developing business models is taken, and the customer view is discussed. Chapter 5 concludes the findings of this part.

In the *third part*, Chapter 6 provides background for building-integrated photovoltaic systems and describes existing photovoltaics business models. The current business models of the Case Company are presented through a case study in Chapter 7. Chapter 8 shows the new, developped BIPV business models, presents the findings of stakeholder interviews, and evaluates the suitability for the Case Company.

Finally, the *fourth part* with Chapters 9 and 10 discusses the findings as well as present conclusions and writer's recommendations. The structure of this thesis is illustrated in Figure 1.

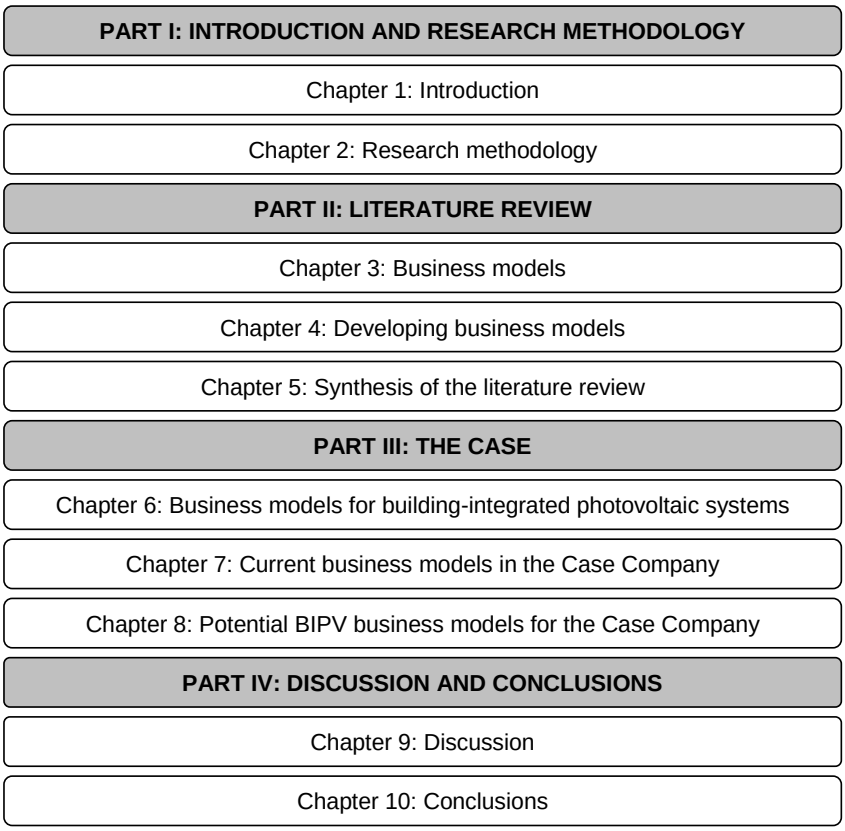

Figure 1: Structure of the thesis

2 Research methodology

The objective of this research is to suggest a solution for the Case Company's practical problem. To reach this goal, a research was conducted as a qualitative study including literature review and empirical research. In the beginning, existing literature was reviewed in parallel with preliminary interviews. After having a sound understanding of the research area, more interviews were conducted. In the final stage, the empirical data was collected in a workshop. Meetings with the Case Company instructors were held regularly during the course of the study.

This qualitative research was conducted as a single-case study. More specifically, the methods followed the constructive approach. A constructive study can be classified as a normative case study (Kasanen et al., 1991), which aims at solving problems of practical relevance (Lukka & Tuomela, 1998). This chapter introduces the constructive approach as research method, describes the literature used, and presents the empirical data collection and data analysis. The reliability and validity of this study are discussed in the end of this chapter.

2.1 Constructive approach as a research method

Constructive research is a form of applied research that produces new information that aims at a certain application or a goal (Kasanen et al., 1991). Constructive research is a method for problem solving by producing constructions, such as models, diagrams, plans, and organizations. These constructions produce solutions to explicit problems. Managerial constructions solve problems related to running business organizations. (Kasanen et al., 1993) These constructions are partly based on business theory and partly based on an innovative research process (Lukka & Tuomela, 1998). This approach is particularly suitable for business model development, as according to a view of Magretta (2002) a business model is a managerial equivalent of a scientific method that works by first forming a hypothesis that is then tested in action and revised when necessary. Thus, a business model can be regarded to be a managerial construction that helps solving a problem of the Case Company.

Kasanen et al. (1993) present that constructive research consists of five important elements: practical relevance of the problem, connection to the theory, constructions as solutions to problems, practical functioning of the solutions, and theoretical contribution of the solutions. These elements are presented in Figure 2. The problem and its solution should be tied with accumulated theoretical knowledge, and a researcher should demonstrate the suitability of the solution. This, however, may not be self-evident, as complex organizational processes are resistant to change. (Kasanen et al., 1993)

Figure 2: Elements of constructive research (Kasanen et al., 1993)

Kasanen et al. (1991) divide the constructive research process into phases that are adopted in this research. The constructive research process can be defined in the following way:

1. Find a practically relevant problem which also has research potential.
2. Obtain a general and comprehensive understanding of the topic.
3. Innovate, i.e., construct a solution idea.
4. Demonstrate that the solution works.
5. Show the theoretical connection and the research contribution of the solution concept.
6. Examine the scope of the applicability of the solution.

The third phase of innovation is often heuristic by nature. Testing and theoretical justification of the solution come afterwards. The innovative phase is necessary for a successful constructive research; otherwise, new solutions could not be produced. (Kasanen et al., 1991)

In this research, the *first* step was taken when the research problem and research questions were formed for the first time. During the *second* phase, an understanding of the topic was formed by interviews, a literature study, and an Internet search. The

third phase, constructing the solution idea, was done iteratively with the Case Company instructors, as Lukka & Tuomela (1998) suggest that the researcher should work in a team. With this team, the possible solutions were constantly discussed and evaluated.

The *fourth* stage, demonstrating how the solutions work, was done after the constructions, i.e. the business models, were iteratively developed with the Case Company instructors. Lukka & Tuomela (1998) emphasize that the solution of a constructive research should be tested during the research process, not after it. During this research, the business models were tested by two weak market tests. First, stakeholder interviews were conducted to test the business models from the perspective of Finnish customers and other stakeholders. According to Kasanen (1986), this kind of market-based validation of managerial constructions is one suitable option, as otherwise the testing takes time and requires several attempts of application. In addition, a workshop with the Case Company management representatives was organized to evaluate and test the business models. According to Kasanen et al. (1993) a weak market test is passed, when a manager is willing to apply the construct in question to his or her actual decision-making problem. Thus, the stakeholder interviews and the workshop acted as a weak market test of the constructs of this research.

The weak market test was regarded sufficient for this research, since even a weak market test is quite strict and passing it is difficult, as Kasanen et al. (1993) point out. Lukka (2000) argues that it is practically impossible to apply the semi-strong and strong market tests in a constructive case study, as the main issue is whether the case organization adopts the construction. The semi-strong market test would require that the construct is widely adopted. The strong market test is passed when the organizations applying the construction systemically produce better results than those that are not using it. (Kasanen et al., 1993)

The *fifth* and *sixth* phases of the constructive research process were adopted in the last stage of this research. After all the materials from the literature and from the empirical field were gathered, analysis was performed based on the theoretical

connections. The contribution of the results and the scope of applicability of the solutions were discussed in the last part of this report.

2.2 Literature review

Written sources used in this research include academic journals, management books and studies. The aim of the literature review was to gain an understanding of the business models and developing them. The literature review covered nearly 70 academic articles and books. The existing literature was studied on the areas of business models, their types, business model innovation, and the way customers should be involved with developing them. In addition, some characteristics of construction industry and its project orientation were researched.

2.3 Collection of empirical data

Empirical data was gathered through *pre-research interviews*, *case interviews*, *stakeholder interviews*, *meetings* and in a *workshop* where Case Company representatives were present. In addition, some written sources and chosen material available in the Internet and in the Case Company internal documents were used. The list of the interviews is presented in Appendix 1. All the 22 interviews were conducted in Finnish. One of them was made through phone and all the others as face-to-face interviews. The empirical data collection is illustrated in Figure 3.

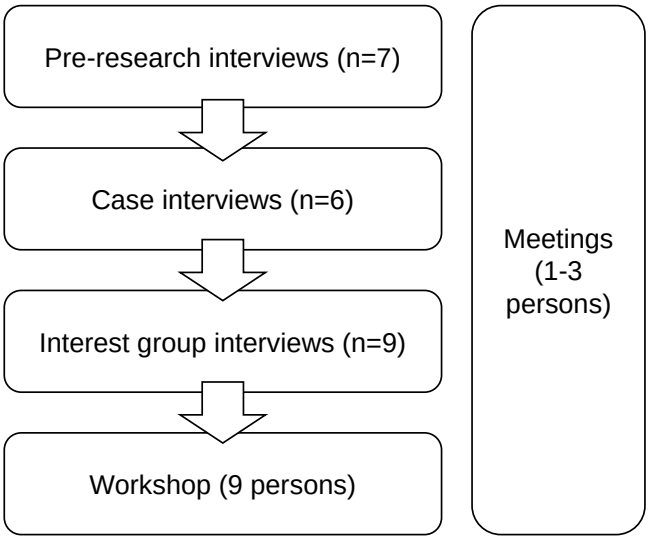

Figure 3: Empirical data collection

The *pre-research interviews* aimed at forming a view of the company and its business. They were discussion-like meetings conducted in an unstructured manner so that the next question was formed based on the previous answer (Hirsjärvi & Hurme, 2009). The question areas were related to the Case Company's current business, business models used, examples of these business models, integrator's role, and views regarding photovoltaic business. These themes were relevant, since pre-research aims at acquiring information on the phenomenon to be studied, as well as finding ideas and research problems (Järvenpää & Kosonen, 2003). Interviewees were encouraged to reconstruct their experience about the subject studied, which is the aim of pre-research interviews according to Seidman (1991). The case business models to be studied further were chosen based on these interviews. Altogether six persons from the Case Company were interviewed in this first empirical part of the study. One of them was interviewed twice. The interviewees were chosen with the two instructors from the Case Company and they represented different business areas, such as strategy, processes, component business, and project business.

The *case interviews* were conducted in the Case Company to form an understanding of the current business models through two case examples. The company representatives to be interviewed were selected based on the suggestions of pre-research interviewees and the Case Company instructors. The interviews were semi-structured, meaning that they had some fixed questions and some aspects that were modified during the interview (Hirsjärvi & Hurme, 2009). Altogether six case interviews were conducted and the average interview length was one hour. The question themes were related to defining the two business models. The interviewees were not directly asked to describe neither the business model nor its components such as the value proposition. Instead, they were encouraged to describe the business in their own words. For example, questions related to the case project were such as "How did the Case Company initially got involved with the project?", "Why did the customer value the Case Company's tender more than its competitors?", or "What kind of subcontractors did the Case Company use in this project?".

In addition to the interviews with the Case Company representatives, internal documents were used to support the understanding of company's business models.

These documents included marketing material, tender documents, and process models.

The *stakeholder interviews* were conducted as semi-structured interviews. Altogether nine stakeholder interviews were done; six out of them were representatives of customers. The interview structure is presented in Appendix 2. The structure was tested in the first interview, as Hirsjärvi & Hurme (2009) suggest. The theme structure and question forming were slightly modified based on the experience of the first interview. The form of presenting the questions was altered according to the interview situation which is characteristic to semi-structured interviews (Robson, 1995). In addition, the order of the questions was changed and further questions were added when necessary. The interviews with customers and other stakeholders aimed at forming a view of:

- the way these customers and other stakeholders perceive solar energy and building integrated systems;
- the decision making process that is needed at acquiring similar systems; and
- the degree to which they want to have installation, monitoring, maintenance, or services connected with finance.

The average effective time for an interview was 50 minutes. The companies included in these interviews were selected with the Case Company instructors. There were contact persons in some of the companies that either were interviewed themselves or they suggested another relevant person for the interviews. The companies represented a variety of actors in the construction industry, i.e. architects, construction companies, investment companies, city authorities, consulting services, and even one representative of the residential housing sector.

Meetings with the instructors of this work were one significant source of empirical data collection. In addition to the actual instructor of this study, there were two instructors form the Case Company, who significantly participated in discussions during the course of the research. The number of attendees of these meeting varied, but at least one of the Case Company representatives was always present. The following topics were discussed in the meetings:

- First meeting: Kick-off, where the research plan was introduced and the topic of photovoltaics was discussed (May 26, 2009).
- Second meeting: Status update, where the stakeholder view of the business models was discussed (June 25, 2009).
- Third meeting: The business models used for BIPV were presented and the business models to be chosen for this study were discussed (August 7, 2009).
- Fourth meeting: Developing further the three chosen business models (August 18, 2009).
- Fifth meeting: The results from the workshops and the stakeholder interviews were discussed (October 20, 2009).
- Sixth meeting: Open questions, the themes of discussion were related the way the Case Company has progressed with the photovoltaics issue (December 15, 2009).

One *workshop* was arranged on September 28, 2009. It had three purposes: to show the preliminary findings of the work, to validate the business models developed, and to collect opinions on business models chosen for this study. The workshop discussions were related to validating the three business models, discussing their strengths and weaknesses, as well as their requirements for the Case Company. The workshop was scheduled to fit into a two hours time frame, since there were nine top experts with titles such as Application expert, Product Group Manager, Architecture Manager, Chief Technology Officer, Senior Application Expert, R&D manager, Director, and Vice President. To reach the maximum efficiency, some pre-readings had been given for the participants prior to the workshop.

Besides all the other empirical data collection, also Internet and public sources were used to provide a clear picture of business models in the field of building-integrated photovoltaics. The business models of different companies acting in solar power business were studied by using company websites and other Internet sources.

2.4 Analysis of empirical data

Notes were taken of each discussion, interview, and workshop. All the stakeholder interviews were recorded and an external company provided transcripts of these interviews. Also five of the six case interviews were recorded and a transcript was provided. The notes from the unrecorded interviews, discussions, meetings, and workshop were used similarly to the transcripts. The transcripts were analyzed using the method of content analysis. Depending on the type of the interview, the relevant themes were identified from the texts and they categorized into groups for further analysis. The data was finalized for presenting it various ways. Summaries were written form the issues emphasized in the interviews. Moreover, cross tabulation and other visual representation methods were used.

Due to confidentiality issues, all the names are removed. The interviewees are presented with their titles. Code names are used for companies, products, and projects. The data, however, was not modified.

2.5 Reliability and validity

The reliability of the research tells whether the same results would be acquired if data collection was repeated the same way (Järvenpää & Kosonen, 2003) or if two researchers would attain the same results (Hirsjärvi & Hurme, 2009). In order to be valid the research should really examine what is intended to (Järvenpää & Kosonen, 2003). Validity can be divided into construct validity and external validity. Construct validity means having correct operational measures for the concepts being studied. External validity refers to establishing the domain to which the findings of the study can be generalized. (Yin, 2003) The reliability and validity of this constructive single-case study were improved by taking into account certain aspects introduced in the literature.

Reliability focuses on how researcher acts when conducting a study and how she analyzes the material (Hirsjärvi & Hurme, 2009). The reliability of the literature was ensured by setting the scope in the beginning of the work, conducting a thorough search in the databases, asking expert opinion on finding suitable material, and by

using valued journals. Conscious limitations were set for literature used in this work, which provides opportunities for further research. According to Yin (2003), reliability in a case study can be improved by using a case study protocol and developing a case study database. In this research, the case study protocol was established with interview structures and careful planning. The case study database was applied by having the interview notes and transcripts separated from the actual report in an organized way. The researcher took an objective role when analyzing the case. Reaching the objectivity was facilitated by the externality of the subject studied. Based on this reasoning, the results of this study would be replicable in the same context which indicates that the reliability of the study is good.

As this study is qualitative, the evaluation of validity is based on the whole research process. To improve validity, the whole process should be described in detail. (Järvenpää & Kosonen, 2003) This research has described the data collection and analysis in this chapter. The interview structures and question areas were defined before the interviews and additional questions were thought through beforehand. The data was carefully analyzed, and the analysis leading to the conclusions is shown in this work.

To improve the construct validity, the research problem and research questions were formed in the beginning of the research and they were reviewed later. Logical research problems, conclusions, and the use of concepts improve the construct validity (Järvenpää & Kosonen, 2003). In addition, the informants should review a draft of the report, multiple sources of evidence should be used, and they should establish a chain of evidence (Yin, 2003; Eisenhardt, 1989). As already stated, the main sources of data are literature, interviews, workshop and meetings. All these provide multiple sources of evidence for the study. The draft of the report was provided for the Case Company representatives to be validated. The conclusions and the reasoning behind them were also clearly presented.

The external validity of this research, i.e. the possibility to generalize the results, is well applicable regarding the Case Company. Some of the results can also be generalized for the use of other construction-industry companies. In addition, many

other parties may find interesting insights in this study. However, a relatively weak external validity is a general characteristic of a case study, as the reliability and validity of such a research may well be good regarding the case, but results remain subjective and difficult to generalize (Järvenpää & Kosonen, 2003).

PART II – Literature review

3 Business models

This chapter describes the concept of the business model, its background, and relation to strategy. A definition for the term business model is formed. The business model elements are discussed, and a set of them is chosen to be used throughout this work. Finally, the basic business model types are presented.

3.1 Business model as a concept

The term business model is widely used in business vocabulary and academic journals. Business models derive from the traditional business strategy theories (Chesbrough & Rosenbloom, 2002; Morris et al., 2005), and they are variations of the generic value chain that all businesses are based on (Magretta, 2002). Several strategy scholars (e.g., Casadesus-Masanell & Ricart, 2009) refer the notion of business model to "the logic of the firm, the way it operates and how it creates value for its stakeholders", which may seem quite similar to that of strategy (Casadesus-Masanell & Ricart, 2009). Often the revenue logic is also regarded to be a prominent part of a business model. A business model differs from business strategy as a business model is focused on the value that is created for the customer (Chesbrough & Rosenbloom, 2002; Morris et al., 2005; Pulkkinen et al., 2005). Moreover, Casadesus-Masanell & Ricart (2009) argue that a particular business model is a reflection of the firm's realized strategy.

Casadesus-Masanell & Ricart (2009) distinguish the definition of strategy, business model, and tactics. They propose the following interconnectedness between the terms: "The object of strategy is the choice of business model, and the business model employed determines the tactics available to the firm to compete against, or cooperate with, other firms in the marketplace." This relation of business model to the terms strategy and tactics is presented in Figure 4.

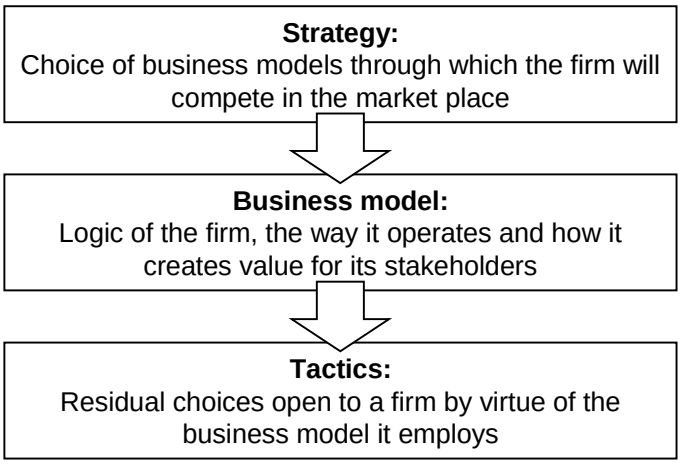

Figure 4: Business model's relation to strategy and tactics (Casedesus-Masenell & Ricart, 2009)

Business models have been discussed in the strategy theory for decades (Hedman & Kalling, 2003), but the term became considerably more popular in the beginning of 2000s, when the e-business boom started and new Internet business models emerged (Magretta, 2002; Shafer et al., 2005; Casadesus-Masanell & Ricart, 2009). Even though the term business model is commonly used, several business model definitions exist in the academic literature (Hedman & Kalling, 2003; Magretta, 2002; Shafer et al., 2005; Morris et al., 2005). In this study, a business model is defined as *a simplified description of business logic, the way a company operates, generates revenues, and creates value for its stakeholders*. Chapter 3.2 elaborates the business model elements and specifies this definition.

Business models have been researched on several levels. The early research of business models aimed at forming taxonomies of business models and classifying them, even for certain industries (Osterwalder et al., 2005). Still, most of the business model research discusses the business models on a company level (e.g., Casadesus-Masanell & Ricart, 2009; Galper, 2001; Gebauer & Ginsburg, 2003). It is assumed that one company has one business model. Some authors (e.g., Chesbrough & Rosenbloom, 2002; Kujala et al., 2010; Magretta, 2002) argue that a company can have several business models. This means that each business case, whether it is a project, solution, product or service, can have an own business model. This study focuses on business models on the level of products, projects, and services. According to this view, a company can have several business models.

3.2 Business model elements

As the definitions of the term business model vary, so do the definitions of the business model elements. There is a myriad of literature that aims at forming a definition for the business model elements or components. This chapter introduces five viewpoints for the elements, forms an own set of them and defines the elements shortly.

A well known definition for the business model elements is the one proposed by Chesbrough & Rosenbloom (2002). They see business models as a bridge that unites technological inputs and economical outputs. The technical inputs refer to issues such as feasibility and performance. The economic outputs refer to the value created, to the profit generated, and to the price gained. This way, business models enable the value creation based on certain inputs. Chesbrough & Rosenbloom (2002) suggest that a business model consists of six elements. A business model should

1. identify the *market segment* and specify how turnover is created;
2. clarify the *value proposition*, i.e. what is offered and how it creates value for users;
3. design the inner *value chain* that is needed to creating and delivering the offering;
4. estimate the *cost structure* and *profit* potential based on the value proposition and the chosen value chain;
5. define how to be positioned in the *value network*; and
6. form a *competitive strategy* to achieve stable competitive advantage.

This view is illustrated in Figure 5.

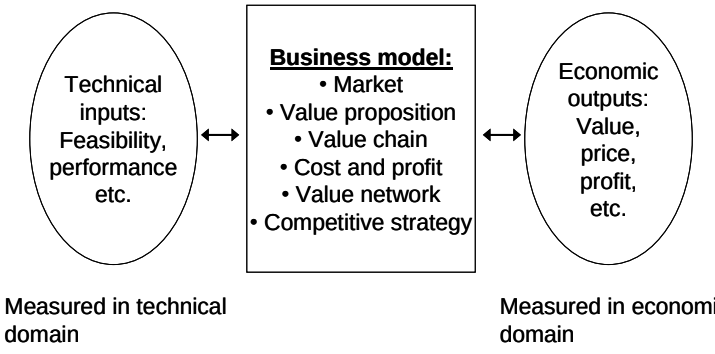

Figure 5: A business model, its inputs and outputs (Chesbrough & Rosenbloom, 2002)

A quite similar bipolar reasoning is presented by Pulkkinen et al. (2005). They define a business model as a structural solution that unites value creation and value capturing. According to Pulkkinen et al. (2005), a business model defines a group of activities that companies must accomplish to offer customers the benefits they need and at the same time gain profit from it. Value creation can be seen as the technological inputs and value capturing as the economic outputs. In addition to Pulkkinen et al. (2005), the value creation and value capturing definition of a business model is used also by several other authors, e.g., Chesbrough & Rosenbloom (2002) and Baliga (2005).

Pulkkinen et al. (2005) also list the following three questions and related elements for designing business models:

- What? (Innovation models, product/service models)
- How? (Organization models, stakeholder/partner models, distribution models, resources and competences, cost and revenue models, finance models, change models)
- To whom? (Segmentation models, customer relationship models, marketing models)

These three categories are quite similar to what Normann (2001) uses for a business idea, which is closely related to a business model. According to Normann (2001), in order to have a business idea, one needs to define the offering which corresponds to the first question of Pulkkinen et al. (2005). Secondly, organization factors, internal factors, resources, knowledge and capabilities, systems and values need to be appropriate. These issues are similar to the second set of elements defined by Pulkkinen et al. (2005). Finally, the external environment must be defined, which answers the third question "to whom". (Normann, 2001)

Afuah & Tucci (2001) conceptualize a business model as a system that is constructed from components, linkages between the components, and dynamics. They list the following components of a business model: customer value, scope of products/ services, scope of customers, price, revenue sources, connected activities, implementation, capabilities, and sustainability of company's advantages. Afuah & Tucci (2001) include dynamics in the definition reminding that the right business

model components and linkages do not last for ever; therefore, they have to be changed before competitors. Sometimes totally new business models must be invented.

As do Afuah & Tucci (2001), also Hedman & Kalling (2003) approach business models by an element-based view. They suggest seven components for a business model: customers, competition, offering, activities and organization, resources, suppliers, and scope of management. Contrary to many other definitions, their definition does not emphasize the economic factors, but includes them as a part of the offering.

Magretta (2002) does not elaborate strict elements of a business model, but sees it as a good story that explains the essence of the business. The specific elements of a business model are less important. According to Magretta's (2002) view, a good business model answers the following questions:

- Who is the customer?
- What does the customer value?
- How is the money generated in this business?
- What is the underlying logic that explains how the value is delivered to customers at an appropriate cost?

Magretta (2002) makes a clear distinction between strategy and business model, even though many use the two terms almost interchangeably. He argues that business models do not deal with competition which, however, is one important strategic issue.

As these insights into business model literature show, the definition of the elements. This study chooses the following elements to be included in a business model:

- *Offering*
- *Customers*
- *Value proposition*
- *Capabilities and competencies*
- *Position in the value network*
- *Revenue logic*

Table 1 shows which of the authors earlier discussed have mentioned the elements chosen. As seen earlier, the names for the elements have varied. Authors may have also indirectly mentioned the element. For example, Chesbrough & Rosenbloom (2002) mention the offering when the value proposition was discussed. In addition, some elements mentioned are left out of the definition. For example, competition, rivals or competitive strategy are not included in the working definition of a business model, as Magretta (2002) proposes. Also some other elements have not been chosen, since they are either regarded to be included in the others or they are not commonly included. As the elements of business model are not self-explanatory, they are shortly described below the table.

Table 1: Literature sources for business model elements

	Offering	Customers	Value proposition	Capabilities and competencies	Position in the value network	Revenue logic
Chesbrough & Rosenbloom, 2002	X	X	X	X	X	X
Pulkkinen et al., 2005	X	X		X	X	X
Afuah & Tucci, 2001	X	X	X	X		X
Magretta, 2002		X	X	X	X	X
Hedman & Kalling, 2003	X	X		X	X	X

The *offering* is a set of products and services a company offers. Kotler & Keller (2006) define offering as a combination of products, services, information, and experiences.

The *customer* element of a business model describes the buyer of the product or service defined in the offering. The key characteristics of the customer are described.

The *value proposition* refers to the benefits the company promises to deliver (Kotler & Keller, 2006). A business model aims at offering distinct benefits for a customer and other stakeholders. The value proposition states what these benefits are. More specifically, Kotler & Keller (2006) define the value proposition as a statement about the total experience a customer gains from the company's offering and the relationship with the company.

The *capabilities and competencies* of the company describe the abilities and skills the company needs for to operate with a business model. The terms capability and competency have slightly different meanings. For example, Smith (2008) defines a capability as an organizational ability to execute activities repetitively, efficiently and predictably, and a competency as a company's ability to continuously improve its performance and as a source of differentiation. In this study, the distinction of these terms is not considered relevant; instead, this business model element defines the essential features for them. Moreover, the capabilities and competencies are widely (e.g., Christensen, 2003) regarded to include the resources that a company needs to perform the activities connected to the business model. The resources can be tangible, intangible, or human (Afuah & Tucci, 2001). However, in this study only the most essential resources are mentioned.

The company's *position in the value network* describes how the company is positioned in a system of partnerships to deliver its offering, i.e. which actors are related to the business. Kotler & Keller (2006) define value network as system of partnerships and alliances that are created by a company to source, augment, and deliver its offerings. Möller et al. (2005) do not pursue this company-centric view, but define a value network as a system of interlinked companies in which the value creating activities are divided among several companies. A value network includes suppliers and their suppliers, as well as immediate customers and their end customers (Kotler & Keller, 2006). Figure 6 shows a simplified illustration of a value network. In reality, value networks are much more complex.

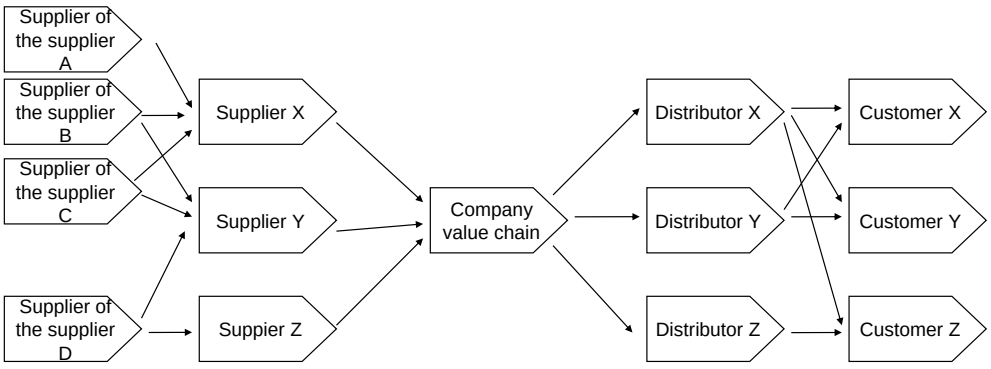

Figure 6: Illustration of a value network

The *revenue logic* describes the mechanism that generates revenue and profit from operations. The revenues can be gained from sales and from other sources of financing, such as subventions. In this study, the revenue logic is considered to include the basics of the cost structure, i.e. what are the main costs.

3.3 Business model types

Parvinen (2008) states that even thought every business model is different, three business model types can be separated: *product business models*, *project business models*, and *service business models*. The most remarkable difference between these business models is the way cash flows are organized (Parvinen, 2008). The three business models each have their characteristics and requirements, which are presented below.

Parvinen (2008) characterizes the simplest one of them, *product business model*, with product and service content that has been strictly defined already before the customer decides what and how many she wants to buy. According to Parvinen (2008), the offering of a product business model can include either products or services, or both. In product business models, the customer initiates the short exchange process by telling what she wants or by initiating an order. The exchange process ends, when customer receives the products or services.

In order to be successful, the product business model requires that the scale advantages are realized (Parvinen, 2008). This means that the products or productized services must be manufactured and delivered in a similar way, thus reducing the costs. Parvinen (2008) suggests that the company should deepen their knowhow and competencies on a narrow concentration area. He adds that partnerships and alliances will help this goal.

The exchange process of a *project business model* is much longer than the exchange process of a product business model. Parvinen (2008) states that the project business model requires interaction between the customer and supplier on a longer period of time. The exchange will stop when the project ends. Parvinen (2008) also points out

that the project business model can be characterized with an offering for which contents are not completely defined beforehand.

The requirements for successfully operating with a project business model are quite different to those of the product business model. A project business model requires efficiency in structural matters, as well as a good financial position. An entrepreneurial attitude towards risks is also need. The company must be locally present and create demand with its customers, since customers do not just place orders the same way as in the product business model. In addition, using references is a good way to promote the offering and increase sales. (Parvinen, 2008)

Contrary to the product and project business models, the *service business model* is based on an exchange that continues an undefined time. Thus, revenues are gained continuously, unless otherwise agreed. (Parvinen, 2008)

The service business model requires that the company has a capability to create and communicate constant need of services. The customers require easiness that the company should be able to deliver in a reliable way. The service relationships are important. The company must be able to invest in them and aim at deepening them. This way, relationships can be exploited by increasing, complementing and cross-selling. However, managing the service relationship with the customer is not enough. The company must manage the network generation and network members' internal pricing. (Parvinen, 2008)

In addition to the differences in the revenue logic that Parvinen (2008) stated, the features of these business model types imply to differences in customers and in the position in the value network, for example. In order to realize the scale advantages in the product business model, there has to be a significant amount of customers. They can be of various kinds and from large areas. The customers of the project business model, on the other hand, may be fewer, since they need more attention from the company. They need to be closer to the company, as that way the company can establish relationships with them early enough and create the demand. The customers in the service business model also require long-term relationships.

The business model type affects also the network the company belongs to and its position in it. As Parvinen (2008) mentioned, the product business model requires partnerships and alliances to concentrate. This entails the need of suppliers that supply what is not included in the company core competencies. It can also be deduced that a company may need partners in the distribution channels in order to cover large markets. The project business model requires suppliers as well. Instead of wide distribution networks, the company needs to have more own personnel that tailor the offering to the customer needs and deliver what is promised. The service business model requires the most personnel that are capable of creating the value for the customers. However, in some cases the company can use other resources for the services. For example, maintenance services can be delivered through a partner network consisting of small entrepreneurs.

Even if the division to these three business model types may seem justified and simple, other business model types can be formed based on them. For example, Wise & Baumgartner (1999) suggest that manufacturers should seek for customer value by business models that offer services and by new product/service concepts. The company can offer solutions that aim at solving the customer pain by a suitable mix of products and services. Especially, project-based firms have moved from short-term project deliveries towards new business models, including services and operation (Kujala, 2010; Wikström et al., 2009). Offering solutions instead of only project deliveries that end after installation may have several benefits for the company. Particularly, in mature markets, solutions are a way to find sustainable differentiation (Eades & Kear, 2006). Wikström et al. (2009) noted that a radical technology innovation can be an enabler to include services into the business model. The services could be, for example, integration of a system, or training end-users.

Pulkkinen et al. (2005) consider that widening the scope of offering to services is one of the biggest challenges Finnish companies face when they develop their business models. Wikström et al. (2009) state that a strong technology orientation in a product-oriented company can be a barrier for including service. According to them, other barriers for including services may caused be by the established roles and

responsibilities, and suspicion towards new business models. Pulkkinen et al. (2005) argues that the main challenge can be the global scale. Especially on niche markets, the volumes by country and area remain low, but still customers require high service levels. However, the companies cannot offer their own representatives everywhere (Pulkkinen et al., 2004). Adopting services as a part of other deliveries changes the value creation logic. In business to business markets, project suppliers also take increasingly responsibility for their customers' business. (Kujala et al., 2010)

Davies (2004) has studied the value stream from the perspective of high-value capital goods. He argues that instead of simply moving into services, many companies are attracted of integrating internally and externally developed components into a system, thus acting as system integrators. The value stream presented by Davies (2004) suggests that the amount of services and added value increase as company moves in a value stream to provide integrated systems. Figure 7 shows the capital goods value stream.

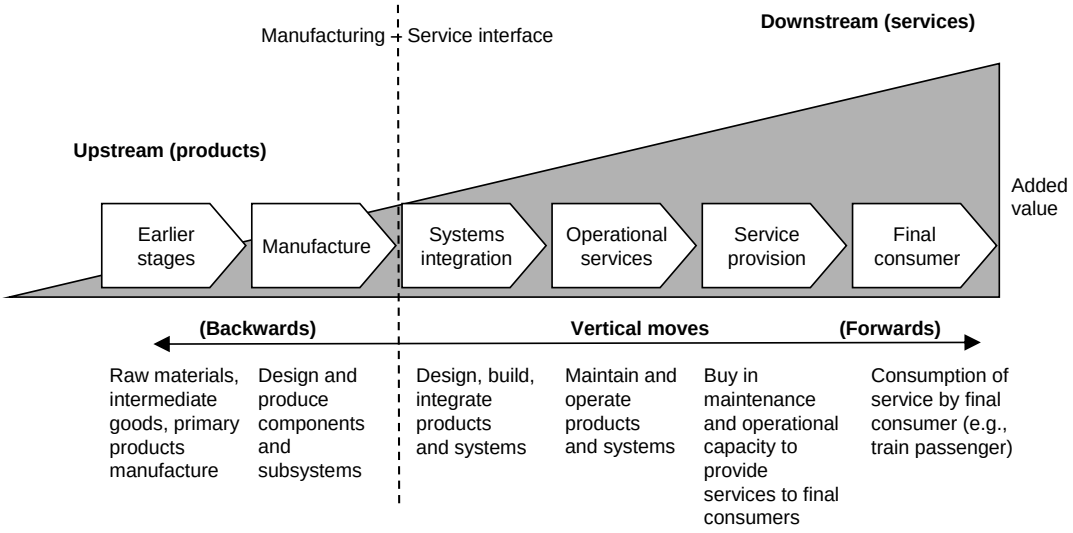

Figure 7: The capital goods value stream (Davies, 2004)

The building-integrated photovoltaic systems studied in this work are manufactured from components from several companies and integrated into one system before delivering them to the customer. The company integrating them can be regarded as a system integrator in the sense the value stream in Figure 7 presents it, even if Davies (2004) studies the subject from a more complicated systems' point-of-view. In terms

of the literature on integrated systems, the actual integration of these BIPV systems is performed on site when the system is installed. This would imply that the delivery of the BIPV components would include an installation service with all the nuts and bolts, thus being a turn-key delivery. This work, however, regards that already the uninstalled set of all building elements and components needed for the BIPV system is a integrated system. This choice is justified in this work, because the main challenges in BIPV integration are manufacturing the building elements that generate the electricity and collecting all the part needed to install these elements.

According to Pulkkinen (2005), other suppliers often consider the integrator as a technical agent that simply assembles and is a part of their supply chain; on the contrary, the integrator often sees itself a designer of suitable packages. The integrator's role increases the risks, but should also increase the possible revenues. Therefore, the role of the company often changes towards being a system integrator. (Pulkkinen et al., 2005) The next chapter studies the topic of business model development.

4 Developing business models

The previous chapter introduced the business model concept and the business model types. This chapter concentrates on developing business models. First, this chapter discusses business model innovation. Business model innovation is defined and some challenges presented. The second part of this chapter takes a closer view to the customer and stakeholder related aspects. When business models are developed, it is useful to ask the opinion of stakeholders. On the other hand, they may not know what they need. Therefore, the needs may have to be shaped.

4.1 Business model innovation

In many industries, the business environment is turbulent and business models become quickly commoditized as new ones are developed. Therefore, companies are forced to innovate in their business models (Casedesus-Masanell & Ricart, 2009). Kim & Mauborgne (2004) propose that new businesses should be innovated in industries that have little or no competition. However, at some point all business models are challenged by new business models, since they can be imitated, diluted, and commoditized (Tucker, 2001). Even if a company has an effective business model, it is challenged by the need of continuous renewal (Verdin, 2002). This study develops business models for building-integrated photovoltaic systems that do not fit directly to the construction business, but not to the energy business either. Therefore, these BIPV business models create a new industry with only a little competition. Since the BIPV business models can be found on current industry boundaries, their environment can be called as a blue ocean, as Kim & Mauborgne (2004) call these unattained areas.

Mitchell & Bruckner (2004) define business model innovation as business model replacements that provide product or service offerings, which were not previously available to customers and end-users. Hamel (2000) states that a business model innovation must be radical, and it should not be related to only one business model element. This means that several business model elements need to be modified in order to fulfill the requirements of an innovation. Although the definition of business

model innovation is varying, this work uses the term for new business models including several changes in the business model elements. This is in line with definition of innovation presented by Rogers (1995). According to him, innovation is "an idea, practice, or object that is perceived as new by an individual or another unit of adoption". The BIPV business models developed in this study have a totally new offering. In addition, new capabilities and competencies are needed. The revenue logics can differ from the current ones, and the value offered for the customers is new. Several business model elements are modified. Therefore, the developed business models can be regarded as business model innovations.

Academicians agree that new business models are needed, but cannot agree on the distinctive features of superior business models (Casadesus-Masanell & Ricart, 2009). Pehrsson (2006) claims that technology is the most important area of business relatedness. By mastering the technology, a company can create a viable business model around it. In this study, the photovoltaics are a new area for the Case Company; therefore, new capabilities must be developed before implementing them. Teece et al. (1997) propose that companies have basic capabilities that can be modified to only some extent. If a new opportunity, a business model, deviates much from the current core capabilities, problems may occur acquiring the needed resources for the new business model (Leifer et al., 2000). These problems must be avoided by starting developing the capabilities early enough.

In addition to technology and capabilities, Pehrsson (2006) and Leifer et al. (2000) note that supply chain organization must be considered. Pulkkinen et al. (2005) state that a new business model often changes the company role or position in the value network which, naturally, may cause challenges. Most commonly, as discussed in Chapter 3.3, the new role widens to an integrator's role that coordinates the offerings of other suppliers towards the customer (Pulkkinen et al., 2005). In addition to technology, capability, and value network issues, also management skills are an area of importance affecting the success of a business model (Pehrsson, 2006).

The established business may conflict with the new business. For example, Zook & Allen (2001) argue that economic conflict must be considered when moving into a

new business area. Thus, the implementation of a new business model may contradict strongly with the established business and result in destroying the old business models. Markides & Charitou (2004) determine the conflict between old and new business models as a serious concern. They claim that if the business models conflict, the company may mismanage both and even destroy value.

One solution for the business model conflict is to keep the two business models separate but also integrate them so that the synergies with one another can be exploited (Markides & Charitou, 2004). Another solution is to keep the two business models physically separate in two distinct organizations (Christensen, 1997; Markides & Charitou, 2004; Porter, 1980). Keeping them separate will prevent the suffocation of the new business model by the old processes and culture; on the other hand, this may hinder the exploitation of synergies. An integration strategy is the most suitable when the business models are aimed at similar markets and few conflicts need managing. (Markides & Charitou, 2004)

This study develops new, innovative business models that do not directly fit into any of the industries present today. This new industry is a blue ocean as Kim & Mauborgne (2005) call it. According to their blue ocean strategy principles, the company should reach beyond existing demand to achieve value innovation. Thus, understanding the current customer needs is not enough. When a company is creating a new business model, the company must understand its potential and existing customers' future needs. Kim & Mauborgne (2005) state that a company entering a blue ocean should not focus solely on exiting customer and their segmentation, since innovations may face a scale risk. This risk can be decreased by creating the greatest demand for the innovative offering from wider target markets (Kim & Mauborgne, 2005).

Customers do not always know what they need, especially when the offering is something totally new (Kim & Mauborgne, 2005; Rogers; 2005). In this case, the company must try to anticipate the customer needs and aim at shaping them. These needs and values are discussed in the following chapter.

4.2 Customer view of business models

Customer orientation has been considered critical to business profitability (e.g., Narver & Slater, 1990; Nwankwo, 1995). Moreover, Pittaway et al. (2004) suggest that customer involvement is particularly important when new ideas are generated. Several authors (e.g., Chesbrough & Rosenbloom, 2002; Morris et al., 2005; Pulkkinen et al., 2005) differentiate business models from strategy by stating that business models focus on creating value for the customer. Thus, studying what customer values, needs and how the needs and values can be shaped is a natural viewpoint in business model development.

A new business model creation process should be started with customer perceptions in mind. The customer needs must be continuously observed in order to provide superior products and services (Tucker, 2001). This chapter addresses the customer-related aspects. First, the customer needs and values are introduced. Then, it is discussed whether they should be influenced already in the early stage of the innovation. Finally, the stakeholders in the construction business are discussed.

4.2.1 Customer needs and customer value

The basic need that all customers have is to purchase goods and services that provide value. Companies can earn superior profits by providing increasing value to their customers. By studying the customer needs, a company can show that it aims at producing customer value. (McTaggart et al., 1994)

There is no single definition of "value". Kotler & Keller (2006) define value from the perspective of buying customers and suggest that value is the difference between the benefits of a product and the cost the product causes. Customer perceives the value when the sacrifices needed are smaller than the benefits the supplier is able to deliver. Value can be created on short-term and long-term. The supplier value could be studied the same way as supplier also makes sacrifices and receives benefits. This is equivalent to the idea of revenue logic presented as a business model element.

The construction business, where the Case Company operates, is based on projects. It is essential for a company delivering projects – or turn-key projects as Ahola et al.

(2008) studied – to understand how they create value for their customers. This may not be easy as turn-key projects are often complex combinations of tangible and intangible components, which the supplier combines into a complete offering. Many of the sacrifices are difficult to measure objectively and difficult to identify. Therefore, understanding them is even more difficult. (Ahola et al., 2008)

Companies delivering projects should thoroughly understand what the customer values are and what kind of buying criteria the customer has. Ahola et al. (2008) present a categorization of customer benefits and sacrifices, which clarifies all the different aspects that either increase or decrease the customer value. The short-term benefits were the following: product-related benefits, delivery efficiency, additional support services, access to resources, and innovation. The long-term benefits were relationship between customer and supplier, innovation, and after sales services. There were two sacrifices in the short term: direct costs and operational transaction costs. In the long term, the sacrifices were strategic transaction costs and customer capabilities.

Customer buying criteria is somewhat related to the value creation. The price is quite often the first buying criterion in construction projects (Koskinen, 2009). This is one of the clearest sacrifices customer makes when buying a project. Beside this, the second buying criterion is time (Koskinen, 2009), since the timing is often crucial in the projects. If something is not delivered in time, the whole project suffers badly. Also Ahola et al. (2008) have found in their literature search delayed deliveries as one of the sacrifices related to direct costs and on-time delivery as a short-term benefit under the category of delivery efficiency. The third buying criterion in construction projects was performance and scope (Koskinen, 2009), which can be related to many of the benefits presented in the literature findings of Ahola et al. (2008).

The customer value concept is directly related to the business model element of value proposition. When business models are developed it is essential to understand how customers and other stakeholders perceive the value a company can offer them. However, the customer may not always understand the value of an innovation.

4.2.2 Anticipating vs. shaping the customer needs

Knowing who the stakeholders are and recognizing their needs may not be enough to develop and implement an innovative business model. The customer needs may have to be shaped, since the customers do not always know what they need. The opinions on whether to anticipate or shape the customer needs vary. These two aspects are discussed here.

For example, Tucker (2001) claims that customers are likely to indicate when the company should change something, and they should be able to tell how to serve them in the best possible way. Christensen (1997) questions the customer focus by presenting the dilemma of getting stuck with the current customers, who may not know all the future needs. Focusing too much on the results of customer research may hinder the company to see future opportunities. Therefore, some authors suggest a completely different approach of first producing a new technology and then finding a market for it (e.g., Papakiriakopoulos et al., 2001; Coates & McDermott, 2002). These two points-of-view can be argued, but both of them can be applied, even at the same time.

Cova & Hoskins (1997) have studied early-stage marketing from project perspective and suggest a twin-track approach including both anticipating and shaping the customer needs. The first approach is deterministic, which means anticipating the competitive arena and the rules of the game. The second approach is constructivist, which aims at shaping the competitive arena and the rules of the game. (Cova & Hoskins, 1997)

In the deterministic approach, the first marketing stage is network positioning, which means developing and maintaining strong non-economic or social bonds to gain intelligence on markets and their development. This can be done either directly with the customer organization or indirectly with the stakeholders who may influence or otherwise be interested in the future projects. (Cova & Hoskins, 1997)

In the constructivist approach, the first marketing stage is network construction. This is particularly needed in emerging or innovative sectors without any stable relational

environment, where the company could position itself. The constructivist approach could, for example, include meeting the working groups and possible committees and this way learning about the strategies and expectations of the various actors. By influencing the others, the adoption of standards can be aligned with the company's core competences. (Cova & Hoskins, 1997)

The constructivist approach is quite similar to the one Rogers (1995) suggests for diffusion of innovations. He states that individual's decision about an innovation is a process that occurs over time. The first stage of this process is knowledge that occurs when an individual gains understanding what the innovation is and how it functions. During the second stage of persuasion, an individual forms an attitude towards the innovation. After this, the individual makes the decision to adopt or to reject the innovation, which is the third phase. The last two stages to follow are implementation and confirmation. (Rogers, 1995)

The first two stages of this process are of interest when considering either anticipating or shaping the customer needs. Rogers (2005) argues that an individual may develop a need when he or she learns from an innovation. The idea is that innovations can lead to needs (Rogers, 2005); therefore, a need can be created. Also Kim & Mauborgne (2004) claim that in new industries demand is created instead of fought over. Considering these points-of-views, a company should first create the knowledge of their innovation, after which the customers hopefully form a favorable attitude toward the innovation. The discussion whether customer need exists before the awareness of innovation can be regarded a chicken-or-egg problem (Rogers, 2005); possibilities are worth considering.

Cova & Hoskins (1997) suggest that a company can adopt even both of the anticipation or shaping tracks at the same time. However, as they noted and as Rogers (2005) emphasizes, the shaping approach may be more efficient when an innovation is to be introduced and customers do not know the innovation beforehand. Therefore, a more proactive way of introducing the innovation is needed by influencing the rules of the game and by increasing the attractiveness of the

innovation. If this is understood early enough, the core competences of the company can be exploited better.

Companies acting in the construction business do not have only one single customer per project. The projects involve many parties and the final user of a building may not even be one of them. In addition, the construction business has several external stakeholders. The needs of all these must be considered and shaped, when developing new business models. The following chapter explains the terms milieu and project network, as well as discusses their meaning in the construction business.

4.2.3 Customers and stakeholders in the construction business

Normann (2001) states that in order to be customer oriented, one has to go beyond the direct relationship between oneself and one's customer. Also the customer's customers must be understood. However, other parties than the customer's customers are also involved in the value creation process. Especially construction business is a project-based business that involves many stakeholders. In addition to company's paying customer, there are several other stakeholders that have needs that have to be anticipated and shaped as well.

The representatives of stakeholder interviews in this study were chosen from the milieu of the Case Company. A milieu is a network of actors that can be organizations or individual stakeholders. Cova & Hoskins (1997) define milieu as "a local network of business and non-business actors". There can be many companies and other actors in a milieu, and several projects can be conducted in it. A milieu could also be called "business network" as Artto & Kujala (2008) define this project business research area, but milieu as a term contains also the non-business actors and powerful individuals that can have a significant role in the network.

Awakul & Ogunlana (2002) propose that in the construction business, there are five groups that can influence a project and that are affected by the construction project. These five groups can be regarded to form a milieu. The groups proposed by Awakul & Ogunlana (2002) are the following:

1. common, affected people that have an interest in the project;

2. project participants, e.g. contractors, sub contractors, architects, and consultants;
3. non-government organizations;
4. academics and experts; and
5. local government officials.

The members belonging to these groups vary by each project. In the context of a particular project, the term project network is used. A project network includes only those firms and organizations participating in a project (e.g., Cova et al., 2002). Project network has a clear objective in delivering a project, e.g. constructing a building (Ahola, 2009). Figure 8 presents the various members a project network of a construction project can include according to the view of Ventovuori et al. (2002).

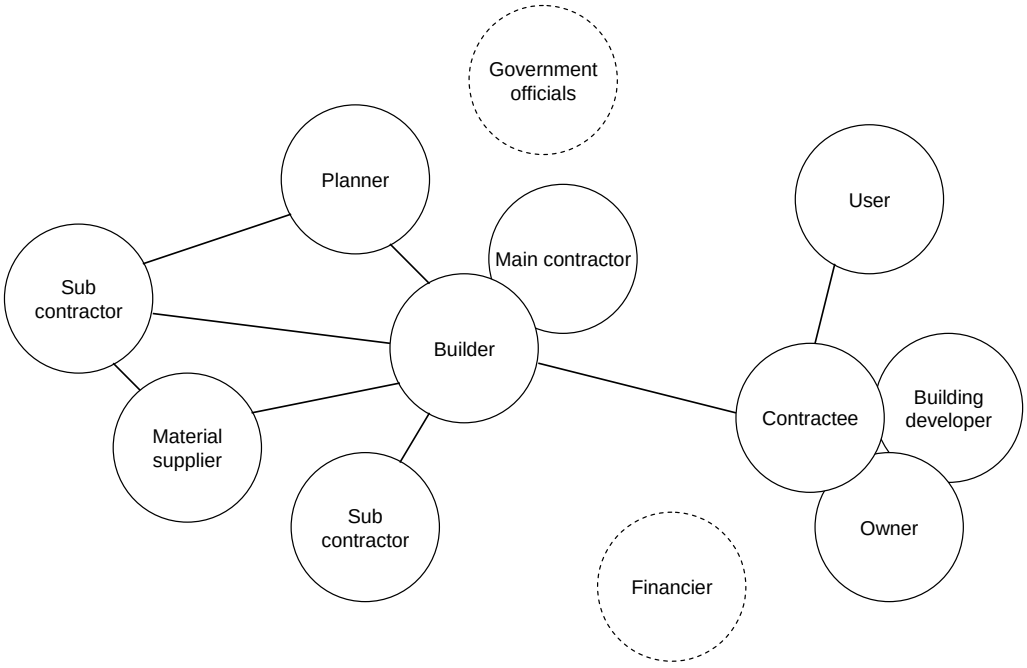

Figure 8: Project network of a construction project (Ventovuori et al., 2002)

The project network typically includes at least a user, contractee, a main contractor, an architect, and sub-contractors. These form a customer chain, where information, goods, services, and money are exchanged (Ventovuori et al., 2002). As can be seen the from Figure 8, the needs of the end-user travel through several members of the network before reaching, for example, the sub contractor or the architect. All members have needs that the others should take into account. However, for example,

main contractors are less willing to emphasize the needs of other stakeholders (Bryde & Robinson, 2005).

From a sub contractor's point-of-view, there are several customers in a project. The most direct customer is the main contractor, but also the architect and other planners have specific requirements. In addition, the other parties of the project network need to be served. Cova & Hoskins (1997) argue that project-based organizations have to meet specific requirements of individual customers and other stakeholders. Therefore, project marketing involves managing a complex interaction process with the other actors. In traditional marketing of standard goods and services, the marketing process is more simplified. (Cova & Hoskins, 1997)

Ventovuori et al. (2002) state that the buying process in the construction business involves several parties and the actual contractee may have strict specifications set, since the contractees do not buy for their own needs in most of the cases. All this emphasizes how the companies working in the construction business need to consider several parties when introducing new business models. The needs and wants of the whole have to be studied and shaped.

5 Synthesis of the literature review

As the definitions of business model and its components vary, one approach is chosen for this study based on these various points-of-view. This approach aims at simplifying the definition of business model and highlighting the most important elements. The following definition of business model is used in this thesis:

A business model is a simplified description of business logic, the way a company operates, generates revenues, and creates value for its stakeholders. A business model describes the offering, the customers, the value proposition for them, the capabilities and competencies needed in the organization, the revenue logic, and the position in the value network.

The components listed in the definition act as a framework used to describe a business model in this study. The framework is applied to understand the current business logic of the company and to describe the new building-integrated photovoltaic business models. In this study, it is considered that a company can operate with several business models at the same time. The elements of business model with explaining questions are illustrated in Table 2 below.

Table 2: Business model elements and explaining questions

BUSINESS MODEL ELEMENT	QUESTIONS TO ASK
Offering	● What are the products and services that the company offers?
Customers	● Who are the customers that buy the products and services offered? ● What are their key characteristics?
Value proposition	● What are the benefits the company promises to deliver for its customers and other stakeholders? ● Which customer problems does the offering solve?
Capabilities and competencies	● What capabilities and competencies within the company are needed for this business model? ● Are there new resources that are needed for this business model?
Position in the value network	● What partners does the company need? ● What is the role of the company in the value network? ● How are the customers reached?
Revenue logic	● How is the profit generated? ● What are the main costs? ● How are the payments arranged?

In the literature study, three main types of business models were identified. These business models are product, project, and service business models. The main characteristics of these business model types presented by Parvinen (2008) are presented in Table 3 below.

Table 3: Business model types and their requirements for success

BUSINESS MODEL TYPE	CHARACTERISTICS	REQUIREMENTS FOR SUCCESS
Product business model	● The customer decides what and how many she buys ● The customer initiates and finishes the exchange ● The product or service content is strictly defined beforehand	● Partnerships and alliances in order to focus on core competencies ● Realizing scale advantages ● Emphasizing narrow, but deep knowhow and competencies
Project business model	● The customer and supplier interact on a longer period of time ● The product and service contents are not completely defined beforehand ● The exchange will stop when the project ends	● Creating demand with customers ● References ● Entrepreneurial attitude towards risks ● Ability to be locally present ● Structural efficiency and ability to spend money
Service business model	● The exchange continues an undefined time ● Revenues are gained all the time, unless otherwise agreed	● Creating demand for services ● Communicating the constant need of services ● Reliability ● Capability to provide easiness ● Capability to invest for the service relationships and deepen them ● Ability to exploit the relationship by increasing, complementing, and cross-selling ● Ability to manage network generation and network members' internal pricing

Later in this work, the current and future business models of the Case Company are referred to as component, project, and service business models that correspond largely to the business model types presented by Parvinen (2008). The product business model is simply called component business model, since it describes the component characteristic of the products delivered in the construction industry.

In a simple way, a business model is the way a company creates value for its customer (e.g., Tucker, 2001). When considering business model innovation, a company must first understand what customers need and value, and how the company can deliver that. However, the demand may need to be created, since customers are not aware of the innovation (Kim & Mauborgne, 2005; Rogers, 2005). Business model development is particularly interesting on markets that do not exist yet. The following chapters provide a case study on BIPV business models for the Case Company.

PART III – The case

6 Business models for building-integrated photovoltaic systems

Building-integrated photovoltaic systems are an example of integrated systems on new, still emerging markets. Separate photovoltaic systems have been known for years, and there are many suppliers in their markets. In a similar way, integrated systems have existed in the construction business. This chapter briefly introduces building-integrated photovoltaic systems and provides some insights into business models of separate PV systems.

6.1 Building-integrated photovoltaic systems

Solar photovoltaics generate electricity from the sunlight. Solar energy is totally renewable, emission-free way of producing electricity. The energy production has been quite expensive, but the technology is advancing rapidly. In a few years, the production costs will decrease, thus making photovoltaics a competitive way to generate electricity. According to a calculation, solar power is even less expensive than energy produced with coal (The New York Times, 13.11.2009).

The attractiveness of photovoltaic systems is enhanced with subsidies in several countries all over the world. Especially, feeding the electricity directly to the grid may be considerably profitable. For example in Germany, a consumer that feeds electricity to the grid receives 41-43 cents per kWh. In Finland, subsidies are not in use, photovoltaic systems are quite rare, and traditionally they are used mostly in summer cottages. Unlike generally believed, the PV systems work also in northern countries. Yearly solar radiation in Southern Finland is only 15 percent less than in Northern Germany, for example. Moreover, the solar panels work better when it is cold.

Most of the photovoltaic systems in buildings have been installed on roofs by using racks. However, new technologies enable integration directly into walls, façades, roofs, or other similar building elements. Building-integrated photovoltaics (BIPV) as an actual integral part of a building can serve as an exterior weather skin instead of a traditional building element. Thus, the building element producing electricity does not need to be built twice and the surface producing electricity can even be difficult to notice.

Some companies use the term building-integrated photovoltaic system for a system that stands on racks as a separate system. In this work, these kinds of systems are not considered as integrated systems. Instead, the actual BIPV systems are defined as systems that look like traditional building elements but have the ability to produce electricity from sunlight. The technologies that can be used for these systems vary and new ones are developed continuously. At the moment, there are available thin layers that can be laminated into the elements, but in the future it may be possible to simply paint the surface.

6.2 Photovoltaics business models

The PV industry is changing and new business models emerge. Frantzis et al. (2008) have studied the business models of photovoltaic systems in the United States. Earlier the customers, who financed and owned the PV system, also managed the installation. Frantzis et al. (2008) view this as a zero generation business model. The model concentrated on manufacturing, supply and installation of PV systems, and its customers were a small group of pioneers. The end-user was always the owner of these systems. Nowadays, the 1st generation PV business models are emerging and the PV systems are more attractive to a wider market. New business models have emerged, for example, in the form of third-party ownership. The 2nd generation business models bring along the integration of PV business models into the grid. (Frantzis et al., 2008) This evolution of PV business models is illustrated in Figure 9.

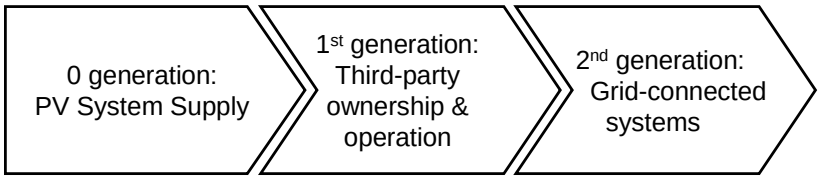

Figure 9: Evolution of PV business models (Frantzis et al., 2008)

The second generation business models have already been seen in those countries, where regulatory incentives have made the grid-connectedness more viable and valuable. This is especially the case in many European countries. According to Frantzis et al. (2008), the 2nd generation business models are still to come in the USA. Figure 10 presents the value network of a business model with a third-party owner of the system.

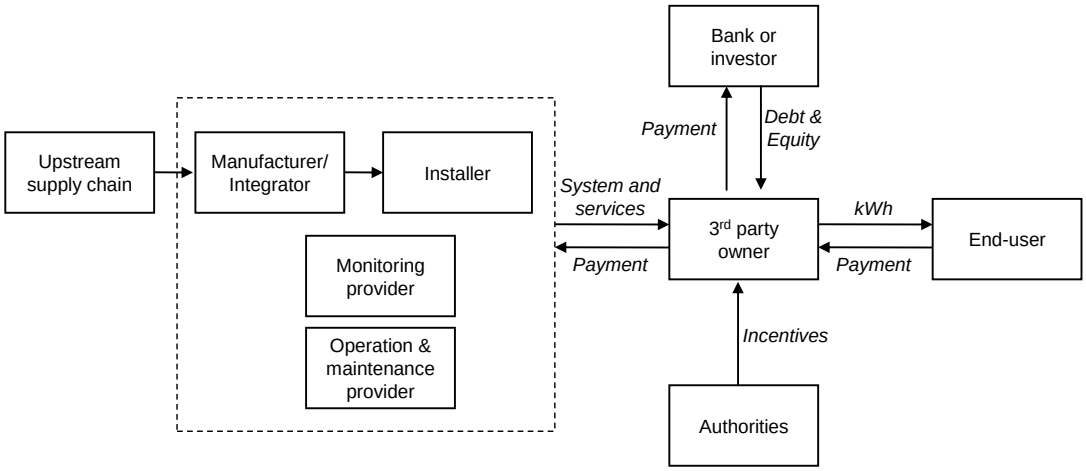

Figure 10: Value network of 2nd generation business models (modified from Frantzis et al., 2008)

The business models found throughout the Internet search can also be found in Figure 10. In addition to the manufacturing and system integration, services can be provided. The services can be installation, monitoring, operation, maintenance, and leasing. These business models can be seen as parts of Figure 10. Inside the dashed, there is a group of possible business models related to manufacturing and basic services. The leasing business model can actually be one of the business models of the 3rd party owner.

An Internet search on the current PV business models showed that similar business models to those presented by Frantzis et al. (2008) are in use. The Internet research

also showed that especially large companies had several business models that varied by country or by business area. They even had totally different Internet sites for these areas. Especially, the revenue logics and customer types were different. It was also noted that in the Nordic countries, there were no companies providing BIPV systems. In other parts of the world, only a couple of companies had them as a part of their offering. Still, not all the systems were totally integrated even though they were called as BIPV systems. The integrated systems were also often provided only for large business customers.

PV systems in general are provided by companies from several fields. The Internet search showed that the companies can have their main business either in energy, electronics, steel, or simply in photovoltaics. The larger players were vertically integrated, as they did everything from research and development until the final products. However, various smaller entrepreneurial companies were often used as a distribution channel.

7 Current business models in the Case Company

This chapter shows the current way of operating in the Case Company. The aim of this chapter is to provide an overview of the current business models and this way help the company strategic decision makers to understand what kind requirements the new, developed business models would set for the Case Company. The business models of the Case Company are introduced with two case examples: one from the component business and one from the project business.

The component and project business models are basically the two business models that the Case Company has adopted at the moment. The two cases selected for this study differ considerably from each other, which was the most important choosing criterion for them. The names of the products, projects and companies are presented with code names due to confidentiality. The first case is about Cover Components (code name) and it represents the component business model of the company. The second case, Project Spicy (code name), represents the project business model of the company.

The data for describing the business models was gathered through case interviews in the Case Company. The business models are described by using the following business model elements introduced in Chapter 3.2: offering, customers, value proposition, position in the value network, revenue logic, and capabilities and competencies.

7.1 Component business model – Case Cover Components

The component business model is studied through the case example of Cover Components. Component elements are sold one by one. Some of the components are manufactured by the Case Company, some the Case Company buys from other manufacturers, and some are manufactured with partners.

The *offering* of Cover Components includes several components from large surfaces to the smallest screws and bolts. All that is needed to build the whole Cover system

is offered. However, the customer may choose to buy only some of the components needed for the system from the Case Company. The idea is that the customer chooses how many and what kind of components are delivered. The interviewees emphasized that large customers act this way. The smaller customers, consumers, may also choose to order the whole system installed at the site; therefore, the Case Company offers an installation service for them. However, the installation is performed by Case Company partners that most often are separate entrepreneurs.

The *customers* vary from large companies to consumers building a house of their own. According to the view of the Case Company representatives, these customers can be roughly divided into four customer segments that have separate marketing channels that are illustrated in Figure 11. One customer segment is consumers that renovate their house. This group of customers is served either through an individual salesman or through a large hardware store. Another customer segment is customers that are having a new house built either by themselves or by ordering it from a house factory. They can buy Cover Components either through a hardware store or the components can be included in a house delivery package from a house factory. In addition to these consumers in the first and second customer segments, house factories serve also multi-house constructors which are the third customer segment. These customers are no longer consumers and they are responsible for construction contracts comprising several houses. This segment can also be served directly through business customer sales that mainly serve large industrial and business customers. These industrial customers are the fourth customer segment.

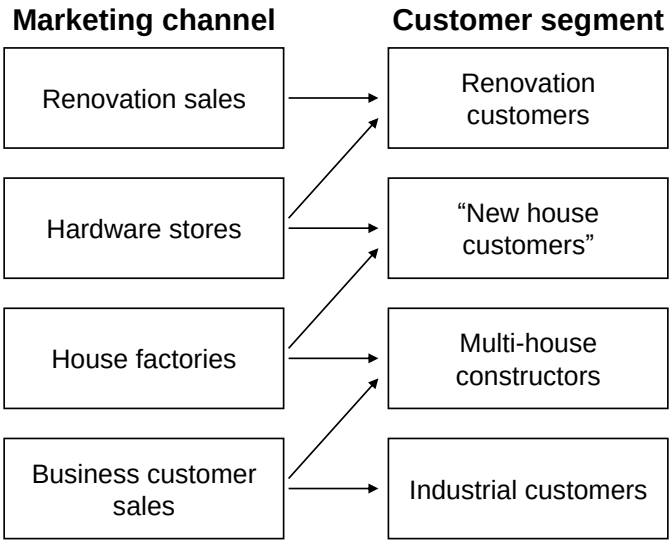

Figure 11: Cover Component marketing channels and customer types

As can be seen in Figure 11, the final customers are either consumers or business and industrial customers. However, as the interviewees stated, hardware stores, house factories, and dealers can be seen as one type of a customer. In some cases, the Cover Component suppliers may have the actual ownership of the components. Although larger customers are included in the customer segments of Cover Components, the customer focus in these products has been consumers. This is not the case in many other components the Case Company offers. Therefore, the Cover Components is quite much the opposite of the project business model described later, as it is targeted only for large customers.

Although the customer segments are various, the interviewees stated that the same *value proposition* is offered for all of them. First of all, the Case Company has delivered Cover Components for decades and its quality is widely known. The material used in the Cover Components is superior to some competing material and it works under all circumstances, also in the Nordic environment. Moreover, the material is easy to take care of and a lot of variety of forms and colors is available. The interviewees also stated that the systems constructed from the Cover Components are regarded aesthetic and stylish.

The interviewees emphasized that having a variety of components available for the customer adds up the value offered for them. The Case Company offers all the

components needed in the complete system, not only basic Cover Components. This facilitates the acquisition of all the smallest general components, such as screws. When acquiring all the components from the Case Company, the customer can be sure that she receives everything that is needed and that all the components fit together and are, e.g., of same color. As the interviewees stated, the possibility for installation with a full service Cover Component package facilitates especially consumers. They do not have to worry about finding suitable expertise or they do not need to study how to install the system. On the contrary, more professional customers may prefer installing the components by themselves.

According to the company strategy, green values and environmental issues will be emphasized in all component business in the future. This aspect, however, has not yet been part of the value proposition.

In the component business model, the Case Company's *position in the value network* is quite narrow. The Case Company basically manufactures the most important Cover Components. Some smaller components that may be included in a Cover Component delivery are acquired from subcontractors. The interviewees noted that also subcontractors are used in the manufacturing process to perform a special treatment in some cases. The interviewees also stated that the Cover Components are still largely manufactured by the Case Company, whereas some other component products use much more material and components acquired from subcontractors.

Unlike in the project business model, in the component business model the customer has the responsibility to design the system and make the order of the needed components. The interviewees described the Case Company's role as quite passive at this stage, and the services provided by the Case Company quite minimal. The pre-sale service is greatly organized by the sales channel. According to the interviewees, the sales are increasingly using dealers and local salesmen. However, the Case Company uses its own sales force also for component sales, especially for large customers. Thus, the Case Company's role in the value network often begins as late as when the order is entered. At this point, the Case Company organizes the manufacturing and packaging of the products. The Case Company's responsibilities

reach the end, when the components leave the factory. However, as the interviewees stated, the end customer may have the impression that the Case Company takes care of the installation even though it is done by the partners.

At the moment, the Case Company is organizing an installation and sales network of individual entrepreneurs to work in a unified way under the name of the Case Company. As some of the Case Company representatives suggested, this network could strengthen the role of the Case Company in the installation and increase the amount of services in the future.

The *revenue logic* of Cover Components is simple: the customer pays for each component delivered. The number of components ordered determines the price that the customer pays, when the components are received. According to one interviewee estimate, the highest costs in component business come from materials, as they account for approximately 80% of the total costs. Thus, the labor costs are relatively low. The possible design costs of the Case Company are included in the price of the components and they are not charged separately. Some of the interviewees noted that this is at least the way it should be. If the whole Cover Component package is ordered, the installation is added to the price, but the revenues of this service are mostly directed to the individual entrepreneurs working as partners for the Case Company.

An interesting specialty that the interviewees mentioned is that the largest revenues compared to the price are gained from the smallest components that the Case Company does not manufacture itself. The margins of the large main components are smaller. Thus, there exists an interest to sell also the small parts. The interviewees noted the customer is usually willing to pay a premium for the small components bought from the Case Company, since it easy and saves a lot of effort otherwise needed to find the suitable nuts and bolts.

The company's *capabilities and competencies* required in this component business are relatively low compared to the project business. This is due to processes which are rather straight forward; the company acquires the components and materials and

manufacture Cover Components out of them. Technical understanding is needed at the sales, since the salesmen of the Case Company must be able to perform the simple design of the needed components. Nevertheless, this business model works with a little effort once the process and distribution channel are set up and there is a constant need for the components.

7.2 Project business model – Case Project Spicy

The project business model is studied through a case example of a large construction project, Project Spicy. This case project consisted of building an office complex including several office buildings. Project Spicy was one of the largest building construction projects in Finland and it lasted approximately three years.

The contractee of this project, here called Anise, occupies itself almost half of the floor area; the rest of it is sublet to outside partners. Building contractor, here called Cayenne, acted as Project Spicy's general contractor managing the project. As Anise is not a professional real estate developer, construction consultant company Basil also participated in the project. Basil has worked as construction consultant in other Anise projects as well. The interviewees stated that Basil's role was to verify that all the necessary steps are taken. The role of this construction consultant was to plan and supervise, whereas the general contractor Cayenne was responsible for the actual construction project in practice. According to the interviewees, other important players in the project network were a structural engineering company and an architect office that took care of the architectural design. The Case Company worked as a subcontractor providing two sorts of structures for the building contractor Cayenne.

Figure 12 below shows the Case Company's position in the project network based on the Case Company representatives' view. This figure is a simplified illustration of the whole project network that included even more parties. There were several subcontractors and suppliers, and naturally these companies had even more subcontractors and suppliers.

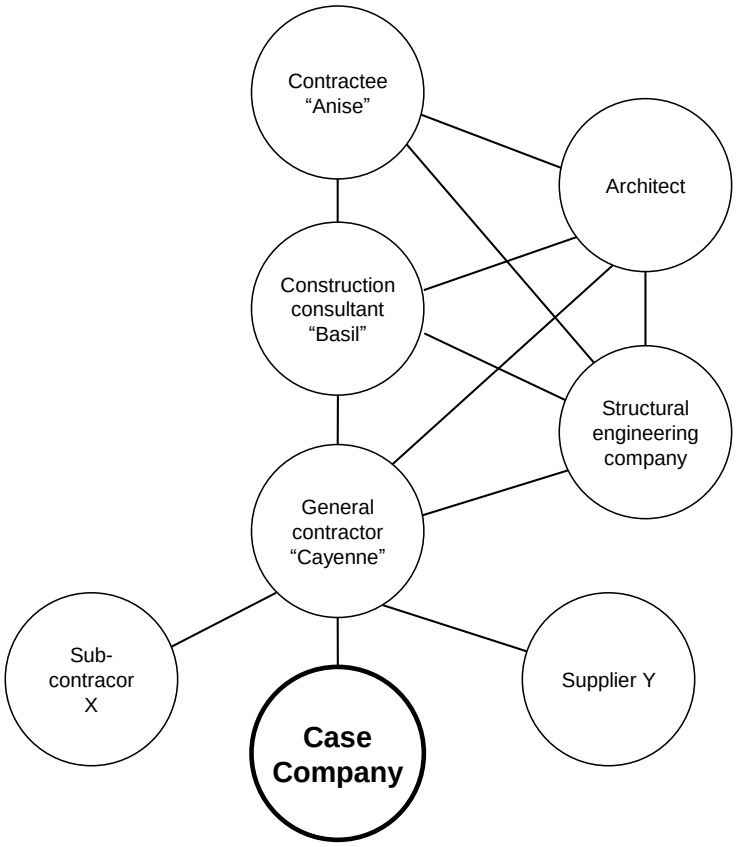

Figure 12: Project Spicy project network

The *offering* in this project can be divided into two, as the Project Spicy actually consisted of two sub deliveries. The first was Structure Alphas delivered at the site, and the other was Structure Betas installed to the buildings. These two were treated as separate projects in the Case Company.

The Structure Alphas were manufactured according to structure plans given by the customer. The interviewees stated that the amount of own design activities was minimal, and the components were manufactured strictly according to workshop pictures received. After manufacturing, the Case Company organized the logistics to deliver the structures to the site, but the installation was not included in this delivery.

The Structure Betas contained multi-material structures as integrated elements. The interviewees noted that the delivery was one of the most remarkable ones the Case Company has ever conducted. There were several types of elements, and a considerable part had a special integrated element that required additional efforts.

The Case Company designed the elements and developed them further with the customer and the architect. The interviewees recalled that the first suggestion of the customer was not easy to satisfy; therefore, the Case Company made their own suggestions to modify the structures. For example, a certain structure was replaced with another material, since the original plan would have been costly and difficult to manufacture in due time. According to the interviewees, the new structure was technically better and aesthetically more attractive. When manufactured, the elements were integrated of three sub elements that were manufactured separately and then combined together. The elements were highly equipped, when the Case Company delivered them to the site. The last phase of this delivery was the installation of the elements, which was performed by the Case Company.

General contractor Cayenne was the direct *customer* and initiator of the project. Cayenne sent the invitation for tenders to several companies which resulted in the Case Company submitting a tender. However, Basil also participated in the contract negotiations and presented the situation to the final customer Anise. According to the interviewees, Anise was the one to actually decide whose tender was accepted despite not being present in the negotiations. The role of the general contractor Cayenne was to supervise the schedule and organize the tendering process, whereas construction consultant Basil and final customer Anise made the actual decisions. The division of the customer roles is presented in Figure 13.

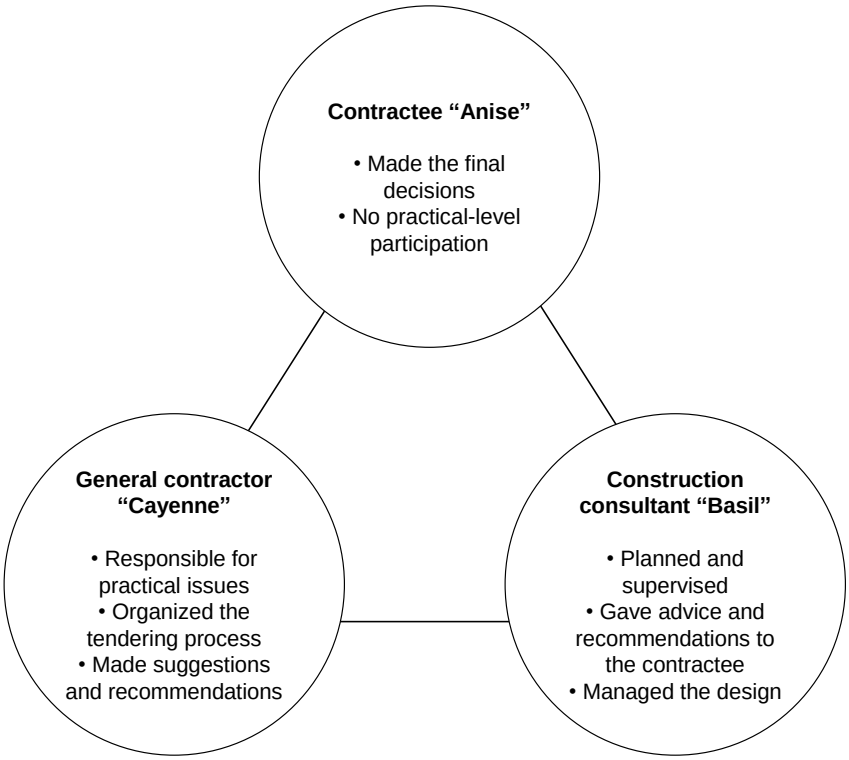

Figure 13: Customer trinity of Project Spicy

As the interviewees expressed, the three parties presented in the figure can all be regarded as customers from the Case Company’s viewpoint, as all of them have a role in the decision making. In addition to this trinity, the Case Company interacted with the architect about the suggested design changes; therefore, the architect can also be seen in a customer-like role, especially, when considering the decision making process of visual aspects. Moreover, the structural engineering company presents the final customer Anise in issues dealing with regulations and other structural matters.

The issues that the customer appreciated in the Case Company’s delivery are a part of the *value proposition* that the offering generated. The interviewees included the delivery of an entity as one of these issues. The interviewees stated that especially the Structure Betas were highly equipped and delivered as a turn-key project. Another significant issue mentioned by the interviewees was related to Structure Alpha delivery. They said that the Case Company was one of the few companies that were able to deliver a large project like that in such a short period of time.

The Case Company brand itself may have created value for the customers. Reliability factors that are associated with the brand were a part of the value proposition as well. As a large company, the Case Company is trusted to deliver good quality in time. Project Spicy was so large that most competitors may have not been able to deliver. The general contractor has also announced that the Case Company as a large company was able to react to deficiencies in plans.

A part of the value proposition was guarantees – for the Structure Alphas the guarantee was as much as hundred years. The interviewees stated that the trust was shown in Structure Alpha case particularly well. As a matter of fact, the project was first given to another company but when problems emerged, the Case Company was contacted and asked to help. This indicates that the Case Company was regarded to be a reliable supplier that delivers quality within the given time limits.

Many of the interviewees emphasized that the personnel of the Case Company was in a key role, when the decision of the project supplier was made. The personnel of the company were regarded to be highly competent. Moreover, the personnel have personal relationships that can be crucial. One of the interviewees pointed out that Finland is a relatively small country, and professionals of the field know each other. Thus, value is brought for the customer also on a personal level.

As almost always in construction projects, a suitable price was an important factor. However, as the interviewees agreed, it is not the determinant factor as it may more often be in the component business. The interviewees estimated that in Project Spicy the prices the Case Company asked were probably not the lowest ones compared to the other tenders. In the Structure Betas, the price was lowered with changes to the original design. At this point, the opinion of the architect office was requested. The new design lowered the costs for the Case Company. As the customer was satisfied with the design changes the Case Company made, the total price could be lowered.

In this case, the general contractor Cayenne, the construction consultant Basil, and the contractee Anise were all customers of the Case Company. In addition, the partner companies in the project network were interested about the value proposition.

The interviewees emphasized that the way these parties gave value to the different issues of value proposition varied. In general, the general contractor is mostly interested in delivery reliability and price. This was true also in this case project. The contractee and construction consultant valued mostly the ability to deliver and the technical functioning. The architect was interested in visual aspects and suitability to requirements. Finally, the structural engineering company necessitate that the technical requirements are fulfilled according to plans.

The Case Company's *position in the value network* in a project delivery is wider than in a component delivery. The Structure Alphas were manufactured according to pictures. First, the Case Company bought the material needed, after which the structures were put together, a treatment was performed and they were delivered to the site. The installation was done by a third party chosen by the general contractor Cayenne.

The Structure Betas were designed with all the installation details by the Case Company. Naturally, manufacturing was a part of the Case Company's responsibility and it was done in a factory situated outside of Finland. Contrary to the Structure Alphas, the Structure Betas were delivered installed on site. After the installation, project's general contractor took the responsibility of these elements.

One of the interviewees estimated that the Case Company had also around 20 suppliers and subcontractors that contributed to the value created. They delivered elements and components to the structures. According to the interviewees, a part of the design was also done outside the Case Company. Although a large number of partners collaborated in Project Spicy, the Case Company was responsible for all the issues related to its deliveries. According to the interviewees, in project business problems must be anticipated and all the information given to subcontractors and suppliers must be correct.

The *revenue logic* of this project was somewhat more complicated than the revenue logic of the Cover Components. The Case Company's deliveries for Project Spicy were priced with one price comprising the whole project. However, changes were

charged separately. In this project, the value of the contract was a few million Euros. The interviewees recalled that the changes increased this sum with almost 25 percent. Thus, the revenues gained from the changes were almost a fifth of the total price. According to the interviewees, this is a common practice which is agreed already in the first contract. By having set prices for the changes, a part of the risks can be transferred to the buyer of the project. The actual payments were arranged in a phased manner, so that payments were made as the project progressed. This is a general practice in the construction business. However, as an exception to this in some countries, where the Case Company operates, the project is delivered before the payments.

In projects of this type, one of the interviewees estimated that only approximately 30 percents of the cost are caused by materials. The interviewees stated Project Spicy's material costs were significantly lowered with a thorough competitive bidding among the subcontractors and suppliers after the Case Company itself had closed to the deal. Thus, most of the costs are caused by the work needed to deliver the project. These employee costs are caused by designing the offering, planning the project with the buyer, designing and planning the changes required – and of course by the actual manufacturing that is more laborious than the component manufacturing. The interviewees reminded that a lot of overhead costs occur also from the design of projects that do not realize.

The internal *capabilities and competencies* that the Case Company needs to possess in order to deliver projects, like in this case, are various. The interviewees stated that in addition to the component manufacturing, project business requires a project management organization that manages the project with its network from the very beginning until its closure. For example, the risks and resources must be managed more carefully compared to the component business model. Competencies on higher-level management, such as project business development and project business management, are needed. The interviewees reminded that the project development and project sales are essential to sell projects. The Case Company must be aware of ongoing construction plans and possibly even contribute to them in the early phase.

According to the interviewees, sales and marketing competencies are essential as the selling process is much longer than the one of component sales.

When projects are sold, design services are needed. The project deliveries are individually designed to meet the customer expectations. The interviewees perceived that in this project a small group of professionals was capable to find solutions so that customers got what they wanted to. The interviewees stated that as in Structure Betas, the Case Company often tries to find alternative designs for the original design possibly proposed by the customer. This must be done to find the best alternatives that have the best price and technical capabilities.

During and after the design, the Case Company must consider the procurement and manage it. The interviewees reminded that new suppliers are needed as each project requires different materials and elements. At the design phase, the prices of the most important components are requested from several suppliers. However, when the design is ready, this is performed again to get the best offers. After the procurement, the employees at the factories need education. The interviewees stated that the employees in the factory were educated twice before the manufacturing of Structure Betas could be started.

As a project sometimes includes the installation on site, capabilities related to installation are needed. This means that the project management must be able to fit the logistics and installation into the timetables of the whole construction project. Therefore, understanding of the whole construction project is needed, and plans must be adjusted to it. According to the interviewees, the Structure Beta project required the special capabilities in the pre-fabrication and logistics, since there were a variety of elements with different features. The interviewees regarded that the special integrated element required internal knowledge, even though processing that kind of features is not a core competence of the company. As almost every structure was a little different from the other, the deliveries from subcontractors had to be well organized, the interviewees recall. After manufacturing, the right structures had to be delivered to the site at the right time. Thus, compared to the traditional component

business the manufacturing process was different and the logistics required additional efforts.

The interviewees reckoned that this project required a considerable amount of interaction capabilities, as following a tight schedule requires cooperation between the Case Company, the customer, and the architect. The interviewees reminded that relationships matter in the construction business. If they are established already before the project, the communication is much easier. For example, if the sales personnel is familiar with the architect, it is easy to discuss already beforehand about the expectations and possibilities. When the contracts are made, negotiation skills are essential. Once again, the personal interaction and capability to maintain good relationships on the personal and on the company level are needed.

8 Potential BIPV business models for the Case Company

Chapter 6 provided some insights into the existing photovoltaics business models and the previous Chapter 7 provided a view to the current business models of the Case Company. This chapter concentrates on the possible BIPV business models the Case Company could adopt in the future. Chapter 8.1 discusses the current attitude towards these new business models. Chapters 8.2, 8.3, and 8.4 describe three possible business models. Chapter 8.5 represents stakeholders' opinions on these business models. Finally, Chapter 8.6 compares the three business models.

The business models are created based on the interviews and meetings with the instructors. They are described by using the six business model components introduced in Chapter 3.2: offering, customers, value proposition, capabilities and competencies, position in the value network, and revenue logic. The strengths and weaknesses, as well as the requirements, of the business models are discussed based on the data collected in the workshop and other discussions.

8.1 Attitude towards setting up a BIPV business

In Finland, buildings account for approximately 40% of the total energy consumption (Taloussanomat, 24.5.2009) and the concept of sustainable building is widely discussed at the moment. Zero-energy and energy-positive building technologies are developed and new regulations are set. The Case Company's strategy recognizes the energy issue as an important focus area. Both renewable energies and energy efficiency are seen as drivers for the future. Therefore, setting up a BIPV business model is in line with strategy. However, the photovoltaic business is a quite novel area for the company and not much internal knowledge exists at the moment.

Before starting up a new business it is of interest to know how the new business and its business model are considered among the employees of the company. If the employees believe in the opportunity, motivated staff can be found to run the business. Moreover, motivated managers are needed to implement a new business

model (Gulati & Garino, 2000). Otherwise, conflicts may occur. Afuah (1998) has presented roadblocks that can be faced, when the decision to adopt is implemented within the company. The employees have an emotional attachment to the established business and they may be blinded by the dominant logic (Afuah, 1998). Therefore, the Case Company employees' attitude towards BIPV business models is studied and the results presented here.

During this study, altogether eleven company representatives were interviewed either in pre-research interviews or in case interviews. The way the interviewees reacted to this new business opportunity varied. Figure 14 shows the attitude of the Case Company employees that was perceived in the interviews. The opinion was not explicitly asked, as the attitude could be observed through discussion.

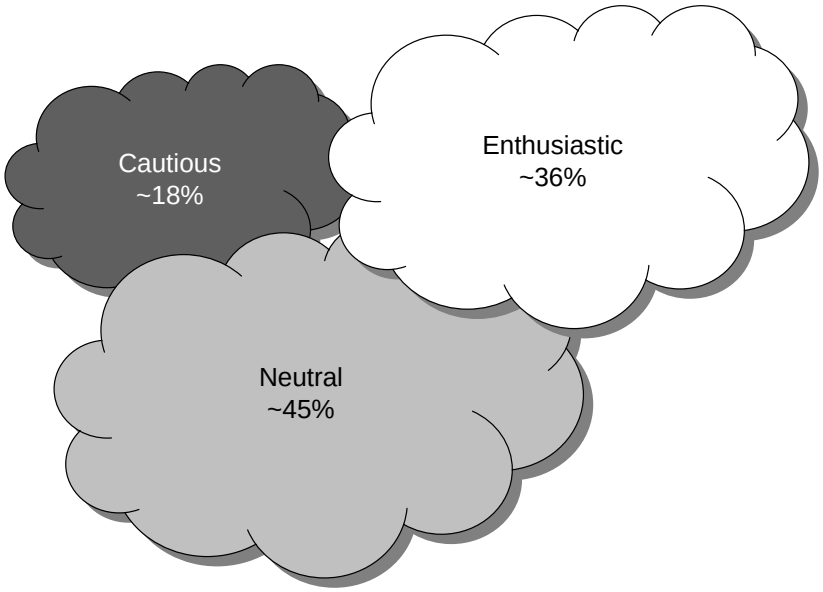

Figure 14: Attitude towards BIPV business models

As can be seen from the figure, most of the interviewees (5 out of 11) had a neutral attitude. This means that they showed neither positive nor negative reaction when the research topic was introduced and discussed. These interviewees may feel that the new business would not affect their current work as such, or they did not have so strong opinions that they would have felt urge to express them.

The second largest group of interviewees (4 out of 11) had a remarkably positive attitude. They expressed enthusiasm towards BIPV systems and towards this research. The third group of interviewees (2 out of 11) had a more cautious attitude. These employees had either heard about earlier negative experiences or they otherwise were not interested in BIPV business models because of personal reasons.

One issue to be noted is also the opinion on the elements the PV system should be integrated into. In all of the aforementioned three groups, there were persons who felt that a certain surface would be better than others. The reasons for this may be previous experiences, lack of knowledge, and the current customer segmentation of certain products.

These issues dealing with the current attitude should be taken into account when implementing a new business model. Although the new business models are in line with the strategy, the personnel must be motivated. The different business models may raise different feelings among the employees simply because some of them require more changes in the current way of operating. The Chapters 8.2, 8.3, and 8.4 describe the three developed business models.

8.2 Component business model

The first of the developed business models is component business model. The component business model for building-integrated photovoltaic systems is the simplest one of the three business models described in this work. The idea of it is that the Case Company integrates the photovoltaic system into a building element, which can be either roof, façade, or other structure. These surface components and all the related components and equipment are then delivered to the customer according to the order. The customer tells how many and which components are needed. The design services offered by the Case Company are minimal as the components are standardized. This business model resembles a lot to the current component business described in Chapter 7.1 through the case example of Cover Components. The key characteristics of the component business model are collected into Table 4.

Table 4: Component business model

Offering	● Productized BIPV modules of different sizes and appearances ● Design service is included, also possibility to use design tool over the Internet ● Customers can either sell or use the electricity by themselves ● Possibility for an installation service close to the customer through selected partners
Customers	● Consumers and business customers ● Residential, commercial and industrial buildings, new buildings and renovations ● Customer is the owner of the system ● Primary business market area, possibility to expand it with partners
Value proposition	● Easiness and fewer risks as two products are combined into one ● Better appearance compared to traditional PV systems ● Good quality, 25-30 years performance guarantee ● Environmentally friendly image
Capabilities and competencies	● Integrator skills ● Technical skills and manufacturing capabilities ● Establishing and managing a wide partner network ● Brand building skills ● Market intelligence and up-to-date knowledge of local regulations ● Marketing and sales competencies in reaching the customers and communicating the value ● Ability to realize scale advantages
Position in the value network	● Partner takes care of solar cell development and manufacturing ● Case Company integrates the solar cells into building components ● Electronic components are acquired from specialized companies ● Inventories in the current logistics centers ● Distribution close to customers ● Solar energy distribution partners (selling and installation) ● Existing distribution channel: dealers and Case Company's own channel
Revenue logic	● Customer pays for all the ordered components and all the components are listed in the order confirmation ● Design service is included in the price of components ● Possible installation creates additional revenues ● Major costs are caused by materials and the integration work needed

The workshop participants stated that the Case Company has a culture of being mainly a component provider due to historical reasons. The employees, who have been used to working with component business, perceive the project business as complicated and slow. Therefore, the component business model is considered to have several strengths, and it is seen as an easy way to enter the BIPV business. The workshop participants justified this thinking with the current way of having component business as a starting point of any business in the company.

The workshop participants regarded the main strengths of BIPV component business model to be its scalability and possibility to gain scale advantages. The component business model can easily expand to wide markets. The scale advantages can be considerable, if there is enough demand for the components. The wide markets can be easily attained with the existing distribution channels, even though new channels would also be needed. Moreover, an Internet ordering system could be deployed to facilitate the order making from even larger markets than where the company's channels exist at the moment. On some business areas, the Case Company has already implemented similar ordering systems. The electronic ordering system could easily calculate the surfaces needed and make an offer directly. The customer could use the same system to see how the order progresses in the system. The sales channels should be well designed, since the component business is based on volumes and thus needs large markets.

In addition to these scale benefits, the component business model requires relatively little competencies compared to the other BIPV business models. Many existing ways of operating would remain the same. The workshop participants mentioned that the existing channels could be used to distribute and promote the products. The participants mentioned also not having human resources confined in projects in this business model as a significant advantage. Less human resources are needed, because the component business model does not require extensive design work or customer-specific features in the manufacturing.

The needed relatively small increase in competencies, compared to the existing business models, was stated to be a strength. Still, the weakness of this new business model is the PV competencies of the Case Company. Also the workshop participants regarded the system knowledge as a challenge. At the moment, there is hardly any knowledge of photovoltaic systems that are somewhat more complicated than the systems currently integrated into building elements. The workshop participants were worried about the profitability issues that may rise from the lack of own skills or from the expensive PV systems themselves. The building-integrated PV system should be competitive with the separate PV systems and also with the traditional building elements without any energy production.

Compared to the project and service business models, the workshop participants envisioned that the component business model is likely to face the hardest competition in the future. The competition is estimated to be hard, since BIPV systems compete with traditional PV systems. In addition, the relatively simple component business model can be easily imitated. The participants predicted that even small specialized companies may enter the field. They also perceived that differentiation in this business model could be difficult.

All-in-all, the workshop participants considered this business model to be the easiest to set up. They were confident that the market leadership regarding the Cover Components would facilitate the implementation of this business model, if the PV systems are integrated to them. Moreover, the risks related to this business model were regarded small. If the solar energy business would not succeed for some reason, the component business would not suffer significant losses. Thus, it can be concluded that the component business model is an easy way to start the business, if the demand is sufficient.

The implementation of this business model requires the development of company capabilities regarding PV systems. The know-how of the BIPV should be developed to the extent of core competence, so that the product could be perceived as a prominent part of the Case Company offering in the future. The workshop participants emphasized that the BIPV product should first and foremost be a product of the Case Company. Finding a suitable, reliable partner is an essential prerequisite for this, even though the aspect was not mentioned in the workshop. As some of the Case Company interviewees mentioned, the Case Company has earlier had some PV experiments that had led into difficulties with some partners. For example, serious delivery problems with a foreign PV company were faced unexpectedly.

Finding a suitable partner may be facilitated by getting involved in the PV development. The workshop participants also regarded this to be important. They emphasized that the involvement in technology development should be started early enough, since this way the Case Company representatives would have a possibility to

learn and establish contacts. It is too late to start planning the business, when the technology is ready to be used. As one suitable technology is supposed to be ready in the year 2015, the participation in the technology development should be started immediately, as discussed with the Case Company representatives.

The workshop participants agreed that the BIPV elements should be mass-produced in order to be competitive. Therefore, the production line should be carefully planned and organized. The workshop participants emphasized that components should flow smoothly through the production line in a reel-to-reel manner. Unnecessary shifts to subcontractors in the middle of the process should be avoided. The workshop participants pointed out the importance of planning the responsibilities of the Case Company and what is outsourced to subcontractors.

In some of the Case Company interviews and discussions an important requirement related to customers was brought up. Reaching the customers and communicating the value requires serious marketing efforts. The customer field should be carefully analyzed and the hidden needs for the products should be recovered and customer interest created. Compared to the Cover Components business model, the main difference of the BIPV business model is that in order to act profitably more large customers are needed. The target group cannot, thus, be the same as for Cover Components. As the workshop participants mentioned, wide markets could be attained with this business model; however, considerable efforts are needed to building the customer need, communicating the value, and making the company known in the area of solar power.

8.3 Project business model

The second developed model is project business model. It is operated in a more complex way compared to the component business model. The BIPV project business model is based on large customized deliveries for large customers in a similar way as the current project business illustrated in Chapter 7.2. This business model enables project-specific design for building elements with an integrated PV system. These elements are then manufactured to meet the designed specifications. The customers can choose to order a turn-key delivery including everything from the

earliest design until the installation. Table 5 below presents the main characteristics of the BIPV project business model.

Table 5: Project business model

Offering	● BIPV systems designed for individual buildings ● System delivered as a whole including all the necessary components ● Installation included in a turn-key delivery ● Customers can either sell or use the electricity by themselves
Customers	● Business customers ● Residential, commercial and industrial buildings, new buildings and renovations ● Customer is the owner of the system ● Primary business market area (not easy to expand)
Value proposition	● Easiness ● Delivery accuracy and few financial risks ● Integration to the customer's processes ● Good quality, 25-30 years performance guarantee ● Environmentally friendly image ● Possible self-sufficiency in electricity generation
Capabilities and competencies	● Capability to design, manufacture, deliver and install complete systems ● Establishing and managing a wide partner network ● Market intelligence and up-to-date knowledge of local regulations ● Marketing and sales competencies in building relationships and creating demand with customers ● Ability to develop local presence ● Brand building skills through reference projects
Position in the value network	● Partner takes care of solar cell development and manufacturing ● Electronic components are acquired from specialized companies ● Case Company sells, designs and integrates the system ● Partners may take care of the installation phase, but customers see the installation as a part of the Case Company's delivery
Revenue logic	● Customer pays for the whole delivery ● Design service is priced separately ● Costs are mainly caused by design and special integration work

The BIPV project business model differs only a little from the current project business model, since challenging components have been integrated into the Case Company's elements and structures already earlier. These integrations have been made on a case-by-case basis, thus resulting in higher costs. If the BIPV elements would be done only with a project business model on a case-by-case basis, the cost of a single integration work would be significantly higher than in reel-to-reel component manufacturing.

Although the costs may increase in the project business model, it was noted in the workshop that the project business model is in line with the strategy. The workshop participants agreed that the project business at the moment requires a lot of work. In their opinion, the BIPV offering could be added to the existing project business model. Offering BIPV systems as projects could support and strengthen the current project business. Especially at present when the PV systems are not so common in buildings, the project business model might suit better than the component business model, because the Case Company is involved in the projects already during the design phase. Therefore, it would be possible to influence the decision of whether to have PV systems in the building.

As discussed in some of the interviews and in the workshop, large successful projects could act as references. Moreover, they may increase the knowledge of the systems and further on increase the demand. These first projects would not even need to be profitable, since they could be seen as a reference that enables future business in the field. The project business would also enable the Case Company to sell energy efficiency. The solar energy production could be embedded to a more holistic way of selling project deliveries that enhance the energy efficiency of the building.

The workshop participants regarded that delivering BIPV projects could facilitate the business growth in the southern business areas. At the moment, the component business is more concentrated in the northern markets, but in the southern areas there could be even a larger demand for the BIPV systems. Delivering larger projects also in these areas could increase the brand image of the Case Company, thus boosting sales.

In the workshop, it was noted that the project business model could enable the Case Company to use its strength as a large, reliable company. If competition in the component field increases, the project business model could offer a way to differentiate. Smaller companies may not be able to deliver large projects or customize their offering for the customer-specific needs.

The main weakness of the project business model compared to the component business model is that the project business is much smaller than the component business at the moment. Therefore, the project resources are smaller, and the project business management as well as the whole organization needs considerable development. The workshop participants were worried about the increasing risks and weaker profitability of project business. This was justified with the need of presence and knowhow that both increase costs. The project business model was also noted to decrease volumes in other business areas, which may further decrease the overall profitability.

The workshop participants noted that competencies regarding the PV systems are needed in the same way as in the component business model. As a matter of fact, the PV competencies needed in project business may be even wider, if the customer wishes to have assistance with the overall electricity plans. The projects may also require knowledge of different PV materials, since the customer may want to have PV systems integrated into other materials than those into which the Case Company would be used to integrating them.

The requirements of the project business model are mostly the same as the requirements presented for the component business model. For example, the partners must be found, relationships created, and customer studied and shaped. The competencies must be increased to the extent of a core competence, as expressed in the workshop. The workshop attendees presented that the Case Company should familiarize with other sustainable energy forms, such as ground heat. This would benefit the energy efficiency thinking, where the BIPV plans could be linked.

Adopting the project business model requires concreteness. The workshop participants perceived that there is a need to improve the internal processes and allocate the resources. They regarded that there would be a need to create trust in the Case Company for this new business opportunity. The current way of perceiving BIPV business as a niche business for summer cottages is the reason for which creating positive atmosphere regarding BIPV project business was seen particularly

important. The Case Company personnel should understand the large business opportunities BIPV systems may create through project business.

8.4 Service business model

The third business model developed is service business model. Actually, several service business models related to BIPV systems can be created. Here, they are treated as one group of business models. The possible service business models identified are the following: monitoring service (A), maintenance service (B), and leasing services (C). These business models were chosen through studying the current photovoltaic business models and through discussions with the instructors of this work. The characteristics of these service business models are described in Figure 15. The degree of services offered increases stepwise from left to right.

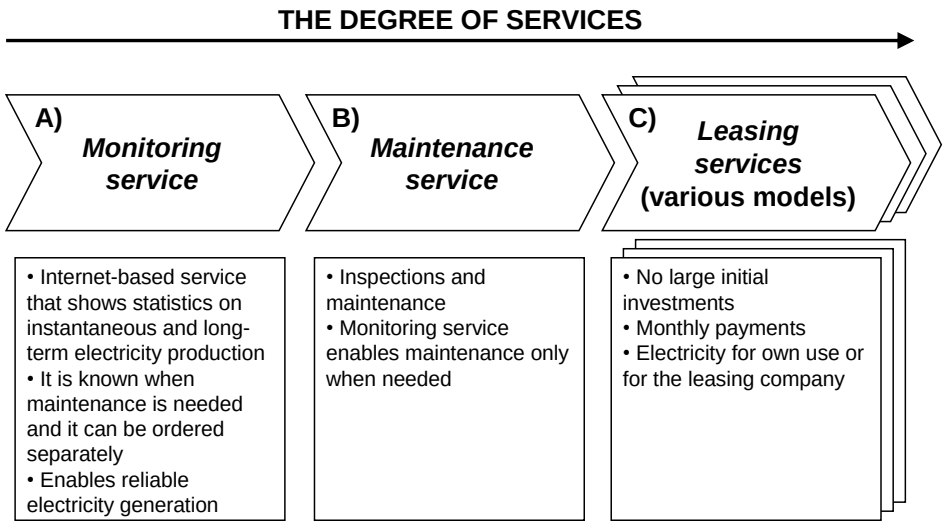

Figure 15: Different service business models

The first of the service business models is *monitoring service,* which simply means that the Case Company would offer a possibility to monitor the electricity production. In return, the Case Company would receive monthly or yearly payments for this service. The monitoring service could also be easily packaged into a project delivery, or even with a component delivery. With a delivery and monitoring package the Case Company could offer BIPV solutions for longer periods of time. The monitoring service could be produced automatically with measuring systems that would display the energy generation information on a web page and possibly on

a large screen in a building. Sudden drops in the electricity generation indicate that maintenance is needed. Thus, maintenance is performed only when needed, as in general PV systems do not need regular maintenance. In the monitoring service business model, the maintenance would be ordered separately, when the need occurs.

The second service business model is *maintenance service*, which would include inspections and maintenance of the PV systems, as well as possible maintenance of the building elements. As the PV systems do not require much maintenance, the monitoring service would enable maintenance only when needed. As in the monitoring service, the payments would be based on monthly or yearly fees. Both the monitoring and maintenance service could be provided for any PV system, not only for the BIPV systems provided by the Case Company. This is not the case for the leasing service.

The *leasing service* business model is the most demanding one of the described service business models. Leasing itself and services related to leasing are various. The basic idea would be similar to leasing a car. The customer makes no initial payment, but receives a building structure including an integrated PV system. After this, the customer pays a monthly fee for having the building structure, for example a roof, and the electricity the PV systems produce. The company providing the structure shares the fee with a financing partner, a bank or an investor.

The basic leasing model is not the only option, since the incentives for renewable energy given in many countries provide more possibilities. All these models are not described in detail in this study, since they could be a topic of their own for further research. One example of the other models is that the Case Company keeps the electricity and feeds it to the grid. In this case, the leasing payment could be lower. The customer could also buy the electricity from the Case Company. It could also be possible that the customer later acquires the systems. Furthermore, the Case Company could give low-cost or even free structures to get the electricity they produce. In this case, the model would not be anymore an actual leasing model. The electricity fed in the grid would then work as a payment for the building structure

provided. This is similar to the idea of renting roof space and installing photovoltaic systems on it, and selling the electricity generated directly to the grid.

The three business models presented above were decided to be treated as one group of business models, as otherwise the emphasis would have been too much on different service business models. The business model components of the general service business model are described below in Table 6. The letters A, B, and C are used to mark statements that are relevant for only some of the service business models.

Table 6: Service business model

Offering	● Monitoring service through Internet (A, B, C) ● Service agreement for all solar systems: inspection, maintenance, and operation (B, C) ● Leasing services, e.g. BIPV system and service agreement with no initial payment with an option to acquire later (C)
Customers	● Individual and business customers ● Residential and industrial buildings ● Acquiring or already having a solar system ● Leasing service especially in countries where upfront capital is a barrier and energy supply not secure (C)
Value proposition	● Reliable and secure energy supply ● Quality throughout the life-cycle ● Organized and competent maintenance (B, C) ● Easiness, help and assistance in all matters (B, C) ● Energy generation without upfront capital (C)
Capabilities and competencies	● Providing services and creating a service network that is always available ● Ability to create and communicate the continuous need of services ● Skills to build a brand as a service provider ● Technical skills and knowledge of local regulations ● Creating financing models suitable for different areas (C) ● Establishing partnerships with financers (C)
Position in the value network	● Maintenance network (e.g., Case Company's own channel) ● Trained local partners and existing distributors act as a link between the company and the customer ● Financing service through a partner (C)
Revenue logic	● Customer pays monthly fees in line with the service level agreement ● Service agreement creates revenues for the Case Company ● Possibility to easily sell new systems when the old ones are in the end of their life cycle ● Costs are mainly caused by work force needed for services ● Leasing agreement creates revenues for the Case Company and for the financing partner (C) ● Financing partner could sell the energy to the grid which would lower the monthly fee (C)

The service business models differ the most from the current business activities the Case Company has at the moment. However, they would be in line with the strategy, as the aim is to put more emphasis on solutions rather than sole products.

In order to be profitable, starting a service business solely based on PV systems is not seen as a feasible option. Therefore, a holistic view of the service business possibilities should be studied. The workshop participants noted that the maintenance business for some products has already started and that the PV service business could be included in that. As the network is already established for the maintenance of these products, other maintenance activities could be added. This would require wider and different knowhow from the maintenance staff.

Having some degree of services might boost the component and project business models, as after-sales services would create trust to the systems. In the workshop, it was discussed that especially the monitoring service would be useful. With the monitoring systems added to the component or project delivery, the customer would actually see that the product generates electricity. As some customers consider the image benefits of sustainable energy to be of the utmost importance, a monitoring system would provide additional value for them. The possibility for maintenance service might also assure some hesitant customers, who do not otherwise have interest in taking care of the systems.

In a wider perspective, the service sold in the PV business could be selling energy efficiency, where solar energy system maintenance would be only a part of the offering. As one of the workshop participants formulated it: *"Service business is a big, new world."* It would offer great possibilities for the Case Company. On the other hand, the workshop participants reminded that the Case Company does not yet have much experience in it. The only experiences, even though positive ones, are from the recently set up maintenance business for a certain type of products.

Some of the workshop participants were worried about the profitability of service business. There was a fear that the effort needed to establish and run the service business would not be compensated by gained excess revenues. Profitability,

however, cannot be prejudged to be low in service business even if establishing it would require a lot of efforts. Whether to enter service business or not is a strategic choice.

Setting up a service business requires a lot of skill and effort. As noted in the workshop, service business can have revenue logics that are completely different from the existing ones. The workshop participants concluded that these revenue logics must be carefully designed in order to reach higher profitability. The way value is created between the Case Company and the customer must be discussed further. For example in the southern areas, there may be more interest in the leasing services than in the northern countries. Therefore, the customer needs and values must be studied further.

Besides redesigning the revenue logics and studying what the customer values are, the service business model requires partner networks. These partner networks must be constructed in a way that reacting fast to the maintenance needs is possible. One way to construct the maintenance network is to create a network of individual entrepreneurs, as the workshop participants envisioned. They also emphasized that the network should not be solely based on the integrated PV systems; instead, it should support the other business lines as well.

The workshop attendees noted that the service business requires a totally new way of thinking. A possibility to add services to the offering is solutions with secured functionality for the next 20 years, for example. One way to approach this service business development could be done through studying how the change has happened in other industries, such as in the elevator business or in the shipbuilding industry. For example, Kone has entered the service business by constructing an elevator maintenance network from individual entrepreneurs.

8.5 Customer and stakeholder views of the three business models

This chapter introduces the results of the stakeholder interviews. First, the background of the interviewees is presented by showing their role in the decision making process and discussing their interest in building-integrated photovoltaics. After this, their opinions on the possible BIPV business models are discussed.

8.5.1 The interviewees and their interest in BIPV

The interest in energy matters has risen and energy efficiency is a buzz word in the construction business. All of the nine interviewees had been some way involved with the solar energy through their work. However, most often the issue had been treated as a sub-topic related to energy efficiency or to sustainable development.

Some of the interviewees were direct customers of the Case Company, some are involved with the projects the Case Company delivers, and some are otherwise influential parties. Their roles in the decision-making processes vary. For example, the architects may propose to have BIPV systems, and their opinions are taken into account when a building is being designed. On the other hand, the construction companies are not that much involved in the decision-making process, but in case of good experiences, they can share references. The interviewees were asked to draw a picture of the other actors they interact with. It was noted that the pictures and the opinions on decision making process vary quite a lot. Therefore, some of the actors might have different visions of their milieu and project networks. The interviewee roles in the decision-making process are illustrated on the horizontal axis in Figure 16.

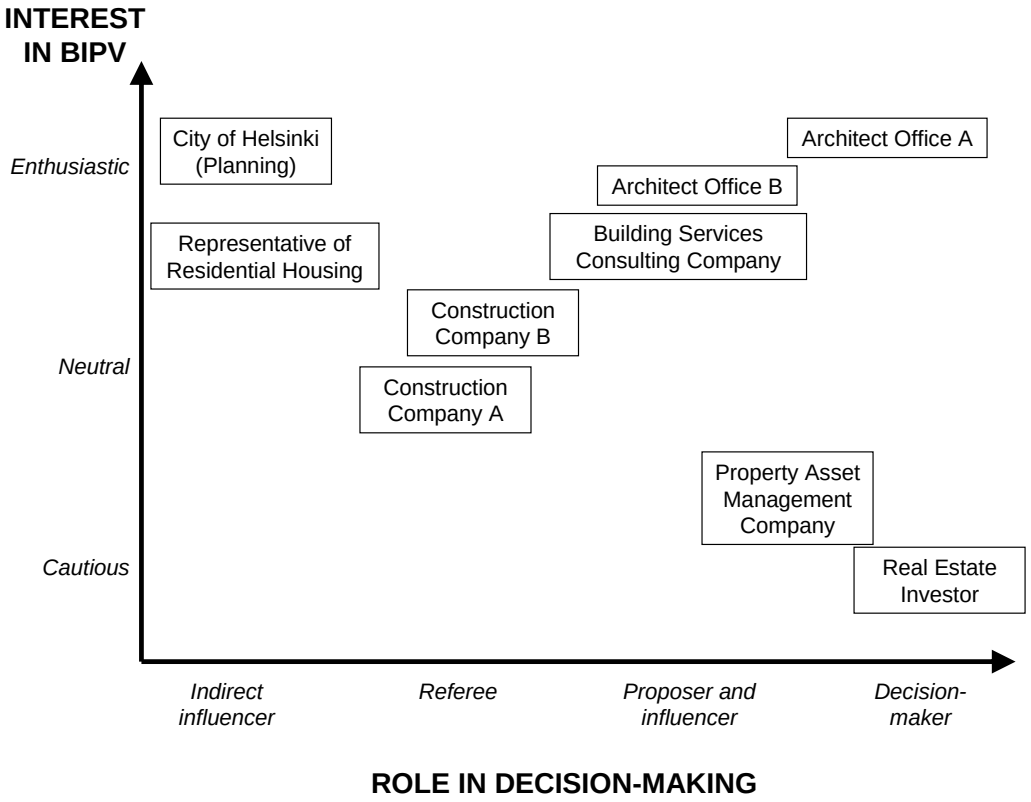

Figure 16: Stakeholder interviewees' roles and interest

Figure 16 also shows the interest towards BIPV systems that the interviewees expressed. The representatives of those parties, who have the final word on whether or not include the systems in a building, are more cautious than the other parties. The reason for this most probably is that the Property Asset Management Company and the Real Estate Investor are interested in the costs of the systems. The Construction Companies A and B do not bear the costs, since they are not making an investment to the building in the long-run. Their interest to the systems could be described as quite neutral. The architects are an exception to the trend proposing that the ones deciding are more cautious. This can partly be explained with the choice of interviewees. The architects were chosen to be interviewed, since they had experiences of photovoltaic systems in buildings.

The interviewees were asked about their opinion on the building elements, where the photovoltaic systems should be integrated. Many of the respondents did not have a strong opinion on this matter. One of the interviewees perceived building-integrated

photovoltaic systems more complicated than PV systems on racks and presumed that they would therefore require a project delivery instead of components.

8.5.2 Opinion on the possible BIPV business models

The interviewees were asked to compare the different business models from their point-of-view. The business models were presented as five different offerings, out of which the interviewees chose the ones that were the most interesting for their organization or for the party they presented. The business models they expressed their interest in are shown with an "X" in Table 7. The business models that they were partly interested in or hesitant are marked with parentheses.

Table 7: Stakeholder preferences regarding the business models

	Component delivery	***Project delivery***	***Monitoring service***	***Maintenance service***	***Leasing service***
Architect Office A		X	X		
Architect Office B		X	X	X	
Building Services Consulting Company		X	X	X	
City of Helsinki (Planning)	X	X	X	X	X
Construction Company A		X	X	X	
Construction Company B		X	X	(X)	(X)
Property Asset Management Company	(X)	X	X	(X)	
Real Estate Investor		X	X		
Representative of Residential Housing		X			

All of the interviewees preferred the project business model, and all but one would have wanted to have a monitoring service as well. A lot of interest was shown for the maintenance service, even though quite a few were worried about the costs or whether it could be integrated into the current maintenance services. The component business model was not seen as a feasible option, since the systems were perceived too complicated. However, some of the respondents predicted that the knowledge on the systems would increase in the future, and this way also the component delivery would be possible. The least interesting business model seemed to be the leasing service.

The *component delivery* was seen somewhat too complicated at least at the moment, when there may not be sufficient PV expertise available. The concerns and risks involved with the component delivery dealt mainly with the installation. The interviewees presumed that getting a BIPV system to work requires a certain type of expertise that, for example, ordinary electricians do not have at the moment. The buyer bears the risk of having problems with the installation or other settings and adjustments. The representative of Residential Housing noted that construction and renovating often consists of small partial deliveries, which has led to problems and disputes with interfaces of the deliveries. The interviewee expressed the fear of not having anybody to install it or being responsible for the functioning.

One of the architects had actually had PV installation problems with a project. After buying the components from the supplier, problems arose. Nobody was willing to install them. The system supplier's experts came with a high day price, but finally the contractor ended up installing the system. The architect was also afraid that the electrical designers do not have the needed expertise regarding PV systems.

While the installation was seen as a problem, some of the interviewees said that a component delivery would be possible, if the PV systems would become popular and if BIPV components would be as easy to install as any other building elements and construction components. In addition to the installation challenges, the other concerns related to component business model were the two following: the risk of acquiring wrong components or not knowing what will be needed for an optimal system and the risk the provider would suddenly disappear from the markets, so that the buyer would not have any support later.

The *project business model* was preferred mostly because of the expertise issues, even though it would be more expensive for the buyers. It was believed that a turn-key delivery would be the easiest way to get the system into operation. The design was also perceived so difficult that help from the supplier would be needed. One of the interviewees mentioned that the overall electrical design would need to be included at least partly in the suppliers' system design. The fear of the interviewee was that, otherwise, the electrical system of the building and the systems would not

work together optimally. The general electrical designer may not either have the competencies to design the solar energy production.

Even though the project business model was the most popular, the other one of the construction company representatives stated that when constructing industrial and office buildings, the company operates by ordering project deliveries from subcontractors, since the need of staff varies so much that having own employees all the time would be too costly. Another interviewee also suggested that a project delivery without the installation would be enough, if there would be a partner or other party who could be ordered to perform the installation.

One hope regarding the project business model was that it would also be available for consumers. The problems were anticipated with the ordering and installation. However, fulfilling this wish does not require the project business model in the sense this work defines it. The problems with the ordering can be solved with providing help in the ordering phase. For example, when delivering Cover Components this help is available, if the consumer orders a package delivery. The installation could be included in the package as well. At the moment, the Cover Components can also be delivered as a package including an installation performed by a partner.

A risk perceived with the project business model was that the system would not operate as wanted or some other problems would arise with its maintenance. A monitoring system was regarded to solve this problem.

The *monitoring service* was perceived necessary by eight out of nine interviewees. Only the representative of Residential Housing was skeptical of consumers being interested in it. However, he also mentioned that in professional construction business interest would be found. This great interest in monitoring reflects the expected uncertainty of the PV system. Another reason for the need of the monitoring is the green image that the companies seek. Having the solar energy generation displayed on large screens would facilitate showing how the systems work. The point that everybody should be able to see the energy generated was emphasized.

Two of the companies, Construction Company B and Building Services Consulting Company, noted that they also offer monitoring services for their customers. According to them, there is a need for comprehensive monitoring services, and solar energy generation could be included in this offering. The representative of Construction Company B noted also that the monitoring service is not a business for them, as they offer it free of charge for some of their customers.

The representative of Property Asset Management Company stated that the monitoring should be linked to their own monitoring systems that group the data from several buildings. Already at the moment, they have building-specific monitoring systems that have screens inside the buildings. However, the actual monitoring is done collectively from the grouped data. This may signify that other companies would also require that the monitoring system would be integrated into their existing systems.

A risk related to the monitoring service was stated to be the possible long-term contracts. These contracts might at some point turn-out to be unprofitable and difficult to terminate. On the other hand, they could create long-term partnerships.

The *maintenance service* was regarded interesting by four out of five interviewees. There were also two quite hesitant ones, and three said directly that they would not be interested. The main negative issue noted was that the costs would rise. However, the representative of the Construction Company A stated that the user of a building makes the final decision on separate maintenance services. He added that they would, however, definitely recommend buying the services, since it would guarantee the correct operation. He referred the BIPV maintenance to the elevator maintenance agreements that they recommend and that most users see useful.

Many interviewees also assumed that the systems would not need a lot of maintenance. The hope was that the normal property maintenance could take care of it. However, with more severe problems an electrician would be called separately. The monitoring was understood to help noticing the possible problems.

The risks of the maintenance service were stated to be either that the customer is "ripped off" with high payments or that the service level is not as high as customers would wish. It was noted that the maintenance requires a lot of personnel that should be on alert position whenever maintenance is needed.

The *leasing services* were not seen interesting by most of the interviewees. Only the representative of City of Helsinki presumed that somebody might be interested in it. According to her, the leasing services could be the easiest from the end-user perspective, since it would be clear what are the customer receives and what she pays. In addition, no knowledge of the systems is needed from any other than the provider of the leasing services.

The representative of Construction Company B stated that it is clearly the customer who decides, but was still cautious of their interest. However, he did not have such a strong opinion as all the seven others who perceived that there would not be interest for the leasing services. The reasons for not being interested were quite similar. It was regarded that in new building construction, the monetary issues are grouped together and taken care of as a lump sum. Therefore, financing for one separate system would not be needed or it would complicate the finance issues. It was also noted that the separate financing would increase the costs. Another reason for the cautious attitude towards the leasing service was the long lifecycles. It was regarded that having a leasing system for long periods of time would not be profitable.

However, one of the interviewees stated that even though the new house building would not be interested, older properties might be interested. They might need renovations and could include the BIPV systems at the same. At these cases, the financing would be needed anyway.

Another issue rose from the interviewees when the long lifecycles were discussed. Several interviewees noted that the BIPV systems could be a part of holistic lifecycle thinking, not considered separately. Instead of a leasing service, energy efficiency solutions could be offered. This would mean that the energy efficiency of the whole

building would be sold on a monthly basis. Thus, energy service company (ESCO) type of solutions could be considered.

8.6 Comparison of the three business models

Component, project and service business models are all suitable to some extent for the Case Company, but the expected effort that is needed to set them up varies. The stakeholder interviews also showed that the customer and stakeholders have certain requirements for them. Based on the results from the Case Company interviews, workshop, meetings, and stakeholder interviews the main strengths and weaknesses, as well as the requirements, for these business models are presented in Table 8 on the next page.

The *component business model* is the easiest option, as fewer capabilities and competencies are needed for it. For historical reasons, it has been the starting point in the Case Company's business and the other offerings have been based on the components. The workshop participants also regarded that the component business model must be in operation before the project business model or the service business model can be considered. Component business is the easiest to set up and the distribution can be wide with several partners. However, setting up a considerable component business definitely needs the demand for the products. Otherwise, scale advantages do not materialize. The stakeholder interviews revealed that the stakeholders are afraid that the installation of the components would cause problems. Therefore, they would prefer easier solutions.

Table 8: Comparison of the three business models

	Component business model	*Project business model*	*Service business model*
Strengths	● Existing culture ● Easy to enter ● Widest market areas ● Scale advantages ● Relatively easy to set distribution channels ● Less human resources needed ● Less competencies to be developed ● Fewer risks ● Market leadership of the Cover Component business facilitates	● In line with the strategy ● Differs only a little from the current project business model ● Supports other project business ● Customers require easiness ● The strength of a large, reliable company could be used ● Project competencies can be used ● Involvement in the design phase enables influencing the early decisions ● Large, succesfull projects can act as references ● A larger view can be taking, e.g. selling energy efficiency ● May facilitate growth in southern market areas	● In line with the strategy ● Could be a part of other service business ● Customers show interest ● Even a little services could boost the other BIPV business models
Weaknesses and requirements	● Profitability due to current lack of skills or due to the expensive systems ● Competes with the separate PV systems and with the traditional building elements ● Likely to face fierce competition in the future ● Easy to imitate, differentiation difficult ● Customers require installation services and easy solutions ● Production must planned	● Project business is a relatively small business at the moment and it does not have a lot of resources ● Incresed risks ● Possibly weaker profitability since need of presence and knowhow costs ● Decreases other volumes ● A more thorough knowledge of various PV materials may be needed ● Resources must be allocated ● Internal marketing is needed to get rid of the "summer cottage" image	● No experience of service business ● Service business for only BIPV not feasible ● Revenue logics must be designed ● Fast reaction to maintenance need may be difficult due to large market areas ● A new way of thinking is required
	● Internal processes must be planned ● PV competencies must be developped ● Reliable partners must be found ● Involvement in PV development is required ● Customer field must be analyzed and the customer need must be created		

The *project business model* requires more capabilities and competencies, and overall more efforts. However, as most of the stakeholders are still in a waiting position, performing well in a few larger projects would make the new component offering better known, and there would be some references to back up with. Therefore, starting first solely with component business and considering project business only after some time is not the best choice. Conducting some projects as examples would have significant marketing value that would lower the barriers for customers to acquire these new systems. The project business model would be in line with the strategy and it could be included as a part of the current project business model. The stakeholders were mostly interested in it, because they felt that a turn-key project would solve possible installation and operation problems. The workshop participants, however, noted that the profitability of the project business as such is not so good, since no scale advantages could be attained.

The *service business model* would also be in line with the company strategy. The workshop participants expressed the wish to emphasize services in the future, since they generate good profits. Services could also give the Case Company a competitive edge in the future. However, setting up a service business network for only BIPV in mind is not a feasible option. A better way is to consider the BIPV services as a part of the whole service and maintenance offering of the Case Company. At the moment, the Case Company has taken some initiatives to widen its service scope through partners. Having PV systems maintenance included in the offering would have synergy benefits, as otherwise large geographical areas would cause problems. The type of service should also be considered. The stakeholder interviewees showed significant interest towards the monitoring service, but hardly any interest was shown for the leasing service.

PART IV – Discussion and conclusions

9 Discussion

This chapter discusses the findings of this study. First, the possible business models and the stakeholder opinions are presented. Then, the suitability of the business models is discussed. Finally, recommendations are given for the Case Company for future BIPV business model development.

9.1 Alternative business models for the Case Company

At the moment, the business models of conventional PV systems are related to manufacturing, installation, monitoring, operation, and maintenance. Some leasing services are also available. Traditional building elements are manufactured, installed, and maintained as well. The business models relevant for BIPV systems would, thus, be quite similar to those of the traditional PV systems.

This study concentrated on component, project, and service business models. This division of business model types was presented by Parvinen (2008), even though he used the term 'product business model' for a business model similar to the 'component business model' in this research. The three business model types only categorize several other business models. There can be modifications and combination of them. A company can, for example, provide solutions that include a service element into a delivery. Figure 17 shows how the degree of services increases by different business models. The business models marked with bold are the ones studied in this research. In this research, the monitoring, maintenance, and leasing business models were grouped together as a service business model.

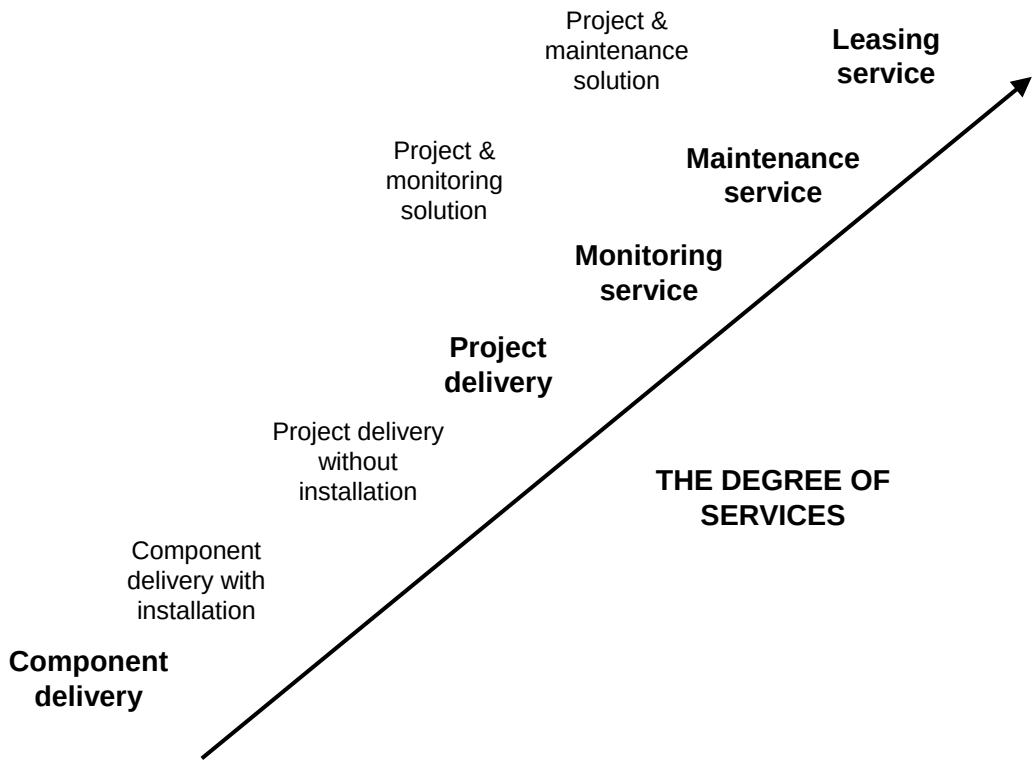

Figure 17: The degree of services in different business models

The business models shown in Figure 17 have mostly the same phases as in the capital goods value stream presented by Davies (2004). Component delivery is similar to the manufacture stage. A turn-key project delivery equals to the systems integration phase. Monitoring and maintenance services match with the operational services and service provision stages. Finally, the leasing service corresponds to the final consumer stage, where the final consumer consumes the service, in this case the electricity and shelter of the construction element.

In this study, the component business model was studied through a simple component delivery. An installation service could be included in the delivery and the degree of services would increase. The project business model was studied through a turn-key project delivery that includes everything from the design until the installation. The Case Company could as well deliver the project without the installation.

Another business model would be customer-centric solutions instead of projects. For example, Eades & Kear (2006) argue that offering solutions have benefits compared

to offering projects, especially in mature markets, where they can help achieving sustainable differentiation. The Case Company could offer solutions for the whole life time of the system instead of separate projects and services. These solutions could include either a monitoring or a more complete maintenance, according to the customer needs. A business model that offers solutions solving customer challenges and problems takes a different approach to the offering than just the traditional product and service based views.

If a service business is set up, the Case Company could also offer the services separately for all customers having a BIPV or PV system. The leasing services are the most untraditional ones in the construction business. However, with a suitable partner they could be successful on some market areas.

All the three business models studied in this work are worth considering for the Case Company. Some of these business models are easier to implement; on the other hand, some require considerable changes form the Case Company. Before selecting a business model, the Case Company must study how their customers and other stakeholders would react to these business models. This point-of-view is discussed next.

9.2 Case Company stakeholders' view

This study has brought some insights into stakeholder and, especially, customer needs. In the construction business, there are several stakeholders that must be taken into account when developing new business models. Awakul & Ogulana (2002) group the stakeholders of construction business into the following groups: common people, project participants, non-government organization, academics and experts, and local government officials. The participants of a construction project include some of the following stakeholders: user, owner, contractee, building developer, builder, main contractor, planners such as architects, sub contractors, and material suppliers. In addition, possible financiers and government officials may work in close contact with the other members of a project network. (Ventovuori et al., 2002)

The different stakeholders have different interests and concerns. For example, architects are interested in the aesthetic matters. The main contractors have no reasons to show any interest to any non-obligatory matter not agreed with their customer. As Bryde & Robinson (2005) state, main contractors are less willing to emphasize the needs of other stakeholders. The sub-contractor, as the Case Company of this work, has to fulfill the expectations of several parties. Therefore, the Case Company can perceive that it has many customers in a construction project.

This study interviewed nine stakeholders of the Case Company. It could be noted that the stakeholders, who have the final word whether to include the systems into a building, were less interested and more cautious about the BIPV systems than the other parties. An explanation to this may be the costs of the systems that these parties are interested in. It is also natural that the stakeholders are cautious regarding the BIPV systems, since they are not fully on markets yet and they know only a little about them. As Rogers (2005) and Kim & Mauborgne (2005) propose, the needs of these stakeholders can also be shaped. This should be one of the next steps to be taken.

The stakeholder interviewees mostly showed interest in the project business model and monitoring service. They were also interested in the maintenance service, but many were worried about the costs. Some interviewees also hoped that the maintenance of the BIPV systems could be included into the current maintenance services. The leasing business model was perceived the least interesting, even though some of the interviewees noted that in certain markets customers might be interested in it. The component business model was regarded too complicated, at least in the current situation. The interviewees had a fear that there would not be enough PV expertise available. Especially, the installation of the BIPV components was seen problematic and help in the design might be needed. The non-customized component nature of the offering, however, was not regarded to be a problem.

It can be concluded that the interviewed stakeholders require turn-key type of total service of the project business model, but could be interested in the component

business model added with an installation service. They would also appreciate a monitoring service included in the delivery.

9.3 Choosing the business model for the Case Company

The component business model has many similarities to the current business and it is perceived easy to start with. If large markets show need, the component business model will offer scale advantages. At the moment, the demand in Finland seems to be small, but with active promoting this situation may change. In many other European countries, the demand is assumed to be considerably higher. The challenge with the component business model is that the customers require more. They are afraid of not having systems that work and want to have more assurance. The component delivery was seen too complicated, and installation service was regarded to be necessary. However, the customer-specific design was not emphasized at all.

According to the stakeholder interviews, the project business model responds to the customer needs. However, delivering customized projects requires a lot of personnel, since each project needs design services, tailoring the offering and active participation. A question arises, whether the customers actually require all this. The main concern of the customers seemed to be the easiness, especially regarding the installation. The interviewees were not interested in tailor-made components or special design.

The service business models differ the most from the Case Company's current business models, although they are in line with the strategy. However, they are not feasible to adopt without any other BIPV business. As the workshop participants noted, the maintenance service should not rely solely on BIPV maintenance; instead, the current Cover Component maintenance and other future services should be combined together. Another viewpoint was also that the service offered could be energy efficiency, as customers might be more willing to buy more complete solutions.

The choice of a business model is not self-evident. There are many viewpoints to assess the business models and choose the best one. Casadesus-Masanell & Ricart

(2009) propose that the company strategy should make the final choice of business model. On the other hand, the customer needs and the stakeholder view must also be studied (e.g, Pittaway et al., 2004; Tucker, 2001; McTaggert et al., 1994; Narver & Slater, 1990; Nwanko, 1995). However, the efforts needed for implementation affect also the choice, as well as the estimated profitability of them. This study proposes that all these factors should be a part of the decision making.

Given by the information collected during this research process, this work recommends that the Case Company should not consider only one of the studied component, project, and service business models. A combination of them would be a better choice. Elements from the three business models can be combined to form a new business model. The BIPV business could also be adopted with several business models.

A business model choice that could be recommended is *a packaged component solution that includes a simple design service, installation, and monitoring service*. This business model would appeal to customers, as they would get assistance in acquiring the systems and all the needed components, as well as the installation. The monitoring systems would assure that the systems actually work and possible need for maintenance could be noticed. This business model would also be in line with the strategy, since it would include more services than most of the current business models.

Delivering the packaged BIPV component solutions with installation and monitoring would also create scale benefits from the mass production and require less employee resources in the design. The Case Company would gain benefits from focusing on some core products and materials, and from the easiness of communicating the offering in the sales situations. The customer would, however, value the easiness, simplicity and lower costs. In addition, the offering could be easily modified, if the customer does not want to have the monitoring systems or the installation.

A component-based offering could more easily attain new market areas. As Kim & Mauborgne (2005) suggest, new customers that do not exist at the moment should be

sought and influenced. They justify this by stating that the company may face a scale risk that can be decreased by creating the greatest demand for the innovative offering from the widest possible target markets. If the segmentation is too strict, the target markets may be too small.

A choice of a business model does not need to be the final one. This recommended business model requires validation within the Case Company and on wider markets. As Magretta (2002) states a business model is a managerial equivalent of a scientific method; first, a hypothesis is created, then it is tested in action, and revised when necessary.

The business models do not last profitable forever either. Even though scale benefits can be gained from this component-based business model, there will eventually appear competitors in the market. These competitors will lower the prices and make the component business less profitable. At that point, the Case Company may need to emphasize value adding services and larger projects that the competitors may not be able to deliver.

9.4 Recommendations for the Case Company

Through this study, the suitability of different business models is compared from the Case Company perspective and from the Finnish stakeholder perspective. To pursue the business model development in the future, the Case Company should first of all *form a cross-functional team*. The team should include employees from various functions, including marketing and technology experts. Ideally, the team members should also be from different levels of the organization. This team could continue the business model development further and plan its implementation.

In the near future, the Case Company should also *conduct a comprehensive market research*. This study gave some insights into some Finnish customers' and stakeholders' interests. These interviews do not present the whole market, where the Case Company operates at the moment, or where the Case Company could offer its products and services in the future.

There are various photovoltaic systems developers and manufacturers around the world. So far, the Case Company has not yet established relationships with them. Finding a suitable partner or partners providing photovoltaic technology may not be self-evident. Different technologies exist and some are still to be developed. The partner company should be reliable and deliver high-quality products. At the moment, there are not many Nordic companies operating in the field. Therefore, *partners should be sought* from all over the world. However, challenges may be faced with ensuring a large global PV technology provider that business collaboration with particularly the Case Company is what they need. In order to find a suitable partner for BIPV business, the Case Company should enter the PV development groups and establish relationships in the area. The Case Company should also aim at *collaborating in the PV research and development*, thus increasing internal competencies and establishing strong long-term relationships with possible partners.

In addition to collaborating with the PV companies, the Case Company should exploit its current relationships and establish new ones in order to *lobby for photovoltaics*, especially for building-integrated photovoltaics. Cova & Hoskins (1997) suggest that a company should start its marketing by network positioning, which means developing and maintaining strong non-economic or social bonds. They see network positioning as a way to gain intelligence on markets, but it can serve as a way for lobbying, too. Several important stakeholders are still unaware of the opportunities and benefits they offer. The lobbying is needed on several levels. Cova & Hoskins (1997) also mention the importance of other stakeholders than the customers.

In addition to lobbying for photovoltaics, the *customer need should be created*. The knowledge of the systems should be increased, since a customer can develop a need, when she learns from an innovation, as Rogers (2005) suggests. Kim & Mauborgne (2004) also state that in new industries demand is created instead of fought over. One way to shape the customer needs is to exploit the Case Company relationships with architects and other influential persons, who participate in project planning. These persons have a significant power when the buildings are designed. As one of the

stakeholder interviewees expressed, having one large, influential architect office promoting the BIPV systems would make them a trend that others would follow. Kim & Mauborgne (2005) also state that a company entering a blue ocean should not focus solely on exiting customers and their segmentation; instead, customers that do not exist at the moment should be sought and influenced.

The interviews with the representatives of the Case Company showed that the attitudes towards these new business models vary. Markides & Charitou (2004) note that old processes and culture may suffocate a new business model. They suggest keeping these business models separate as one solution, but add that this may hinder the exploitation of synergies. As the synergies between the established business models and the new business models in this case are significant, separation is not a solution. On the contrary, positive attitude through *internal marketing* should be increased. As Pehrsson (2006) states, management skills are an important factor affecting the success of a business model. These management skills are needed in these situations involving change.

Especially, adopting the service business model, or even parts of it, requires a lot of effort and structural changes. Service-oriented employees are needed. Recruiting service oriented people outside the company may be a solution. Again, the Case Company may face challenges with its current personnel to shift from component manufacturing to services. Naturally, resistance to change would be faced. The employees may feel threatened, as they are not used to working in a service-oriented company. Therefore, they may feel that their competencies do not match with what is expected from them.

The new business models require *new internal competencies and capabilities*. Leifer et al. (2000) have noted that problems may occur at this point, if the new opportunity deviates much from the current core competencies. Therefore, the Case Company must act on this issue early enough. In addition to lack of competencies in providing services, the Case Company has limited knowledge of solar energy. For example, Pehrsson (2006) emphasizes the importance of mastering the technology. The development teams have studied the subject, but the sales, project, and other

personnel do not seem to be acquainted enough with the systems. Therefore, the Case Company should develop core competencies regarding photovoltaics and also regarding other solar energy production systems.

At the moment, the Case Company has a good brand on its market areas, but the environmental issues have not been included in it. Therefore, the brand would need to be renewed with environmentally-friendly, "green" image. As perceived in the stakeholder interviews, the most current stakeholders did not envision that the Case Company would enter the BIPV market. As a matter of fact, strengthening the current company image would be beneficial even without the launch of BIPV. It was stated in a case interview that a part of the customers do not have a clear picture what different products the Case Company offers, since some company acquisitions cause confusion. Therefore, the brand may need strengthening on some areas. At the same, BIPV products and services could be launched. *Building a "green" brand* would also be aligned with the current corporate strategy.

Planning the internal organization and processes is an important step to take before implementing a new business. The processes should be defined starting from the buying and designing processes until the installation. The subcontractor chain must be coordinated and responsibilities set. Further, it has to be planned how the integration is done and by whom. Ideally, it should be organized in a reel-to-reel way. Especially, with some elements the coordination of logistics is likely to be challenging. For these reasons, the whole order-to-cash process should be clearly designed, thus enabling a smooth flow of operations and delivering as promised, which is essential for customer satisfaction.

Establishing distribution channels must also be considered early enough. The current distribution channels can be used, but additional ones are needed. In the simplest deliveries, Internet-based systems can be used to calculate the needed material. Similar systems have already been developed for some other Case Company products, so possibly the same system could be used also for the BIPV products. One efficient way to construct a wide distribution channel for the simpler, component-based deliveries is to construct a network of small entrepreneurs. In many European

countries, the PV systems are considerably more popular than in Finland. These countries already have many small companies providing solar systems from several companies. These companies could be part of the network. In addition, the Case Company has started to build up an own distribution network of entrepreneurs to some market areas. The BIPV distribution could be integrated to this distribution channel. However, installation capabilities and knowledge of the systems is then needed.

Even before all the processes are completely set and component manufacturing is fully started, it would be worth aiming to *deliver a few large projects* that could be used as references. These projects should be large and interesting enough, so that it would increase the public knowledge. This way, the customers could also be assured of the competencies and the Case Company's ability to deliver.

Figure 18 summarizes the recommended actions for the Case Company. They are divided into immediate actions and following actions. The immediate ones should be acted upon as soon as possible. The second group of activities is necessary, but they do not need to be started immediately. The exact timing of performing these activities should be discussed further with the development team. However, action should be taken fast in order to profit from the first mover advantages.

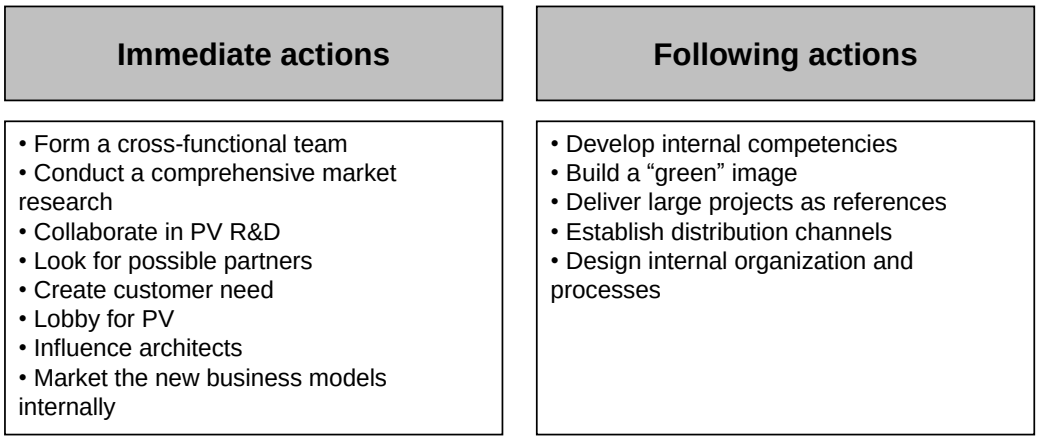

Figure 18: Recommended actions for the Case Company

10 Conclusion

This chapter concludes the thesis and the findings. The work is evaluated, and the usability of the results in a wider context is discussed. In the end, possible future research areas noticed during the research are presented.

10.1 Summary of the key findings

The purpose of this study was to develop and evaluate business models for building-integrated systems in the Case Company. The study concentrated on component, project, and service business models that were evaluated from the Case Company and stakeholder perspectives.

The first research question was *"What kind of alternative business models exist for BIPV systems that the Case Company should consider?"* It was discovered that the business models of BIPV systems can be related to manufacturing, installation, operation, maintenance, and leasing. This study concentrated on component, project, and service business models. In addition, it is possible to offer combinations of these, such as component deliveries with an installation service.

The second research question was the following: *"How do stakeholders experience the applicability of these business models regarding BIPV systems?"* The stakeholders regarded the component business model to be too complicated. The most important lack of it was that it did not include installation service. In addition, the interviewees were afraid that other problems might occur, for example, with the correct design. The project business model was the preferred one, because it included the installation and overall responsibility on the supplier. The service business model was partly of interest to them. Especially, the monitoring service was experienced necessary. Some interest was shown towards the maintenance service as well.

The third research question was formed as follows: *"What are the strengths and weaknesses of these business models for the Case Company?"* The component business model has its main strengths in wide market areas, in possible scale advantages, and in the existing culture in the Case Company. Its main weakness is

that customers and other stakeholders require more services, such as installation. In addition, the component business model is likely to face competition in the future. The project business model answers the need, as it includes the service elements the customer require. However, it may not be so profitable, since scale advantages are not gained. The service business model applied to even some extent could strengthen the other business models. It is in line with the strategy and customers show interest to monitoring and maintenance services. However, the Case Company does not have much experience of providing services. Moreover, expanding on large market areas might case problems.

The overall research problem that the three research questions aimed at answering was formulated in the following way: *"What kind of a business model should the Case Company use to deliver building-integrated photovoltaic systems in order to create value for their existing and potential stakeholders?"* This thesis recommends that the Case Company considers a business model that is based on the component business model but also includes the service elements most appreciated by the customers and other stakeholders. This business model could be a packaged component solution that includes a simple design service, installation, and monitoring service. The component-nature of this business model would allow selling also only components or deliveries without the monitoring service.

10.2 Evaluation of the study

This study took a practical approach to a real-life problem of the Case Company by developing new, innovative business models that do not fit to industries present today. The study focused on the case of BIPV business models and their suitability for the Case Company. Simultaneously, the understanding of the current business models was increased. This practical touch is one of the strengths of this research. The Case Company has already during the course of this work used the results in its decision making, which shows the value and topicality of this work for the Case Company.

The empirical part of this study was carried out as a single-case study. Altogether 22 interviews were conducted. The large amount of interviews increased the reliability

of this study. The reliability of the case interviews was particularly good, since the same points-of-view were repeated in several interviews. No conflicts could be perceived in the way the interviewees described the current business models. The reliability of the nine stakeholder interviews can be regarded sufficient for this work. They provided valuable insights into the business models, even though a wider sample would have made the results more reliable. As the interviews were supposed to focus on customers, some stakeholder groups were excluded from the interviews.

The interviewees were selected with the Case Company representatives, which may have caused some bias. Some of the stakeholder interviewees were also purposely chosen based on their previous experience on photovoltaics in buildings. It should also be noted that all the interviews were limited to Finland, while the Case Company operates in other countries as well. The question structure of the interviews remained quite similar; thus, the data can be considered comparable.

A workshop was organized to validate the developed business models, thus helping to improve the reliability of the research. The workshop participants were from various positions in the Case Company, which also increases the reliability. The participants were acquainted with the subject, and pre-reading material was sent before the workshop for them.

In the beginning of this research, some restrictions were set to the scope. At the same, some important areas were purposely excluded from this study and suggested to be researched separately. The business environment issues, such as competition, regulation, and political issues, were not studied. The future competitive situation should be anticipated, while the BIPV business is still emerging and only a few companies have had trials with the integration of photovoltaic systems into building elements. The regulations and political stand regarding photovoltaics differ by country, as well as do the possible incentives given from the production of sustainable energy.

Also, the financial aspects related to the feasibility of the BIPV business models were not taken into account. The possible size of the markets was not studied either.

However, having these restrictions on the scope enables the focus on developing the business models. Still, these are all issues that the Case Company should consider.

The business models were evaluated based on their applicability for the Case Company, which causes limitations on generalizing the results. The Case Company can well generalize the results regarding its other business areas and business models. Construction-industry companies and some larger manufacturing companies may also find the results on business models useful, since this study depicts the main differences between product, project, and service business models. An overview to business model development is also provided for anyone developing business models, even in a different context. In addition, the stakeholder insights gained in this study can be interesting for several parties, including photovoltaics manufacturers.

The research contributions of this work are mainly in providing a practical case study on business models. The theoretical research on business models was used to provide a framework to analyze the current way of operating in the Case Company and to use it in the development of new business models. Applying the theory in practice strengthens the theory. This work also provides an insight into the requirements of product, project and service business models in a manufacturing company in the construction industry. The results may provide insights to the research of these three business models and for other manufacturing companies considering them. The case descriptions of the current business models in the Case Company also proved that a company can have several business models simultaneously, unlike some authors assume.

10.3 Future research topics

During the research, some areas were identified to require further research. As this study developed business models and made a proposition about choosing one, the next phase would be the implementation of the business model. This stage requires internal marketing to increase positive attitude towards the new business models within the company. At that stage, organizational conflicts may also be faced. As operating in the service sector is new for the Case Company, further research on this

topic would be useful. One way could be benchmarking other manufacturing companies that have successfully added services to their offering. Especially, success stories could provide valuable insights to this issue.

The customers for the new business models may be different from the present. Moreover, successful implementation of a blue ocean strategy requires wider markets than the company may be used to (Kim & Mauborgne, 2005). Therefore, the customer segmentation should be considered. This is also related to the recommendation to conduct a thorough market research. As in the construction business the customer perspective should be regarded more widely, the stakeholders that affect the customer buying process should also be researched. It should be asked who makes the decisions and whom the company can influence. The foreign stakeholders should also be studied, since this research provided a view only to the Finnish stakeholders.

Another interesting research topic stems from the business model research. It could be researched how new business models affect the old business models. Moreover, the possible conflicts of various business models could be studied. The business model development in this study describes an early-stage innovation. This work has mostly excluded the wide innovation research out of the scope. However, useful points-of-view could be gained from that research area. For example, planning the business for early-stage innovations would be an interesting topic of further research. One interesting topic for future research could also be the impact of the BIPV systems on the PV and construction industries. Table 9 summarizes the possible future research topics and proposes some example research questions for them.

Table 9: Future research topics

FUTURE RESEARCH TOPICS	EXAMPLE RESEARCH QUESTIONS
Implementation	● How should the possible organizational conflicts be tackled? ● How to increase the positive attitude towards the new business models?
Benchmarking	● How a manufacturer can change its culture from products to services? ● How other industries have performed this? ● What can be learned from the success stories?
Customer segments	● Which customer segments are the preferred ones? ● What are the specific needs of these target groups? ● What value can the Case Company offer them?
Stakeholder view	● Which of the stakeholders are the most important? ● Who makes the decisions and who influences the decisions? ● Should the cooperation be stronger in order to reach the strategic targets?
Global view	● How do the customers and other stakeholders outside of Finland perceive the different business models? ● How do the local regulations and incentives affect the business models?
Multiple business models	● What are the implications of the new business models for the old ones? ● Can a company operate with considerably different business models? ● What are possible challenges?
Early-stage innovation	● What are the characteristics of business models for early-stage innovations? ● What can be learned from innovation based business planning?
Impact on PV and construction industries	● How do the building-integrated PV systems affect the PV industry? ● How do they affect the construction industry?

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Appendices

Appendix 1: Interviews

	Interviewee	Organization	Type of interview and date
Pre-research interviews	Product group manager	Case Company	Discussion, 2.6.2009.
	Architecture manager	Case Company	Discussions, 9.6.2009 and 27.8.2009.
	Project manager	Case Company	Discussion through phone, 15.6.2009.
	Key customer manager	Case Company	Discussion, 16.6.2009.
	Chief technology officer	Case Company	Discussion, 24.6.2009.
	Product group manager	Case Company	Discussion, 21.8.2009.
Case interviews	Business manager	Case Company	Interview, 1.9.2009.
	Sales manager	Case Company	Interview, 2.9.2009.
	Project manager	Case Company	Interview, 2.9.2009.
	Business segment director	Case Company	Interview, 8.9.2009.
	Architecture manager	Case Company	Interview, 9.9.2009.
	Sales director	Case Company	Interview, 11.9.2009.
Stakeholder interviews	Architect	Architect Office A	Interview, 3.9.2009.
	Architect	Architect Office B	Interview, 11.9.2009.
	Executive vice president	Building Services Consulting Company	Interview, 3.9.2009.
	Development engineer	City of Helsinki (Planning)	Interview, 14.9.2009.
	Project manager	Construction Company A	Interview, 22.9.2009.
	Project planning manager	Construction Company B	Interview, 16.9.2009.
	Senior Advisor	Property Asset Management Company	Interview, 10.9.2009.
	HPAC development manager	Real Estate Investor	Interview, 4.9.2009.
	Chief executive officer	Representative of residential housing	Interview, 2.9.2009.

Appendix 2: Interview structure for stakeholder interviews

1 Perustiedot haastateltavasta

1.1 Nimi?
1.2 Organisaatio?
1.3 Nimike ja työnkuva?
1.4 Tausta?

2 Yleinen näkemys aurinkoenergiaratkaisuista

Tämän osion kysymykset vapaan keskustelun muodossa. Aurinkoenergiaratkaisuista puhutaan yleisesti eikä tehdä eroa aurinkolämmön ja aurinkosähkön välille.

2.1 Missä yhteyksissä olette huomanneet puhuttavan aurinkoenergiasta? (Esim. uutiset, yhteistyöverkostot jne.)
2.2 Ovatko järjestelmät mielestänne tunnettuja rakentamisalalla ja miten niihin suhtaudutaan?
2.3 Miten markkinat ovat mielestänne valmiit aurinkoenergiaratkaisuihin rakennuksissa? Uskotko aurinkoenergiajärjestelmien käytön yleistyvän ja koska?
2.4 Onko yrityksenne ollut kiinnostunut aurinkoenergiajärjestelmistä? Onko yrityksenne jo mahdollisesti hyödyntänyt aurinkoenergiaratkaisuja ja miten?
2.5 Miten näette yrityksenne tulevaisuudessa hyödyntävän aurinkoenergiaratkaisuja ja miten paljon?

3 Integroitujen aurinkosähköjärjestelmien lisäarvo

Selitetään, että loppuhaastattelussa keskitytään aurinkosähköjärjestelmiin ja tarvittaessa tarkennetaan niiden toimintaperiaatetta. Selitetään erot erillisille, päälle asennettaville ja integroiduille aurinkosähköjärjestelmille.

3.1 Mikä seuraavista ovat mielestänne kiinnostavin vaihtoehto: erilliset, päälle asennettavat vai rakenteisiin integroidut aurinkosähköjärjestelmät? Miksi?
3.2 Mitä etuja ja haittoja rakenteisiin integroiduilla järjestelmillä on päälle asennettaviin verrattuna ja miksi?
3.3 Mihin kohtaan rakennusta päälle asennettavat tai integroidut aurinkosähköjärjestelmät mielestänne sopivat parhaiten? (Esim. katto, seinät, lasirakenteet jne.)
3.4 Mitä lisäarvoa aurinkosähköjärjestelmät tuottavat ja miksi?
3.5 Kenelle aurinkosähköjärjestelmistä on hyötyä ja miten?
3.6 Kuka olisi valmis maksamaan aurinkosähköjärjestelmistä ja missä määrin?

4 Päätöksenteko aurinkosähköjärjestelmistä ja niiden hankkiminen

Kysymysten asettelussa otetaan huomioon, mitä tahoa haastateltava edustaa.

4.1 Piirrostehtävä: Miten näette päätöksentekoprosessin rakentamisessa? Mikä teidän roolinne on siinä? Mikä taho tekee aurinkosähköjärjestelmiin liittyvät päätökset?
4.2 Millä kaikilla tahoilla on vaikutusvaltaa päätöksenteossa?
4.3 Mitkä tahot ovat kiinnostuneita aurinkosähköjärjestelmistä ja mitkä puolestaan eivät?
4.4 Olisitteko valmiit suosittelemaan aurinkosähköjärjestelmiä aktiivisesti yhteistyökumppaneillenne ja asiakkaillenne?
4.5 Jos mielestänne sopiva tarjoaja löytyisi, olisitteko valmis hankkimaan? Miten tällaisessa tilanteessa edettäisiin?
4.6 Tiedättekö yrityksiä, jotka tarjoavat aurinkosähköjärjestelmiä tai minkä yritysten olettaisitte tulevaisuudessa tarjoavan niitä?
4.7 Keneltä olisitte valmis ostamaan aurinkosähköjärjestelmiä tai ketä olisitte valmis suosittelemaan? Miksi ja millä ehdoin?

5 Tarjoamavaihtoehtojen arviointi

Tutkimuksen eri liiketoimintamallit esitellään yksinkertaisesti tarjoamavaihtoehtoina. Pääpiirteet asiakkaan näkökulmasta kuvataan huomioiden, mitä tahoa haastateltava edustaa. Vaihtoehtoiset tarjoamat:

- *komponenttitoimitus,*
- *isompi projektina toimitettava kokonaisuus asennettuna,*
- *seurantapalvelu (energian tuoton ja kulutuksen seuranta),*
- *huoltopaketti (seuranta ja ylläpito), ja*
- *rahoituspalvelu (eli leasing sisältäen huollon).*

5.1 Mikä tarjoamista tuntuu kiinnostavimmalta ja mille olisi tarvetta? Kuinka paljon ja millaisia palveluja toivoisitte?
5.2 Mitä vaatimuksia ja toiveita teillä olisi eri tarjoamien suhteen? Millaisia haasteita, riskejä ja uhkia ne aiheuttaisivat?
5.3 Mitä vahvuuksia ja heikkouksia näillä eri vaihtoehdoilla on erityisesti teille?

6 Lopuksi

6.1 Onko mielessänne muita asioita aiheeseen liittyen, joita haluaisitte kommentoida?