Digitization in creative professional service firms
new business models of architects

Verstegen, G.P.J.

Award date:
2014
Digitization in Creative Professional Service Firms: New Business Models of Architects

by
G.P.J. (Luuk) Verstegen

BEng in Electrical Engineering
Student identity number 0575569

in partial fulfilment of the requirements for the degree of

Master of Science
in Innovation Management

Supervisors:
dr.ir. I.M.M.J (Isabelle) Reymen, TU/e, ITEM
dr. W.N. (Wybo) Houkes, TU/e, Philosophy & Ethics
Subject headings: architectural business, architects, digitization, business model, organizational paths, path creation, path dependence, professional service firm, building information model, BIM
Abstract
This research project focuses on a particular type of professional service firms (PSFs), namely architectural firms. These companies are struggling with the emergence and implementation of new digitization technology, such as building information modeling (BIM). One of the main reasons for implementing this technology is the reduction of failure costs, which can account for as much as 15% of total expenses in a construction project. The primary research objective was to gain insight in how digitization influences business models of PSFs, and specifically how business models of architectural firms are influenced by the implementation and use of BIM technology. The secondary objective of this study was to guide practice by developing design principles that can be used by practitioners. A qualitative research design was chosen, gathering data by interviewing owners and managers of architectural firms. This enabled studying the business models of 12 architectural firms. Results show that business models of architectural firms can be grouped into four general types: integration, specialization, flexibility, and externalization. Additionally, findings revealed that business models interact with the business environment; a concept that is related to all firms in a specific industry. Design principles are developed to guide actions of practitioners who want to improve their business model(s), develop new business models, or want to check how digitization technology can support or improve their current business model(s).
Acknowledgements

With this thesis, I have reached a new milestone in my educational path. The report finalizes my work for the master Innovation Management at Eindhoven University of Technology, executed at the Innovation, Technology Entrepreneurship and Marketing (ITEM) group. This master’s thesis has been one of the most interesting tasks that I have completed up to now. I want to thank several people for making this work possible.

I would like to show my gratitude to Isabelle Reymen for the guidance throughout this project. It wasn’t the standard graduation project that was initially planned. The start was a leap of faith for both of us, you investing semi blindly in a new project member, and me leaving my job. The way you guided me was key to the final piece of work which lies in front of the respected reader here today. Thank you Wybo Houkes for the sharp comments in the review meetings. They motivated me to dive back into the data and literature finding new links to deepen the analysis. I appreciate the efforts of the participants of the interviews. Every interview lead to new inspiration to really get down to business. Also, the AiOs in the ‘tuin’ gave me insight in the interesting journey of a PhD track. In general, I experienced the ITEM group as friendly and supportive, but also ambitious and hardworking. Graduating at ITEM has been a lot of fun, and a great learning experience.

Working a full time job and taking a master’s degree in parallel is quite a challenge, but also offered a lot of new and valuable insights that benefitted both work and study. My thanks go to the people at AME where I worked for 7 years before starting this thesis. I have had the opportunity to do a huge variety of work. From developing electronic products, to setting up manufacturing lines, and new business development. These experiences have been extremely valuable, and definitely shaped me as a professional. I am looking back at a very fruitful period. I wish AME all the best to keep up their steady growth.

My friends must be mentioned for the many very enjoyable experiences. I am still amazed how we managed to get ourselves in all those memorable situations. Thanks to my family. And finally, I want to thank Marieke for being my life partner. You supported me indefinitely (which is not an easy job) and you have really enhanced my life.

Luuk Verstegen, February 2014
# Table of Contents

Abstract ................................................................................................................................. III  
Acknowledgements .............................................................................................................. IV  
Table of Contents .................................................................................................................. V  
1  Introduction .................................................................................................................... 1  
   1.1  Research Model ...................................................................................................... 1  
   1.2  Relevance ............................................................................................................... 2  
   1.3  Content description ................................................................................................. 2  
2  Theoretical Background ................................................................................................. 3  
   2.1  The Professional Service Firm (PSF) ...................................................................... 3  
      2.1.1  The Creative PSF ............................................................................................ 4  
      2.1.2  Value creation .................................................................................................. 4  
   2.2  Digitization .............................................................................................................. 5  
      2.2.1  Contextual Performance .................................................................................. 5  
      2.2.2  Digitization in Professional Service Firms ........................................................ 5  
   2.3  Business Model ....................................................................................................... 6  
      2.3.1  Defining the Business Model ............................................................................ 6  
      2.3.2  Business Model Innovation .............................................................................. 7  
      2.3.3  Interpreting the Business Model ....................................................................... 7  
   2.4  Business Models in Professional Service Firms ...................................................... 9  
   2.5  Path Dependence ................................................................................................... 10  
      2.5.1  Three Phases of Path Dependence .................................................................... 10  
      2.5.2  Self-Reinforcing mechanisms .......................................................................... 11  
      2.5.3  Researching Organizational Paths ................................................................... 12  
      2.5.4  Paths in Professional Service Firms .................................................................. 13  
   2.6  The Path of Digitization in the Business Model ..................................................... 14  
   2.7  Gaps in literature ................................................................................................... 15  
3  Research Design ......................................................................................................... 16  
   3.1  Rationale for doing this research ........................................................................... 16  
   3.2  Research Questions ............................................................................................... 17  
   3.3  Methodology .......................................................................................................... 18  
   3.4  Data ....................................................................................................................... 19  
      3.4.1  Data Collection .................................................................................................. 19  
      3.4.2  Data Condensation ........................................................................................ 21  
      3.4.3  Data Display .................................................................................................. 22  
4  Results ......................................................................................................................... 23  
   4.1  Business models of architectural firms .................................................................. 23  
      4.1.1  Value Proposition and Customer Segments ................................................... 23  
      4.1.2  Key Partners, Activities, and Resources ........................................................ 24
1 Introduction

Architecture has experienced the introduction of a new information technology, called Building Information Modeling (BIM). This technology serves as an integral design tool interacting with multiple parties in a construction project, starting with the architect designing a building (Barlish and Sullivan, 2012). Although several benefits are appointed to the use of this technology, such as reducing failure costs or project execution times (Barlish and Sullivan, 2012; Bryde et al., 2013), other less explicit effects can become increasingly important. For example whether this BIM technology also influences the fundament of doing business as architect. Does it impose threats and dependencies, or does it create new business opportunities and lead to a competitive advantage (Piccoli and Ives, 2005)? It could be that effects of information technology, or more broadly *digitization*, are not recognized by architects and therefore architectural firms do not benefit from it, and may even be harmed by it. For example, an architectural firm may implement BIM and attract new business, or BIM may be forced upon them, leading to increased costs. By instigating more rules, more work must be done against the same price. This causes lower performance and increases the risk for competition, which is also perceived to come from developing countries (Amiti and Wei, 2005). Because these problems are currently occurring in the Dutch architectural industry, insights in the influence of digitization on business practice are extremely relevant and important (BNA, 2011; CBS, 2013).

1.1 Research Model

In general, this research project examines the influence of digitization on business practice. Research on digitized processes has indicated its importance for over 60 years (Banker and Kauffman, 2004). These digitized processes are managed with information systems, which are important because they can improve decision making, communication, knowledge management, and productivity; creating certain value for a company (Banker and Kauffman, 2004). As increasing numbers of business processes are being digitized, looking at examples of these processes in a specific context can help to understand business practice (Eisenhardt, 1989). A visualization of the project is created, which is depicted in Figure 1. It shows the perspective that is taken and what is examined on a functional level, giving a better overview compared to only a narrative explanation (Miles et al., 2013; Verschuren and Doorewaard, 2007).

![Figure 1: Research Model](image)

Following Figure 1, the context of this study is the Professional Service Firm (PSF), where the business model of these firm are examined. By gathering data about the past and current business models of the firms, we can learn how digitization influences these business models. The applied version of the model is depicted in Figure 2, representing the initial research setting. This study surrounds architectural business. Architects have a certain role in the Architecture Engineering and Construction (AEC) Industry, as which they act in the process of creating a building. A new technology, called Building Information Modeling
(BIM), enables users to digitally perform a set of functions, such as 3D visualization, structural analysis, design optimization, and project planning; attempting to improve coordination throughout a construction project (Sebastian, 2011). In the applied research model, the study takes the view of the architectural firm on its own business model(s), and on BIM as digitization technology. The model is divided into two parts. The left part represents the situation before the influence of BIM, the right part after BIM began to diffuse throughout the industry. Data is gathered by interviewing executives of architectural firms.

Figure 2: Applied Research Model

1.2 Relevance
The ambition of this research project is to create a knowledge base for companies like architectural firms to build their economic and/or social position on a local, national or international level. It aims to add scientifically by offering a different perspective on the examination of creative service companies. This is done by taking a business model perspective and looking at business practice of architects. By applying business model literature to describe business practice we aim to learn how architectural business works and how it interacts with the increasing influence of digitization of processes. Business models can be used to gain understanding in certain industries; the concept has been used to explain other processes, like the first mover advantage (Markides and Sosa, 2013). This project also adds to the Architecture and Construction literature, which is increasingly concerned with the diffusion of BIM technology within the AEC industry (Gu and London, 2010).

By gaining insight in these practices we want to learn how business practice changes because of digitization technology. However, we do not only want to learn from practice; actively contributing to practice by designing a solution which can be implemented in organizations (Romme, 2003) is a priority as well. From a practical point of view, this project aims to help architects and other creative service firms to respond better to changing circumstances within their industry. This is done by explicating the business models that are currently used and attempting to show that this business model perspective can help to improve their business.

1.3 Content description
The remainder of this thesis is built up as follows: Chapter 2 develops an overview of current literature on the following concepts: professional service firm, business model, and digitization. A fourth studied concept is path dependence, which will be used in later chapters to describe the relation between the other three concepts. From this literature several gaps emerge. In Chapter 3 these gaps are translated into research questions, which will be answered using a qualitative research design. Chapter 4 describes the results of this study. These results are discussed in Chapter 5. Chapter 6 concludes the thesis by answering the research questions, explicating limitations, and setting directions for future research.
2 Theoretical Background

This chapter gives an overview on the current literature surrounding influences of digitization within professional service firms. It covers a range of four concepts that are linked to this study and have found their grounding in scientific literature. These concepts are the abstractions of the problems that were presented in the introduction of this thesis. The professional service firm (PSF) acts as a context, digitization as an influence within this context. The business model is used as an analytical concept to analyze how firms are operating. To study how change in the business models is occurring theory of path dependence is applied.

2.1 The Professional Service Firm (PSF)

Because the scope of this study is directed towards companies like architectural firms, a classification to collect the proper concepts is needed. These type of firms are classified as Professional Service Firms (PSF). So, what is a professional service firm? Von Nordenflycht (2010) asked this exact question and created the basis of a taxonomy for organizations that do not create physical output. Instead, their output depends on the application of knowledge. Previous work lacks a clear definition or an ambiguous understanding of the concept of the PSF (Nordenflycht, 2010). The developed taxonomy focuses on the characteristics of the PSF; not just on a list of specific industries. This enables the investigation of variation within industries, and prevents the inclusion of basically every service firm. Some examples of these PSF industries are: Accounting, Law, Management Consulting, Engineering Consulting, Advertising, Architecture, Software Development, Research, Universities, Media Production, Fashion Design, and Graphic Design (Nordenflycht, 2010).

From this starting point three characteristics of professional service firms are extracted: Knowledge intensity, low capital intensity, and a professional workforce. Knowledge intensity indicates “that production of a firm’s output relies on a substantial body of complex knowledge” (Starbuck, 1992). This knowledge is related to individuals; not to other integral parts of the firm, because it would include any large firm. This definition leads to the implication that the firm is depending on a “highly skilled workforce” which are present throughout the firm. Low capital intensity means “that a firm’s production does not involve significant amounts of nonhuman assets, such as inventory, factories and equipment, and even intangible nonhuman assets like patents and copyrights.” The professional workforce is constituted from three features, (1) a shared knowledge base, (2) regulation and control of that knowledge base and its application, (3) an ideology underpinned by codes of ethics and professional behavioral norms (Nordenflycht, 2010).

This classification view has been criticized of possible irrelevance because the underlying problems encountered by the PSF may not fit with the industry classifications over time. This argues against a taxonomy framework, because of an ever increasing amount of exceptions. Instead of trying to define the concept, the proper question should be how services in a changing context should be organized in a most optimal way (Zardkoohi et al., 2011). To overcome these classification difficulties, it is possible to take a capability perspective that does not set boundaries to the industry sectors, but creates a process model for the workforce and the knowledge that is specific for a type of industry (Ritala et al., 2013). From testing this principle it was found that the skills of the workforce change over time, so industries cannot be classified unambiguously (Consoli and Elche, 2013). Although the
process based perspective by Ritala et al. (2013) could give more insights in the business practice of PSFs, to proceed this study the classification of Nordenflycht (2010) is used, as the current goal of this concept is to narrow down the context of the study.

2.1.1 The Creative PSF
The classification level of the PSF may be too broad; heterogeneity in the professions can have influence on the classification principles (Malhotra and Morris, 2009). A more specific identification of an architectural firm, design firm, or any other creative firm could be necessary. Therefore, an extension to the PSF is described. When talking in economic terms, the Creative PSF can be pinned down to a firm that provides services that encompass ‘applied creativity’ (Hill and Johnson, 2003). However, there is no strict definition of what a creative firm or industry is. There are governmental programs trying to gain recognition and support for creative professions like music and film (Hill and Johnson, 2003). A different view on these type of firms are that they operate in design-intensive industries; especially when they operate outside of their own industry. For example, because architects have a broader set of design skills, they can apply these skills in different contexts (Verganti, 2006). This is especially important when interactions with society and culture play a bigger role. Because of the increasing diversity in knowledge, designers become translators and interpreters between different stakeholders; increasing innovativeness (Dell’Era and Verganti, 2010).

2.1.2 Value creation
As mentioned, PSFs create value without delivering physical products. The characteristics of the firm itself can be extended with characteristics of the output; being services. This gives insight in the value creation process of PSFs, where value is created in two directions. Directly for the customers in the form of solutions, and indirectly for the firm itself in the form of knowledge. The creation process is often customized per client or project and it requires substantial interaction with the client (Lowendahl et al., 2001).

Value creation appears on the individual, organizational, and societal level (Lepak et al., 2007). An individual can create new value by applying his/her knowledge to improving the quality of a product, or reduce production time and lower the costs. On the organizational level, value creation becomes more related to the perspective of the stakeholder (Sirmon et al., 2007). This means that the targets and benefits for the stakeholder must be clearly defined to make claims about the creation of value. On societal level, the whole concept of value cannot solely be broken down to stakeholders; the interactions between users and the context must be encompassed as well. In other words, value according to an organization may not be value to society or an individual. It is not a simple equation of what customers are willing to pay for a product or service; the complexity of the concept ‘value creation’ increases because of involved subjectivity, the multiple levels of analysis, and the applications of different theories (Lepak et al., 2007). When remaining at the organizational level, firms capture value by using resources that are hard to imitate. This can be achieved by creative destruction of the captured source, or resource management methods once value is created (Lepak et al., 2007). To see how value develops over time, and how it relates to previous value creation events, the next chapter will view the processes that are influenced by historical context.
2.2 Digitization

In this section an overview of the literature on digitization is developed. Digitization is defined in the same sense as Information Technology (IT), referring to an artifact with underlying technology, based on computer hardware and communication software (Cooper and Zmud, 1990). More specific, digitization process is the transition from doing business in a traditional manner to conducting them in a digital form (BarNir et al., 2003). Scholars suggest that digitization has a crucial role in increasing firm performance (Rai et al., 2006). For example, when firms integrate information technology in the supply chain, it moves from dispersed processes to an integrated and synergetic set of processes. The most important determinant factor for this result is a high degree of data-consistency, in other words, having high quality data (Rai et al., 2006).

2.2.1 Contextual Performance

The systematic transfer of knowledge and the way how it is transferred can influence firm performance (Levine and Prietula, 2012). This influence is strongly depending on the context. Even a high quality, well designed and implemented digitization system can still fail to reap performance gains when implemented in the wrong context. Increasing the performance of a company by systemizing knowledge and information transfer through digitization is not evident. Levine and Prietula (2012) use a multi-level perspective to gain insight into knowledge processes. They found that although managers generally believe investments in knowledge digitization are justified, data does not support this belief. The performance of digitization investments varies when interaction with individual, organizational, and the organizational field characteristics becomes influential (Levine and Prietula, 2012). For example, investments in individual educational programs reduce the performance of digitization. Also, in turbulent organizational fields, the investments are not always justified. This is because the knowledge depreciates more quickly. The costs of digitization does not outweigh the benefits, especially when not only direct costs are added to the equation (Levine and Prietula, 2012).

2.2.2 Digitization in Professional Service Firms

Professional service firms interchange digital information in multiple ways and with multiple goals (Ewenstein and Whyte, 2009). How this information is transferred from one firm to another is the focus of this section, starting with a historical overview. Architectural firms have encountered several waves of digitization innovations over the past 30 years. In the 1990s two-dimensional (2D) computer-aided design (CAD) was widely adopted. In the years after 2000 the use of 3D computer models started to make its way throughout the industry (Boland et al., 2007), which has the goal to help architects designing by supporting visual representations of physical objects. Ewenstein and Whyte (2009) researched the epistemic values of the visual representation objects used by architects. Some of these objects are engineering drawings, sketches, charts, or machine equipment. The traditional view of these objects proclaims that they embed certain knowledge and can therefore be used for problem solving. The authors empirically examined at what moment certain objects are more useful for organizational practice than others. For example, a detailed 3D representation of a building is better suitable for communication with other firms than a rough handmade sketch on a napkin. However, the epistemic value of the sketch can be much larger. The main point of the authors is that information technology such as digital representations are not only used to communicate design, but are also used to create the design itself (Ewenstein and
Whyte, 2009). Visual representations answer questions of the design, and create new questions that need to be answered. It is a tool in an evolution of a representation.

As introduced in the first chapter, the architectural industry is experiencing a new form of digitization, called BIM. Barlish and Sullivan (2012) conducted a literature review on BIM and found several definitions. Following their definition a Building Information Model (BIM) is “a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle from inception onward. The BIM is a shared digital representation founded on open standards for interoperability.” This definition was adopted from the National BIM Standard (NBIMS) Project Committee of the Building SMART alliance (Barlish and Sullivan, 2012). The body of literature on BIM has been expanding over the last five years. An overview of BIM related research can be found in Appendix C: Additional Literature. Besides the risks of BIM introduced in Chapter 1, potential benefits in the industry have also been researched. This includes, for example: scheduling, coordination, rework, visualization, and production improvement. Metrics are still under development (Barlish and Sullivan, 2012; Succar et al., 2012).

2.3 Business Model

The goal of this section is to clarify the definition and the interpretation of the business model so that the concept can be used as an analytical tool to understand digitization and other processes in organizations. Business models have been of interest to researchers for several decades. It is claimed to be an important strategic element to the firm (Magretta, 2002).

2.3.1 Defining the Business Model

No consensus on the exact definition of business models has been reached (Teece, 2010; Zott et al., 2011). This brings forth the issue how to progress in this field of study. How can business models be defined in such a way that it does not become a term covering everything (thus losing every importance), but covers enough to be of interest to both theory and practice (Magretta, 2002)? The business model can either be implicitly present within the company, or be explicated in many forms. The problem with the concept is that many definitions exist. This lack of consensus is not the only problem. Many studies do not explicate the concept at all or assume that it is part of common knowledge (Morris et al., 2005; Zott et al., 2011). This review will use the available definitions to mold an exact definition. Any assumptions are explicated; creating a ground to build on.

Before the concept can be described by an exact definition, the functions of the business model are discussed. According to Chesbrough and Rosenbloom (2002) the functions of a business model are to: “1. articulate the value proposition, 2. identify a market segment, that is, the users to whom the technology is useful and for what purpose. 3. define the structure of the value chain within the firm required to create and distribute the offering; 4. estimate the cost structure and profit potential of producing the offering, given the value proposition and value chain structure chosen; 5. describe the position of the firm within the value network linking suppliers and customers, including identification of potential complementors and competitors; 6. formulate the competitive strategy by which the innovating firm will gain and hold advantage over rivals.” The business model serves as an interface between technical inputs, like technological performance, and economic outputs, such as value and
profit (Chesbrough and Rosenbloom, 2002). Although this view leaves many openings, it serves as a starting point. A more specific definition was created by Teece (2010) stating that the Business Model “articulates the logic, the data, and other evidence that support a value proposition for the customer, and viable structure of revenues and costs for the enterprise delivering that value.”

Because the dissent surrounding the concept is evidently present (Teece, 2010; Zott et al., 2011), a different view on its interpretation by people may advance a more broad support for the business model. The business model is interpreted differently by different groups of people, which each have their meaning for, and application of the concept. In business model literature the word ‘model’ is often defined as: a representation, a set of characteristics, a simplification of the real world (Zott et al., 2011). This model is then applied to a business context. Aligned the definition with the goals of this project, which is to study business models of architectural firms, the following definition is pragmatically chosen: “The Business model is a conceptual representation (Morris et al., 2005) that states how a firm creates and captures value, and viable structure of revenues and costs for the enterprise delivering that value” (Chesbrough and Rosenbloom, 2002; Teece, 2010). Agreeing on a definition to explain value creation is seen as a way forward in business model research (Arend, 2013), although the chosen definition still leaves a lot of freedom which makes it difficult to compare companies from different industries.

2.3.2 Business Model Innovation
Another way of applying the business model, is by using it as a means to change and improve a business; this is called Business Model Innovation (Amit and Zott, 2012; Sinfield et al., 2012). Innovating with help of the business model can be done in several ways; activities can be added or linked in new ways, or changes can be made in the configuration of the value chain (Amit and Zott, 2012). Questions to be asked in this situation are: “Who is the target customer? What need is met for the customer? What offering will we provide to address that need? How does the customer gain access to that offering? What role will our business play in providing the offering? How will our business earn a profit?” (Sinfield et al., 2012). Although these approaches have very practical implications, their scientific contribution must be verified empirically. These practical approaches can serve as input to the research design. Business Models can also exist in parallel (Bonaccorsi et al., 2006; Smith et al., 2010). This can be achieved by applying Business Model Innovation for example by means of experimentation (Amit and Zott, 2012; Chesbrough, 2010; McGrath, 2010).

2.3.3 Interpreting the Business Model
The next concern is how a business model is explicated and applied in practical contexts. Derived from the chosen definition of the business model, several aspects can be of importance when applying business model theory to a specific context. Morris et al. (2005) divide the business model into three levels. The foundation level is a standardized set of quantifiable decisions. This can be used to understand differences between companies and find relations between variables. On the proprietary level, the business model becomes specific for a kind of business as it tries to gain competitive advantage. On the operational level, action can be guided towards the plans of the stakeholders.
In an article by Casadesus-Masanell and Ricart (2011), a system dynamics perspective is taken towards the business model. The business model of Ryanair is examined, dividing it into different components. This opens up several possibilities for experimentation and simulation of business models and may therefore be a powerful design tool. Also, more practical applications have been developed. The ‘Business Model Canvas’ is an creation by Osterwalder and Pigneur (2010). It is a tool developed with and for practitioners. It consists of nine components which can be used to get insight into the business and create a basis for changing it. The result of this approach was a handbook for practitioners to understand and apply business models. It can be used to analyze current businesses, design new ways of doing business, align the business model with strategy.

- **Value Proposition**: An organization seeks to solve problems for a customer and satisfy their needs with value propositions. These propositions are creating value for the customer.

- **Customer Segments**: An enterprise delivers value to a customer or a group of customers. These can be segmented as they share or differ in certain characteristics. Different segments can require different services or completely different business models.

- **Channels**: The customers are reached through communication, distribution, and sales channels. This represents the way in which the value reaches the customer. It is an essential link between the organization and the market.

- **Customer Relationships**: Depending on the type of customer, different relationships are established and maintained. This can vary from acquisition to long term retention efforts.

- **Revenue Streams**: The successful delivery of value to the customer, results in revenue streams. This can be done for example by subscription fees, one-time sales, or leasing constructions.

- **Key Resources**: Key resources are the physical, intellectual, human, or financial assets required to offer and deliver value.

- **Key Activities**: The company needs to perform a number of activities for the business model to work.

- **Key Partnerships**: Outsourced subparts of the business and acquiring resources from outside the organization can be necessary to optimize or leverage on parts of the business model.

- **Cost Structure**: The cost structure of the business is related to the other building blocks. For some businesses lower costs are more important than others.

The explanation of these nine components is clearly focused towards practical application. The theoretical grounding of the canvas is not established in high ranking journals. It was based on previous work in the PhD dissertation of Alexander Osterwalder in 2004; it can be used as a way to bridge the gap between practice and other theoretical concepts that are introduced in this review. The graphical representation of the business model canvas is given in Figure 3. The business model canvas will serve as a central tool in the remainder of this thesis.
2.4 Business Models in Professional Service Firms

Because searching in literature for combinations of the concepts *business model* and *professional service firm* did not yield usable results, our own view on how to combine these concepts will be developed. When tying the perspective on PSFs to Business Models, viewing the business model from a taxonomy perspective could help advance theory. It may lead to a prioritization of components underlying the business model concept and help channelize research when business models are involved (Morris et al., 2005). The downside is that interpretation of the business model components becomes more difficult, because the applications to different practitioners can give very dispersed results. The results of these applications are mostly qualitative (Morris et al., 2005). Depending on research designs; different theories and frameworks can be adopted, modified, applied, and/or tested (Yin, 2011). When comparing the PSF framework with the Business Model Frameworks; the application from Von Nordenflycht (2010) can create comparable data for empirical analysis.

To get more ideas on how to progress, I will first look at one of the core component of the business model, being the value proposition. This is a lower unit of analysis, which may create other insights compared to the firm level or the business model level, because the process of value creation differs across different units of analysis (Lepak et al., 2007). Currently, the business model is viewed from a firm perspective. However, different interests between the firm, the individual, and the industry may emerge. For example, a professional ‘creative’ may have a different perspective on the business practice when his/ her goal is creative freedom. This can be seen more as an individual business model. This concept has been developed by Svejenova et al. (2010). With their in-depth analysis of a very specific case, the authors found triggers for changing the individual business model. These can vary from value capturing for the company, to extending the expertise of the profession, or even creating value for society. Their paper that was based on a case study opens the black box on how the business models of creative firms change and what the underlying motivations are. So, the next step is to search for a multi-level concept that can explain how PSFs create value, and how their business models are build up.
2.5 Path Dependence

This section aims to create a knowledge base surrounding the concept of path dependence. Although definitions are not exactly alike among scholars, they share a lot of commonality; the definition of a path is a course of events that are interrelated on different levels (David, 2001). These levels can be a single technology or organization, or may cover a broader field (Sydow et al., 2012). When these events become coupled in terms of causality, one talks about path dependence. It is a reference to complex processes that are determined by their history and are unable to break free from this history (David, 2001). An initial event does not provide enough information to determine a path. The available options gain momentum in time-space; becoming increasingly linked. Path dependence is a way to describe links between the past and present state of an organization. Other related theoretical mechanisms are “absorptive capacity, first-mover advantage, commitment and sunk costs, institutional persistence, organizational imprinting, or structural inertia” (Schreyögg and Sydow, 2011; Vergne and Durand, 2010). Four general properties of path dependence can be distinguished. These properties need to be tied to a certain line of events to be classified as path dependent (Sydow et al., 2009):

- **Nonpredictability**: there is an indeterminacy of outcome.
- **Nonergodicity**: several outcomes are possible (multiple equilibria), and history selects among the possible alternatives.
- **Inflexibility**: the actors are entrapped, so a shift to another option is impossible.
- **Inefficiency**: actions resulting from the path lock the market into an inferior solution.

### 2.5.1 Three Phases of Path Dependence

Path dependence explains chains of events. These can be divided into three different phases (Sydow et al., 2009). Each of these phases have their own characteristics that are important when studying path dependence in a certain context.

![Figure 4: The constitution of an organizational path (Sydow et al., 2009)](image)

In Phase I (preformation) a certain scope of variety exists. Here, small seemingly independent events occur as an organization is active. Future events cannot be predicted or determined, but at a certain point it will trigger a set of self-reinforcing mechanisms. This moment is described as a critical juncture, ending the phase. History is already at play, since decisions are not taken independently, but are already influenced by the governance of the
organization. Phase II is characterized by the dominance of self-reinforcing processes. In this phase chances are high that patterns start to emerge. Other patterns are getting less priority, or are being left out of decision making completely. This reduces the scope of options, making it increasingly difficult to revolt. The decision events are still neither accidental nor fully predictable (non-ergodic). When moving to Phase III the process is even more bounded, causing organizational lock-in. Even when superior alternatives appear, they are not considered, and the current process is continued leading to a single outcome. This lock-in can be cognitive, normative, or resource-based; although lock-ins within actual organizations presumably include combinations of the three modes (Schreyögg and Sydow, 2011; Sydow et al., 2009).

2.5.2 Self-Reinforcing mechanisms

With the distinct phases described, a closer look at the self-reinforcing mechanisms in phase II gives deeper understanding of how paths are constituted (Sydow et al., 2009). These mechanisms are widely spread throughout organizations. These mechanism are mostly positive, presumably improving company processes; they can be very advantageous and necessary in certain situations. However, they can eventually turn a competitive advantage into an unescapable dependent path.

- **Coordination Effects**: When actors within an organization apply specific rules or routines repetitively, the more efficient the behavior between actors will become and processes are executed. Rule based behavior can significantly decrease the costs of coordination activities as more and more people adopt and follow these rules. In economic terms, one can relate this to the concept of ‘economies of scale’, where the increase of participants decreases the costs for a unit.

- **Complementary effects**: When several rules, resources, or practices are synergizing into a solution, it can reach a higher output than two of them separately. The activities complement each other. Because combined they reach additional higher output that them separately, repeating these combination activities can become progressively interrelated and eventually dominant. This will cause them to be integrated into the organizational structure, and become organizationally path dependent.

- **Learning Effects**: Learning effects are emerging when efficiency is gained in repeatedly executing a task. In organizations it can be seen when focus on efficiency dominated the urge for seeking alternative and novel approaches to improve a solution or process. This can happen when for example a firm is focusing all its learning activities to a former successful solution, which can move from a success formula to a failure.

- **Adaptive Expectation Effects**: Organizational members do not have changing preferences. They may vary as they are interacting in a response to the expectations of others. When a dominant way of thinking emerges from this, it attracts even more members because they want to be on the ‘winning team’, and do not want to become labeled as ‘outsiders’. This can be interpreted as a self-fulfilling prophecy.
2.5.3 Researching Organizational Paths

When following up on the three-stage framework, three steps must be executed to do thorough path analysis (Sydow et al., 2009):

1. The identification of strategic persistence or operational rigidity of or within a particular organization must be discovered. This is done to assert path dependence.
2. An important element is the identification, exploration, and reconstruction of the self-reinforcing feedback mechanisms that may underlie the rigidity of the organization under examination.
3. A search for a triggering event that was likely to have started the path-building process.

Sydow et al. (2009) state that a longitudinal analysis with different time chronologies are needed to find the constitution of organizational path dependence. Based on literature of path dependence, several research designs are recommended (Vergne, 2013). One suggested method is to move away from case studies, and apply more controlled research designs. When doing more experiments and simulations, these can create linkages between the introduced theoretical (Sydow et al., 2009) and empirical path dependence (Vergne and Durand, 2010). The approach by Vergne (2013) is criticized by Garud et al. (2010). They state that experiments and simulation may not lead to new insights. The de-contextualization will not create relevant insights for managers to fully implement and sustain path-breaking activities. Other criticism towards path dependence exists concerning the retrospective nature of the concept; exogenous shocks can cause a path to be broken but this assumes a passive role of the organization towards paths. However, because the dominant way of thinking still exists within the firm, it is unlikely that a new path will be superior (Prahalad and Bettis, 1986). To overcome these difficulties of path constitutions, a need arises to study how paths can be broken deliberately, and other paths can be created.

This concept is called path creation. In this perspective, agency is conceptualized as being distributed and emergent through the interactions of actors and artefacts that constitute action nets (Garud et al., 2010). Agency is a certain capacity, indicating what an actor can and cannot do. Path creation assumes that paths are not formed by the re-enforcing mechanisms which are uncontrollable. Paths are not only broken by 'exogenous' forces, but can also be altered by actors that are involved in the constitution of a path, taking action within their abilities. This needs a more narrative approach for which case studies fit better (Garud et al., 2010). The main differences between the path dependence and path creation are summarized in Table 1.
Table 1: Main Differences Path Dependence and Creation (Vergne and Durand, 2010)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Path dependence</th>
<th>Path creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Initial conditions’</td>
<td>Given</td>
<td>Constructed</td>
</tr>
<tr>
<td>‘Contingencies’</td>
<td>Exogenous and manifest as unpredictable, non-purposive, and somewhat random events</td>
<td>Emergent and serving as embedded contexts for ongoing action</td>
</tr>
<tr>
<td>‘Self-reinforcing mechanisms’</td>
<td>Given</td>
<td>Also strategically manipulated by actors</td>
</tr>
<tr>
<td>‘Lock-in’</td>
<td>Stickiness to a path or outcome absent exogenous shocks to the system</td>
<td>Provisional stabilization within a broader structurational process</td>
</tr>
</tbody>
</table>

To be able to apply either path dependence or creation, a small sidetrack is taken to check whether the differences are obstructing its application. In entrepreneurship research, an ongoing discussion covers creation and discovery of opportunities (Alvarez et al., 2013). What is discovery and what is creation? And what is its influence on organization sciences? This review is aware of the ongoing ontological and epistemological discussion on creation and discovery, but focusses on the processes surrounding either one of them. In these processes both discovery and creation are involved (Garud et al., 2010). One can take either the path dependence or creation perspective to learn about paths in organization or even the organizational field. When taking a path dependence perspective, reflection processes can enable researchers to critically think about possible emerged paths in the organization. Understanding the involved dynamics requires theoretical and practical knowledge. In many cases this reflection process is hindered by hidden dynamics, caused by hidden agendas within a part of the organization. This obstacle can be overcome by applying specific uncovering techniques, which are outside the scope of this review (Sydow et al., 2009). One can also place him/her-self at events in a real-time perspective to uncover underlying plots; giving meaning to the narratives that actors create when describing certain events that have taken place in on a suspected path (Garud et al., 2010).

2.5.4 Paths in Professional Service Firms

Institutional effect within the professional service firm (PSF) have been researched and can be related to path dependence. Robertson et al (2003) found several mechanisms in a science and a law firm that tie together the professional context to the way knowledge was created and integrated into the firm. These mechanisms were examined at an individual level; they are not directly related to path dependence, but are seen by the authors as institutionalization mechanisms. These mechanisms are explicated through formal processes used to create knowledge, such as using the scientific method and transferring results into patents. In a different study, institutional change in the PSF has been examined on an organizational field level in relation with the influence of collective agencies. It was found that collective agencies, such as professional associations do not just oppose change (Greenwood et al., 2002), but can also play a large role in the legitimation of the definitions for change in highly institutionalized fields. Looking at the value and knowledge creation process within the PSF from a path dependence and/or path creation perspective can lead to new insights. This can for example be done by linking the contextual mechanisms with path mechanisms or gathering qualitative data with a real time path creation perspective.
Kipping and Kirkpatrick (2013) searched for differences in change among PSFs. These differences were present between classical consulting firms, such as accounting and law, and later established consulting firms, such as strategy and IT. Both types seek for ways to standardize their skills. But new waves of PSFs (like IT) seem to rely less on the professional workforce, one of the key characteristics of the PSF. These firms have more hierarchy and standardization increasing bureaucratic behavior, also because there organizational field is less institutionalized. More classical PSFs standardize their knowledge by training and investing in a community (Kipping and Kirkpatrick, 2013). So the institutionalization mechanisms operate at different levels within the field of PSFs. The authors suggest further research on the professional regulations within organizational fields to better explain institutionalization. This can lead to better understanding on how PSFs change and the kind of mechanisms that are important and operate on which level.

2.6 The Path of Digitization in the Business Model

To understand digitization processes, a path perspective may give insights in the changes that occur within companies related to these digitized processes. A company has the option to implement a technology or not; both decisions can be path dependent. A possible barrier to digitization could be forms of inertia, where a company is unable to respond to change due to dominant factors in an organization. Inertia is closely related to path dependence (Sydow et al., 2009).

When the digital process exceeds firm limits and are influencing customers or suppliers as well, the integration of the processes depends on the capabilities of the firm. They are also related to the customer and supplier being ready to implement these digital processes. When implemented, they can increase financial performance of the firm (Barua et al., 2004). As this research was conducted in a manufacturing and retail setting, the influences on a service setting should be explored. Research has been done on digitally enables business, where business is done through the means of the internet (Amit and Zott, 2001). No research to date has been found on how digitization of a service is effecting paths within the firm. To better understand how and when digitization is influencing the organization, an approach can be to align the digitization process with the Business model (Hedman and Kalling, 2003). This may explain the performance of digitization or IT efforts, because IT does not have a single particular function. It interacts within and between business models. The business model is the focus of the next chapter.
2.7 Gaps in literature

The literature review uncovered several gaps which served as input for the research design and are coupled to different research questions. The gaps that were introduced in this chapter are summarized as follows:

- The combination of formal methods in the PSF setting have not yet been combined with business models. This means that it is difficult to make claims about how business models of PSFs are different from those of other firms (Morris et al., 2005). Depending on the research design different theories and frameworks can be adopted, modified, applied, and/or tested (Yin, 2011). When comparing the PSF framework with business model frameworks, the application from Von Nordenflycht (2010) can create comparable data for empirical analysis.

- Looking at the value and knowledge creation process within the PSF from a path dependence and/or path creation perspective can lead to new insights. This can for example be done by linking the contextual mechanisms with path mechanisms or gathering qualitative data with a real time path creation perspective (Greenwood et al., 2002; Robertson et al., 2003).

- Kipping and Kirkpatrick (2013) suggest that research on the professional regulations within organizational fields to better explain institutionalization can lead to understanding on how PSFs change and the kind of mechanisms that are important and operate on which level. This can lead to better understanding on how PSFs change and the kind of mechanisms that are important and operate on which level.

- Performance of new digitization initiatives can be related to the customer and supplier being ready to implement these digital processes (Barua et al., 2004).

- Research has been done on digitally enables business, where business is done through the means of for example the internet (Amit and Zott, 2001). No research to date has been found on how digitization of a service is effecting business models within the firm. This is needed to understand the relation of digitization with business models.

The gaps were not leading for the whole project, but keep focus on the scientific relevance, to determine where the output can add to progress research in the covered topics. In the next chapter, a research design is created to explicate how the gaps will be researched empirically.
3 Research Design
This chapter defines the research by setting the boundaries and conditions, leading to a research design. This chapter starts with describing the goals and context and translated this into research questions. The methodology describes how these questions will be answered.

3.1 Rationale for doing this research
As already introduced in the previous chapters, this research project focused on a section of the creative industry, being architectural firms. Architecture can be placed under the category of Professional Service Firms (PSF) (Nordenflycht, 2010). These companies are struggling with the entrance and implementation of new digitization technology, such as building information modeling (BIM). One of the main reasons stated for implementing BIM is the reduction of failure costs, which can account for as much as 15% of total costs of a building project (Nijhof et al., 2008). Causes for these types of costs are the ineffective information flows between different involved parties (van Nederveen et al., 2010). The aim of BIM is to streamline these information flows to create non-ambiguous exchange of project and product parameters. Additional features of BIM enable users to manage the whole process of a construction project.

To several involved parties the advantages of BIM seem to have enough weight to start its implementation. Some studies assume that BIM will be adopted by the industry (Arayici et al., 2011; Porwal and Hewage, 2013; Sebastian, 2011). This study takes a step back. It looks at BIM and asks if, how, and when it changes companies within the industry. Moving on from that point, a direction has been chosen to scope and focus the research and initiate the research project. BIM may have several consequences in the architectural industry. Although not explicated properly, worries have been expressed by the Institute of Dutch Architects (BNA) as well as the Royal Institute of British Architects (RIBA) about the changing architectural profession that may be related to large scale use of BIM (BNA, 2011; RIBA, 2011). Journals in the AEC industry show an increasing amount of literature devoted to technological and managerial issues with BIM. Some examples of managerial questions are: When should BIM be implemented (and when not)? Who will benefit from BIM? Who carries which responsibilities within a BIM project (Sebastian, 2011)? What is the performance of BIM (Succar et al., 2012)? These questions are important for parties within the architectural industry to answer before implementing BIM in their business. In the next section this research explicates some of the implicit and vague worries surrounding BIM. BIM is viewed upon as an digitization technology, having some influence on the organizations that are involved in this technology.
3.2 Research Questions

The research starts by formulating a research question (Verschuren and Doorewaard, 2007; Yin, 2011). To address both the scientific and the practical relevance, the research question is divided into an abstract (scientific) and a concrete (practical) question. The research questions are as follows:

*RQ (Abstract): “How does Digitization influence the Business Model of the Professional Service Firm?”*

*RQ (Concrete): “How are Business Models of architectural firms influenced by the implementation and use of BIM technology?”*

As of this point, the concrete question will be used to develop sub questions (SQ), constantly keeping in mind how this will reflect on the more abstract question. The literature review revealed the involvement of four main concepts in the research. It is expected that knowledge can be combined between the concepts. For example, when talking about the service that a company delivers, this is related to both the business model (Osterwalder and Pigneur, 2010) and to the company as a PSF (Nordenflycht, 2010). To keep track of which question is related to which concept the abbreviation of the concept is given as a suffix to the questions: Business Model [BM], Professional Service Firm [PSF], and Digitization [Dig]. Literature on Path Dependence is not included in the main research questions, but is used as an analytical concept, explaining certain phenomena, instead of being the subject under study.

To explain how the architectural industry works, knowledge is needed on the practice of the firms. This is related to the business model and also touches upon the professional service firm [SQ1]. With these questions, a base for analysis is built. From this base the concept of BIM can be introduced, examining how it exerts influence on the firm [SQ2]. Moving to answering the research question, digitization and the business model of the architect are combined [SQ3]. These questions are broken down into sub-questions (SQx.x) and are as follows:

*SQ1: How can architectural business be described from a Business Model perspective?*
  - SQ1.1 How can Business Models of architectural firms be described? [BM/PSF]
  - SQ1.2 What is the role of the architectural firm? [PSF]
  - SQ1.3 How do business models of architects differ? [BM/PSF]

*SQ2: How does digitization influence architectural firms?*
  - SQ2.1 What are the goals of BIM and the consequences of using BIM? [Dig]
  - SQ2.2 How does BIM Influence the role and businesses of architects? [Dig/ BM]

*SQ3: How does digitization influence business models of architectural firms?*
  - SQ3.1 What components of the business model are influenced by BIM? [BM/Dig]
  - SQ3.2 Do certain Business Model types relate to particular BIM influences? [Dig/BM]
  - SQ3.3 How did other digitization actions influence business models? [Dig/BM]

This research has an exploratory character, which can best be examined using an empirical qualitative approach, because it is not clear at this point which relations between concepts are present, and how the concepts are perceived by practitioners (Verschuren and...
Therefore, it is needed to dive deeper into the industry. There are several ways of gathering information. For this research, a cross-case analysis is performed, which is generally held to lead to deeper and richer understanding of certain phenomena (Daft and Lengel, 1986; Yin, 2003).

### 3.3 Methodology

The research is executed using a Design-Science approach. This approach is based on circular design that benefits both theory and practice (Romme and Endenburg, 2006; Van Aken, 2004); it attempts to bridge the gap between the often rigorous academic work to relevant practical guidance. The rigorous, descriptive, or explanatory research does not always focus on the practical relevance of its work. On the other side, practitioners are in need on solutions to their managerial problems in specific situations (van Aken, 2005). Romme (2003) describes a view that synergizes the design of solutions with the scientific method. This research project followed this view. Figure 5 presents the research-design-development cycle. It takes a design perspective, which can be deliberate or emergent. Emergent in the sense that practitioners encounter certain situations and experiment in order to come to certain solutions and eventually transform into design principles as a guide for solution development in other contexts. Deliberate in the sense that research findings that are often not context specific, can be synthesized into principles that can be contextualized into particular problems (Van Burg et al., 2008).

This project mainly focused on the direct link between “Practices” and “Research findings”. This implies doing empirical research and recommending changes and improvements for organizational and management practice. A secondary objective of this study was to guide practice by developing “design principles” that will be fed back to practitioners. Placing this into the current context, a design can for example be a new kind of business model for a certain type of architectural business.

The research is qualitative, enabling in-depth understanding of certain phenomena. With the literature review in place, the first knowledge in the context is gained. This is important to ask the right questions and stay within the scope of the project. Because of the nature of this research, being flexible is an important trait, so the project iterated between steps several times (Yin, 2011). Besides the already mentioned literature, three methodological books have been the main source of inspiration. Robert Yin has written several books on qualitative research and case studies. For this research, the book *Qualitative Research from start to finish* was used as a methodological reference manual. Because it covers the whole
research process, from planning to writing up a report, it can serve throughout the whole project. The second important book is *Qualitative Data Analysis* from Miles, Huberman, and Saldana (2013). It is the third edition, following up on the widely known second edition published in 1994. It covers the data analysis part of the qualitative research method (Miles et al., 2013) which is an important part of this study. To relate the research to the practical stakeholders, the book by Van Aken, Berends and van der Bij, titled *Problem Solving in Organizations* is used. It presents a methodology for solving complex business problems systematically (Aken et al., 2007).

3.4 Data
This section describes the data process. This process of data analysis is not approached linearly. It is viewed as an interactive model. Therefore, the approach developed by Miles and Huberman (1994) served as a process guide, which is displayed in Figure 6. Following their view, executed steps were documented and described carefully, explaining changes along the project. This ensured that the line of thought throughout the project can be followed.

![Interactive Model](image)

**Figure 6: Components of data analysis: the Interactive Model (Miles and Huberman, 1994)**

3.4.1 Data Collection
As the core of empirical research involves the collection and interpretation of data, the main method of data collection was by means of a set of semi structured interviews. The sample was cross-case, meaning that interviews were done at different architectural firms. One person from a company was interviewed. To capture data on all concepts a business perspective is taken. Therefore, architects that also cover the role of entrepreneur or business manager were targeted (Miles et al., 2013). Using internet searches on architectural firms a sample was drawn. This sample first targeted firms based on near geographic locations to get acquainted with the practical context. In a later stage it was extended towards a more widespread sample. As it was not immediately clear what the size of an architectural firm was, and whether the right person would receive the information, a context description helped the potential interviewee to guide his/ her decision to accept the invitation for the interview. This invitation was written in Dutch. Also, the interviews were conducted in Dutch, depending on the mother language of the interviewee. All interviews were recorded, transcribed, and backups of the original files are stored on multiple locations.

Due to the explorative character, the interviews were semi-structured and contained mostly open-ended questions. This was aimed to create an open conversation requiring analysis during the interview. Other design requirements were; to speak in modest amounts, being
non-directive, and staying natural. Because of the multiple cases the structure of the interview needed some attention. Using a semi structured interview protocol ensured the interviews to cover the same topics, enabling data to be compared across cases (Yin, 2011). The second revision of the interview protocol is given in Appendix D: Interview Protocol (In Dutch). In the beginning of the interview, an introduction of the project was given to the interviewee, so that he or she was aware of the goals of the research and the interview. This elaborated on the invitation letter that has been accepted. The first set of questions concerned the individual. Some aspects about their personal history and role in the company were asked. This was followed by basic company characteristics, including the history and vision of the firm. The first concept was the business model. Information about the business model of the firm was gathered by asking about basic concrete characteristics. This concerns specifying the customers, partners, competition, suppliers, and the company’s own view on how they are different from other architectural firms. These questions were based on the article of Amit and Zott (2012). This article is mainly concerned with business model innovation; i.e. how new business models can be implemented to create new value. In this case, it is used to map the existing business model of the firm. In the next section, questions about technology and more specific BIM were asked. These relates to the business model components. This maintains a business perspective on the problem. This included, for example, whether customers expect the architectural firm to master the technology, or whether they see it as an opportunity for expanding their business portfolio. The following section focused on the role of the architect within the industry. Questions surround the position of the architectural firm, and what the underlying factors for this position are. This provided more detailed insights in how the firm creates value for its customers and for the firm itself. Also, projections of the position of the architectural firm was asked. Then, combinations of concepts will be made by asking questions about the relationship between BIM and the role of the architectural firm.

There was room at the end of each interview there for items that the interviewee deemed important, or for additional questions or views that popped up during the interview. The interviewee had freedom to talk about anything he or she pleased, even if not related to the goal of the research. The questions were set up as concrete as possible. This means that no theoretical concepts were used in the questions. When complexity of the answers increased, the conversation became more abstract, but the interviewer followed the level of the interviewee, to maintain a smooth conversation and to not cause ambiguity. Based on the interviews, supporting data was added in the shape of policy documents, news articles, or other available sources.

**Additional Sources of Data**
The fourteen interviews were conducted in the period from August to November 2013. Twelve of these interviews were fully transcribed. The average length of an interview was 70 minutes. The transcribed interviews covered more than 200 pages of raw text, which served as a base for data analysis. To support claims from the interviews, additional data sources were attained. This data included: five presentations from a visited BIM conference, six informal conversations at BIM conference with BIM related non-architects (~20 minutes each), one interactive workshop attendance, reviewing 70 company websites, analyzing six strategic policy documents on the current and future position of the architect, four conjecture measurements, four policy documents from the Royal Institute of Dutch Architects (BNA), and industry statistics from CBS. The complete overview is presented in Appendix E: Data
Sources. Several descriptive numbers are given below. Data that was missing in the interviews has been supplemented with information from the company's website. This was basic descriptive information about the company.

Table 2: Characteristics of interviewed companies

<table>
<thead>
<tr>
<th>Pseudo Company Name</th>
<th>Sector</th>
<th># employees</th>
<th>Startup year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>Design</td>
<td>6-10</td>
<td>1997</td>
</tr>
<tr>
<td>Beta</td>
<td>Regional</td>
<td>11-20</td>
<td>1963</td>
</tr>
<tr>
<td>Gamma</td>
<td>Regional</td>
<td>3-5</td>
<td>1972</td>
</tr>
<tr>
<td>Delta</td>
<td>Regional</td>
<td>3-5</td>
<td>1988</td>
</tr>
<tr>
<td>Epsilon</td>
<td>High Tech</td>
<td>51-100</td>
<td>1979</td>
</tr>
<tr>
<td>Zeta</td>
<td>Unassigned</td>
<td>20-49</td>
<td>1955</td>
</tr>
<tr>
<td>Eta</td>
<td>Regional</td>
<td>10-19</td>
<td>1986</td>
</tr>
<tr>
<td>Theta</td>
<td>Education</td>
<td>51-100</td>
<td>unknown</td>
</tr>
<tr>
<td>Iota</td>
<td>Multiple</td>
<td>20-49</td>
<td>1911</td>
</tr>
<tr>
<td>Kappa</td>
<td>Art</td>
<td>3-5</td>
<td>2010</td>
</tr>
<tr>
<td>Lambda</td>
<td>Care &amp; Cure</td>
<td>&gt;100</td>
<td>1989</td>
</tr>
</tbody>
</table>

Central Bureau of Statistics
To get an idea on how this set represents the population of architects within the Netherlands, data from the Central Bureau of Statistics (CBS) is reviewed to see how this relates to the size distribution of architectural firms. Based on the standardized company classification (SBI2008), 5000 architectural firms exist in the Netherlands. The sample from this study contains 20% of firms larger than 100 employees (1 of 5), 13% of firm with 50 to 100 employees (2 of 15), 4% of firm with 20 to 50 employees (2 of 50), 1.5% of firm with 10 to 20 employees (2 of 140), 0.8% of firm with 5 to 10 employees (2 of 245), and 0.6% of firm with 3 to 5 employees (2 of 325). This sample represents the population in the context of this study nicely, because mostly larger firms (>10 employees) have implemented BIM already. Even though the proportion of interviewed firms is higher at the larger firms, as the goal of this project is to study the influence of digitization on business models, larger firms fit best with this goal, which is an important requirement (Miles et al., 2013). More than 30 small firms (<3 employees) were contacted, but these were less responsive to the invitation. And when a response was received, most respondent stated that they weren't interested in the study. This may mean that this study is more relevant for larger firms, or that smaller firms don't have the time to participate. One interview with a one-man firm was held. However, this interview focused on the personal level of the interviewee instead of firm level. It could be argued that this then still can be used, yet, this interview was not included in the data analysis.

3.4.2 Data Condensation
Miles et al. (2013) introduced data condensation as the process of selecting, focusing, simplifying, abstracting, or transforming the data that is being collected from all inputs. This condensation starts at the beginning of the project, where a certain scope is set. It continues to evolve throughout the rest of the project, as interviews are being prepared, and input from
the executed interviews are being transcribed and coded; eventually drawing conclusions and writing a report. Coding was initially done using the theoretical concepts introduced from existing literature (Table 3). A more detailed coding scheme can be found in Appendix F: Coding Scheme.

Table 3: Initial Coding Scheme

<table>
<thead>
<tr>
<th>Concept</th>
<th>Sub Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Service Firm</td>
<td>Knowledge Intensity, Low Capital Intensity, Professional Workforce</td>
</tr>
<tr>
<td>Business Model</td>
<td>Value Proposition, Customer Segments, Channels, Customer Relationship, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structure</td>
</tr>
<tr>
<td>Digitization</td>
<td>Information Technology, Building Information Model, Computer Aided Design</td>
</tr>
</tbody>
</table>

As interviews were conducted, knowledge on the topic was gained, and the structure of later interviews was altered. This was done because the exact right questions was not yet known in an early stage of the project. Iterative coding was done in a later stage to really get the answers that are most interesting for this research (Miles et al., 2013).

3.4.3 Data Display

Displaying data can be done in numerous ways. This research project aimed to present its findings not only narratively, but also with figures, diagrams, and other graphical representations. Table 4 is an example of how data is gathered. Based on the stage within the data analysis process, the tables became more structured based on newly gained insights.

Table 4: Table with Digitization versus Business Model Components

<table>
<thead>
<tr>
<th>Digitization</th>
<th>Business Model</th>
<th>Value Proposition</th>
<th>Customer Segments</th>
<th>Etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasons to use BIM</td>
<td></td>
<td>Example: Quotes from Alpha &amp; Delta</td>
<td>.....</td>
<td>.....</td>
</tr>
<tr>
<td>Effect of decision to use BIM</td>
<td></td>
<td>Example: Quotes from Beta &amp; Gamma</td>
<td>.....</td>
<td>.....</td>
</tr>
<tr>
<td>Effect after implementing BIM</td>
<td></td>
<td></td>
<td>.....</td>
<td>.....</td>
</tr>
<tr>
<td>Differences between BIM and CAD</td>
<td></td>
<td></td>
<td>.....</td>
<td>.....</td>
</tr>
<tr>
<td>Are there changes in the role of the architect after using BIM?</td>
<td></td>
<td></td>
<td>.....</td>
<td>.....</td>
</tr>
</tbody>
</table>

To keep track of how the data relate to the research questions, a data accounting table was maintained. This table also served as an informal management tool to monitor in which directions searched were done, and to track the progress of the study.
4 Results
This chapter presents the results of the study based on a cross case analysis within a qualitative research design. The cross case analysis covers business model components of architectural firms. Aggregating these components leads to an analysis on firm level and on industry level. These different levels are maintained throughout the chapter and are placed in a path dependence perspective. This creates new insights on different business model types that are existing in practice. These insights are then linked to findings on digitization.

4.1 Business models of architectural firms
This section gives an overview of the business model components as described by Osterwalder and Pigneur (2010) for all studied firms. All cases were coded on these components. When comparing the coded results, some components showed more variety among cases than others. Components with low variety can be used to make generalizations (Miles et al., 2013) and are used to analyze the industry. Components with high diversity are studied in more detail on a firm level. The components are grouped based on this diversity and are described in separate subsections. Only two business model components seem to be actively described by the architects (Table 5), namely the value proposition and the customer segments. All interviews cover the value proposition multiple times per interview. Channels, revenue streams, and cost structure were hardly mentioned.

Table 5: Coding quantities of the Business Models Components

<table>
<thead>
<tr>
<th>Company Code</th>
<th>Value Proposition</th>
<th>Customer Segments</th>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Key Resources</th>
<th>Customer Relationship</th>
<th>Revenue Streams</th>
<th>Cost Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>14</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Beta</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gamma</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Delta</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Epsilon</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Zeta</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Eta</td>
<td>11</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Theta</td>
<td>16</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Iota</td>
<td>11</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Kappa</td>
<td>11</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Lambda</td>
<td>11</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

4.1.1 Value Proposition and Customer Segments
Higher diversity within the business model of architectural firms is found in the value proposition and the customer segments of the firms. All architects talk about their value proposition. A large share of the value proposition is based on past experience, which is aligned with the theory on PSFs (Lowendahl et al., 2001). This theory suggests that value for customers is created, and that knowledge for the firm is created. This proposition is not explicitly mentioned. However, the interviewees explained how they create value; the owner of Gamma: “<customers> come here because they have a problem... And if they could fix it, or could make a design themselves, they did it themselves. But they can't, so they look for professional assistance”. The knowledge that was attained during work is then re-applied in assignments for new customers. Therefore, this knowledge is highly related to the customer segments. Two major groups of customers for architectural firms can be distinguished. On
one hand, there are the laypersons. This category is mainly consisting of consumers having an idea and a request to create a new building or wanting to change a privately owned building. This category is mainly served by small architectural firms or even sole architects. Word of mouth and personal networks are important to match the customer with the architect (Source: Gamma, Kappa).

On the other hand, there are professional customers: This group is much larger and can be further divided into sub parts. The first group is the private companies, who have similar characteristics in terms of relationships in the sense that architects can have a more long lasting relationship with the customer (Source: Delta, Theta). These customers can be any firm, so there exists a large variety between these customers. This can vary from factories and offices, to laboratories and clean rooms (Source: Alpha, Delta, Epsilon, Zeta). The second group consists of public organizations. This group is spending public money, so it has to adhere to specific laws and rules when choosing architects or other firms to work on a project. This is often done in the form of public tenders. These tenders have a set of specifications and requirements to which interested architectural firms need to apply for. When the firm adheres to the requirements the can submit a plan, competing to several other firms that apply for the same project. Also, in this group there are a lot of different types of projects, like schools, court houses, governmental buildings, fire stations, etcetera. (Source: Lambda, Iota, Theta). An important requirement in this public tendering process is experience in the direction that is comparable with the potential new project. This means that the client can ask the architect to show evidence how they have designed the same type of building before. This leads to more segmentation, and even to extremes, as the CEO from Lambda states, “the whole industry has become guided by sectors… if you are able to build something once, you will do that forever”.

4.1.2 Key Partners, Activities, and Resources

The components key partners, activities, and resources are tightly related, as they are part of the role of the architect. First, the differences between firms of each single component were studied, which resulted in high diversity among firms; meaning that some architects have other activities compared to other firms. However, after grouping the components: partners, activities, and resources, the diversity was much lower. This implies that some architects outsource activities that other architects do internally. Tasks have shifted from being key activities of the firm towards partners of the firm; a change that is described by almost all of the interviewed firms. This means that architects subcontract expertise; for example: consultants on building physics, or for creating work drawings for workers at the building site. Transferring activities from inside the firm to external partners was done to focus more on the designer role of the architect. On the short term the architectural firm has freedom to choose how these tasks are divided among its partners; Alpha: “So we really present ourselves as a design agency and not a very broad agency that does everything in the sector, but really a design agency”. However, as activities and resources are transferred towards partners, architects lost the role of the leader in the building project, and their role gets marginalized. This development is counteracted by the larger firms (Source: Epsilon, Theta, Iota, Lambda) who are actively working on the enlargement of the role of the architect in the AEC industry. The smaller firms have more troubles in the current market to invest in any large changes (Source: Alpha, Gamma, Delta, Kappa). The role is analyzed further in the section of the architectural industry, where the role is described on industry level.
4.1.3 Customer Relationships and Channels
An external force is influencing customer relationships and channels within the business model. European law prescribes that large governmental spending should be quoted through a public tender on European level. This implies that firms cannot build relationships with public organizations. These public tenders also require a formal quotation process, which in this case can be seen as a channel. Many professional customers purchase the services of architects through this process. This is indicated as low diversified, because it mainly depends on the customer segmentation. With private customers this works differently, because law does not forbid that these relationships are maintained. However, private consumers (laypersons) do not need the services of architects very often, as this implies a large investment in a new house or other capital intensive changes to their privately owned buildings (Source: Gamma, Kappa).

4.1.4 Revenue streams and Cost Structure
By applying a theoretical PSF filter, the revenues and cost structure may be explained. There was almost no data that could be coded on these two business model components. Theory of the PSF implies that architectural firms have little to no capital resources, because all PSFs have low capital intensity (Nordenflycht, 2010). This means that the most important components of the business model are not the cost structure and the revenue streams. Also, the revenue stream is directly related to the cost structure, as the salary costs are a large share of the firm’s costs. This means that a low diversity on these business model components can be assumed. In the next section, evidence coded to the business model components is aggregated to analyze the architectural industry.

4.2 Architectural Industry
This section specifies characteristics of the architectural industry. These characteristics follow from observations related to the architectural firm. The value proposition, customer segments, and customer relations are used to analyze the market place and the structure of projects. Partners, activities, and resources are studied to analyze the role of the architect. This is done by coding the activities and linking them to the role that the architects assign themselves. Without analyzing the industry, it is not possible to adequately adjust business strategies, structures, or business models. Firms can choose an industry, be chosen by it, and can also change the industry they are operating in (Teece, 2010). In a later stage of this research, the industry will be called the business environment, to address its dynamic nature, and the interactions with business models.

Industry Revenues
The interviews all suggest the presence of an economic recession. This is supported with evidence from the CBS. Revenues have been decreasing from 2008. This trend is presented in Figure 7. Since 2010 the revenues of the whole industry have decreased with approximately 40%. This imposed additional challenges for the architects. Data and numbers can be found in Appendix B: Fears lowering prices Architectural Services (In Dutch). The negative trend suggests a long lasting crisis in the architectural industry, which is reaffirmed by market research studies (CBS, 2013; BNA, 2011). This study attempts to find digitization influences within the architectural firm. But because of this shrinking market, other aspects might be important that can overpower the influence of digitization. A different lens may be needed in looking at the data.
Figure 7: Index revenue development Dutch architectural firms (Source: CBS)

Project Structure
In the current Dutch market several changes have occurred in the project structure. This is related to different causes, of which many are interrelated. This makes it difficult to analyze and make statements about causality. A description of the observations is therefore more accurate and valid (Yin, 2011). Regulation increases segmentation because a firm needs to have experience with certain type of building to design more of them. The European laws state that public buildings need to be sourced with public tenders. This created a new role specialized in managing these tender processes. Related to this, projects are getting increasingly complex because risks are being minimized. This can be done with tenders. This may sound promising to a customer, because this implies a high chance for a successful project. Several of the interviewed architects believe that this only reduces value of the final solution, because a large sum is not spend on creating a building, but on defining the project in complex tender processes (Source: Zeta, Theta, Iota, Lambda). Related to this, projects are being cut into smaller pieces. This increases the number of parties that are involved in a project, but also distributes the responsibilities among these parties. This makes the project difficult to manage, and also requires a large sum to be spend on project and contract management. Architects have a decreasing share within large projects.

Because of the shrinking market, the competition increases. For customers this can be beneficial, because they can get many more offers for a project. Also, in an early stage, a large part of the architectural task has to be delivered pro deo, in order to receive an order at all. Lambda sketches an example to emphasize: when five firms compete for an offer and invest up to €20.000,- in a quotation project, already €100.000,- is invested for a total project sum of €200.000,-. This means that a substantial share of the market is vaporized. Also, architects now act more often as sub-contractors or are a member of a consortium. The project is completely placed at a contract manufacturer, and they distribute the work among different roles of a project.

Role of the Architect
Roles that have been stated by the interviewees are: problem solver, integrator, translator, visualizer. These roles are mainly pointing towards the role of designer. The overview in the role perceptions can be found in Appendix G: The Role of the Architect. In the past, architects have specialized more on this specific role which made their business more narrow and focused. However, in the financially challenged times, this role has become less
important. This is translated in the decreasing prices that are asked for architectural tasks and the large decrease of total revenues for the industry (Appendix B: Fears lowering prices Architectural Services (In Dutch)). The role of the architect has changed over the last decades. This means that tasks that were initially key resources are now shifted towards key partners. These partners have taken over the expertise of the architect. This is recognized by most interviewees. The role that seems to remain more important is to be an advisor on the complete building project. The architect could guard the interests of the stakeholders that are involved in the building projects. However, this role is changing, as explained in the changing project structure.

4.3 Path Dependence of PSF
Based on the previous parts describing business models of architectural firms and describing the architectural industry, an organizational path analysis can be executed. This analysis is done by using the codes of the business model components, and linking them to the sub concepts of path dependence (Nordenflycht, 2010). To detect patterns that are structurally present in all architectural firms, I will look at the possible Lock-In mechanisms and compare them with the typical characteristics of the professional service firm. Table 6 shows the results from the interviews which are placed in the path dependence analysis model. In this analysis, firm and industry level are separated again. The business model components (BMCs) that showed low diversity between cases are aggregated to industry level. These are related to the role of the architect (BMC: Partners, Activities, Resources), derived from Appendix G: The Role of the Architect (In Dutch). The parts were the business model components showed high diversity are used to analyze the firm level (BMC: Customer Segments, Value Proposition).
Table 6: Path Dependence Analysis

<table>
<thead>
<tr>
<th>Path Dependence</th>
<th>Industry Level</th>
<th>Firm Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Persistence (Phase III)</td>
<td>Because architects became design specialists, they were not able to also do other tasks in the whole project of creating a building. <em>(BMC: Partners, Activities, Resources)</em></td>
<td>Even though the market was changing (shrinking), many architects did not change their business model.</td>
</tr>
<tr>
<td>Self-Reinforcing Feedback Mechanisms (Phase II)</td>
<td>By decreasing the number of roles, management for the architects became easier.</td>
<td>European Law enforced public tendering. To get a higher chance for success on a tender, the company specialized in certain types of buildings. <em>(BMC: Revenue Streams, Cost Structure, Customer Relationship)</em></td>
</tr>
<tr>
<td>Coordination effects</td>
<td>By dividing the integral role of the architect into smaller roles, the architect could focus more on its core capability, being design.</td>
<td></td>
</tr>
<tr>
<td>Complementarity effects</td>
<td>Because of the increased focus on design, the whole industry became focused on design. This includes Universities.</td>
<td>Based on PSF theory, firms deliver value for a customer and receive knowledge from the job. <em>(BMC: Value Proposition, Customer Segments)</em></td>
</tr>
<tr>
<td>Learning effects</td>
<td>Because designing became a very important role, other architects followed to specialize on designing.</td>
<td>Architectural firms that focused on design had higher status than firms with good management skills.</td>
</tr>
<tr>
<td>Adaptive expectation effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triggering Events (Phase I)</td>
<td>Architects have many options to choose from, and prioritize design over other tasks in the building process.</td>
<td>Architects have many options to choose from, and prioritize buildings that are closer to their experience. <em>(BMC: Customer Segments, Value proposition)</em></td>
</tr>
</tbody>
</table>
Paths on Industry level

The industry was locked into the path of success due to a long period of growth. The demand for architectural service was larger than the supply of these services. This led to architectural firms focusing more on the core activities, where the highest added value was attained. This focus has led to firms choosing either to subcontract certain tasks or choosing not to engage on these tasks. This created a window of opportunities for other parties. Due to the mono disciplinary focus of the architectural industry, other parties have taken over activities which were executed by architects. This was no problem, and architects focused on the roles that added most value. The high demand also increased prices for architectural services. This also created room for alternative solutions, such as the so called model buildings. These buildings were designed once, and can be replicated unlimitedly. This type of building does not require an architect to do the design anymore.

This path did not immediately lead to noticeable suboptimal options. However, when the market started to shrink in 2008, the number of options decreased, and competition increased in all parts of the market. The role of the designer became less valuable, and managerial roles became more important; guiding the customer throughout the process of creating a new building. Summarizing this finding: the industry has been cut into smaller pieces and architects tended to focus on design tasks.

Paths on Firm level

On the firm level also a dependent path can be noticed. This path is market segmentation. This path is reinforced by laws, and the entrance of other firms, creating higher competition. The firm must put more effort to win clients. Does this mean that the architectural industry, and many architectural firms were knowingly creating a difficult industry to work in? These statements cannot be made, as this analysis is done retrospectively. However, the effects of the choices that were made have such an significant impact on a lot of stakeholders, that architectural firms could learn from this process.

4.4 Business Model Types

From this point we move from the dependent paths to the creation of new paths. A shift in the business models of the firms developed a focus on design specialization. Several architectural firms did not agree with this strategy and acted with a different strategy. These strategies are analyzed in this section. As stated in previous sections, the architectural industry has suffered from dependent paths which caused suboptimal solutions. These dependences, together with the recession that started in 2008, explain the 40% decrease in revenues of the industry. To determine how architects are dealing with this issue, the role of the architects was discussed with the interviewees. During the interviews I asked for a retrospective statement on the role of the architect (Appendix G: The Role of the Architect). The results showed that the role had been changing from overarching integrator to design specialist. This was supported by most respondents, except Alpha. Alpha explained that the industry did in fact not notably change, except for the personal development based on more experience. Alpha stated that they were a design firm focusing on the design aspect of the process. This is in line with the path of the industry, which also focused more on design in general.
Business Environment

The architectural industry has a particular size in terms of revenues. In this industry, firms are operating with an underlying business model. The firms interact with the industry. The most basic interaction is in terms of revenues. The revenues of the industry are the sum of the revenues of the individual businesses. However, interaction between firm and industry is not only based on revenues. It has a more dynamic structure. Therefore, I will adopt the term business environment (Bornemann, 2009; Sirmon et al., 2007; Teece, 2010). The architectural firm’s business models have a certain interaction with this business environment (Teece, 2010). This interaction is determined by the executed strategy of the firm, which can be extracted from the business model (Casadesus-Masanell and Ricart, 2010). As the business models of the participating firms have been explicated during the analysis, they were grouped based there interaction with the environment. All interviews were coded for potential business models. The word ‘potential’ was added, because the stage of the business model differed among the firms. For example, firm Alpha had already been executing the business model for 15 years, while Delta adopted a new business model and killed it after a period of 5 years. This resulted in four distinct business model types, as presented in Figure 8: Integration, Specialization, Flexibility, and Externalization.

![Figure 8: Four General Business Model Types](image)

The business environment is visualized as an ellipse which is a dynamic conception, having many interactions. This model is restricted to showing the relation between the business model type and the business environment. There are other interactions, such as macroeconomic forces or relations with other industries. These are not explicitly visualized, but are also not omitted. For example, the effect of a different industry infiltration this industry, results in a shrinking role of the architect, and thus a smaller ellipse. The effect of the decreasing revenues can also be visualized as the business environment ellipse shrinking. The next section explains the different business model types, and shows the main characteristics of the types, and an example for each type. The overview of the types is given in Table 7. It summarized the business models of the firms, and groups them according to the four types based.
**Integration: enlarging the business environment**
Vertical integration explains the strategy to increase the size of the market by actively trying to include new activities within the role of the architect. This could for example mean that the architectural firm moves into the field of construction, and takes over certain parts of the contract manufacturer. The business model of Iota gives more details: “So we create a concept, a design concept, and then talk directly to the suppliers, so we can use their knowledge to improve the design. And then we will also contract them. So we are contract holder for all those suppliers. The client only has one party with whom he concludes a contract, and that's us. And we will arrange everything. I mean very transparently, so we buy and also organize transparently”. This can be seen as integration, because the firm positions itself in the role of the contract manufacturer, managing relationships with sub-contractors.

**Specialization: securing a position in the business environment**
Specialization can be done in two directions. Horizontal specialization is focusing on a specific task within the industry. An example is focusing on design activities. This horizontal specialization creates room for companies outside the field to infiltrate unprotected parts of the market. Only so called star architects are able to maintain this strategy, because there designs are a way of creating new business. Vertical specialization is focusing on attaining specific skills that can be applied to multiple contexts. This can for example be a competence in very complex building designs, involving high accuracy. An observation is that firms who are now focusing on design, do not see the changes as much as other companies. The specialization type is different from integration. Integration seeks external interaction with other business environments, with a goal to integrate roles from the other environment within the architectural environment. Specialization searches for interaction within the architectural environment. It tries to secure its place in this environment.

**Flexibility: moving around in the business environment**
A different strategy is to organize in a way that firms can move from one assignment to a completely different one flexibly. This implies a very agile way of working, and requires significant investments in human resource management, because it has a large impact on their way of working. Zeta describes how they act in the current business environment: “You have to be very agile. This is essential for survival now ... We notice that clients contact us earlier in the process, precisely because we think agile. Sometimes from a different angle, for example, then we are suddenly thinking much more strategically about a housing plan for a school <instead of purely the design>”.

**Externalize: moving to external business environments**
A strategy could be to also move to different countries, because these markets may behave differently. A firm can attract customers from other countries, where the market is not shrinking or even growing. Also, particular expertise of architects could also be applied to other activities, not only to design buildings. One can think about applying the design competences from the architect to design a car instead of a building. This latter one is not widely applied yet, although firms like Epsilon are already trying out new ways of working together with people from other fields of expertise.

These four business models types are not mutually exclusive. Some of them exist in parallel. Also, no single type provides a guarantee for better performance. This models shows that architectural firms are trying different ways of doing business.
**Table 7: Business Model Type Evidence**

<table>
<thead>
<tr>
<th>Category</th>
<th>Firm</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>Delta</td>
<td>In 2001 I started ‘Delta Projects’ which entailed the development of construction projects. But I didn’t do it so much as a developer, but rather as someone who is pro-active in the process. My goal was to keep the overall leadership ... and it was not about the leadership ... But, then so I could really determine until the end whether there would be wooden materials as a part of the façade, and the color, and the structure, and how large. Otherwise I only make suggestions and you have another who will decide.</td>
</tr>
<tr>
<td>Eta</td>
<td>We want to be very broad. We do not just design, we don’t want to be concept creators, we also want to engineer, we also want to participate in projects. We want engineers and I have always been convinced, although many would have you believe that it is not the way. There are many agencies who only do designing. These tasks are horribly marginalized. Eventually you create people within your organization who can design, but have no idea how it should be made. They are completely pushed out of the market, because they have no place anymore.</td>
<td></td>
</tr>
<tr>
<td>Theta</td>
<td>So we distinguish ourselves there. Because, yes, that sounds really quite blasé, or very obvious, but by a kind of reliability and because we can provide a client everything. From city planning to interior design, we have everything in house. We have our own calculation department, we have our own lawyer who can ensure that zoning plans are well spent. So we can do a lot.</td>
<td></td>
</tr>
<tr>
<td>Iota</td>
<td>And then we said, when you look at the automotive industry, for example you pick Audi. They think of a concept car that they want to release in the market. The first thing they do is to call the supplier of the headlight .. That is the one who knows everything about the lights. And then the specifications of those supplier are then used in the design of the car. The head of design at Audi, must ensure that the Audi remains an Audi. So it does not become something else. And we have also taken over that principle.</td>
<td></td>
</tr>
<tr>
<td>Specialization</td>
<td>Horizontal</td>
<td>Alpha</td>
</tr>
<tr>
<td>Vertical</td>
<td>Epsilon</td>
<td>Our vision is that we try to seize opportunities in all sectors and markets where we really have added value.</td>
</tr>
<tr>
<td>Horizontal</td>
<td>Lambda</td>
<td>We make public property, service-architecture. Our buildings can be recognized because labor processes take place. You should know the logistics, you should be interested in the user. This was seen in the heydays as: those guys don’t practice architecture. We have taken that for granted, but at this time you can see them moving in our direction from all sides.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Zeta</td>
<td>In addition, all projects are getting smaller. We notice that a lot in our activites, smaller in size, smaller parts, shorter lead times. It must all be very fast, and that means for us as an agency that we have a very short horizon. You almost plan daily; watching, how can we answer those questions coming at us fast and quickly, and that requires enormous flexibility from people, switching enormously.</td>
</tr>
</tbody>
</table>
When you are operating broadly, and you have a large network in particular, where you talk with all kinds of people in the building industry, but also people from the government or universities, you get a sense of where the world is going.

Kappa

We have done that two years with help of crowd funding. So people could just donate money. The only thing is, of course, uh, that the project is best known to family and friends. So they are the ones who deposit the money.

Gamma

So because it is a very difficult market, what you actually have left in this market, is the private customer. Those individuals who still wants to remodel or reconfigure..... And that wasn’t interesting for many architects, because they require a lot of time. You cannot ask much money ... not much is relative. Look, if you design a fire station, you can do much more activities, with working drawings and all, then with a private individual. An individual who wants minimal service. He just wants a draft, but he keeps indicating that the toilets are not big enough, and that an extra dormer is needed, etc.. because he is a layperson. Many architects have ignored those customers in the past. And have never done that, and now that's actually very important to us.

Externalization

Epsilon

We have a joint venture in China. We have been active there for a longtime. And with that Joint Venture, we are trying to get projects in China from the ground. Especially in the elderly care, which is a major problem in the Chinese market. That's really where we have an international strategy for that specific country.

We have also opened an office in Germany last year. Because the German market is very interesting for us. We did do projects over there already, but we want to do more projects. And in that particular market, we want to expand. And besides that, we also do a number of international projects we follow the customer.

Theta

Where Germany first looks at the hype for a bit; shape an opinion, sit down in a meeting together and then decide. So I said to my German prospect, “look… you can now take advantage of the fact that we experimented in the Netherlands for ten years with these community schools. We have learned what works, but we have also learned what does not work. So use that to your advantage.” We have also built community schools here in the Netherlands who are already being rebuild, because it just does not function. I think they can benefit from that calmer approach.

Zeta

Sometimes you also get questions from our network or from the environment with which I think, I cannot directly answer that, I cannot give a concrete answer. But then I'm still going to talk to them and perhaps it leads to something. Maybe my or our gaze can cause an enrichment and it may lead to something. It can come from all directions, so I think that is also a fun side in this period.
The Entrepreneurial role

A role that is gaining importance for owners of architectural firms is to become more entrepreneurial. This means searching for new business opportunities and being involved differently in projects. I found that alternative business models are being developed. The larger firms were more likely to invest in certain projects. This was done in several ways. The first way is by applying to public tenders. This causes them to invest time and money in a plan for a potential project. The second is working together with other firms to participate in a project. The success of the project is then related to the reward for the participating firms. Entrepreneurial initiatives of the company in new business models are not yet done by all firms. Smaller companies were not able to invest in larger projects, although they did actively search for new projects and new initiatives.

The entrepreneurial role is not obvious. Architects were not used to spend a significant amount of time and money on entrepreneurial activities because there was enough work. The former generation of leaders were not used to the fears competition (Theta). This could also be seen as another type of path dependence, which is present on the individual level. Architects were not comfortable with the changing environment, and did not develop the competences needed to cope with the changing circumstances. Other, more entrepreneurial architects took this role, for example from a younger generation. Another example of the traditional way of thinking is explained by Epsilon: "with the capacity we have in house, we can solve much more than just a building assignment ... because you also invent all kinds of new things. Actually, every project is a prototype for us. And we often develop innovations, things that do not yet exist. But we forget to realize that this innovation itself is something you can do more with it ... Sometimes we think of something that was needed in a project, something that does not exist in the market ... But we use that innovation for one project only, and then we do nothing with it. That's of course plain stupid!" This shows that innovations and ideas are not being utilized to their full potential. Another innovation that may be beneficial for the firms is Building Information Modeling (BIM). The next section will analyze how this new technology is being used by the architectural firm.

4.5 Digitization

This section examines the influence of BIM in these business models. The current standard is two dimensional (2D) computer aided design (CAD). Three dimensional (3D) visualization is done using programs like Sketchup, which is mostly used for representation purposes. The 3D model communicates the design. Most engineering drawings are still 2D. Even when a 3D model is created by the architect; when the construction of a building starts, the work drawings are made 2D.

Using the emerged business model types, the use of BIM will be coupled to these types. Most of the interviewed architects explained that they are using BIM at this moment or are seriously considering the purchase of BIM software. Data was gathered by an interview with a BIM technology expert from TU/e, to gain understanding of the core layers of the technology. After this interview I visited a BIM conference at the KU Leuven in Belgium, where the current state of BIM was discussed with many different companies and scholars, for example: architects, BIM consultants, BIM professors, contract manufacturers, students, and professional clients. Although the technology is still in development many different aspects were discussed. Topics varied from how to use BIM with different parties in a project, how to properly use it, or how to manage a construction project with BIM. This study
does not focus on the progression of the technology or the diffusion throughout the AEC industry. Based on the data gathered from these sources, the interviews were coded to BIM use. Three usage levels of BIM can be distinguished:

- **No BIM usage**: Smaller companies are not yet using BIM, as it requires a significant investment in software. No budget is available for this at the moment. Also, these firms are not sure what the benefits of BIM will be for their firm.
- **Low BIM level**: In the BIM community this is referred to as Little BIM. Little BIM is described as using BIM software that does not span boundaries throughout the value chain of the building process. It is used more as a 3D representation tool, and is used to do calculations.
- **High BIM Level**: Larger companies have already used BIM for several years. When BIM is used also to communicate and actively manage the whole project, this is referred to as Big BIM. Only a small number of firms is capable of attaining this level.

At the core, BIM is an information technology. This technology enables different people to communicate particular information from one point to another. However, this description is very simplistic. The technology to create BIM type of software has been around for 15 years, as was described by a BIM consultant who was working on the technology for that amount of time. Different parties are involved in the use of BIM. These parties all have their own way of working that is not aligned among them. From an internal BIM perspective, as much as possible firms should adopt it to get the highest performance. However, this adoption requires a mind shift in many different industries. How this adoption can be achieved is still a matter of discussion. The BIM conferences tried to advance in this discussion by showing success stories and telling stories about large construction projects that were being executed with BIM. Within these projects a lot of variation was possible. As this will move away from the core of this study, these projects are not covered.

A problem that can arise with BIM is that it may harm the creativity of the architect. This could be because the architect is working with a larger set of boundaries that are imposed by the software, and with that negatively affecting the creativity process. During the interviews it became clear that this was not the case. This may relate to the fact that the role is changing. When the role is focusing more on the design, this could become more problematic. However, due to the pressure on the whole industry, this problem is not relevant in this point of time. Another argument that was given is that digitization efforts do not decrease creativity, but increase it (Source: Lambda). Because of this set of extra conditions, architects are forces to think harder and differently to come to a viable solution. Conditions are even perceived to be required to come to a good solution. Also, BIM does not replace other techniques, such as physical models, which are also use as creative tools (Source: Epsilon).

In the AEC industry, BIM has a different impact on different roles in the AEC industry. Contract manufacturers use it to manage the building process. Here it becomes more of a logistics tool. Does this differentiation also exist between architects? I.E. would one of the four business model types benefit more from digitization then others? When analyzing digitization versus the four types no convincing separation could be made. Because digitization can serve many functions, I placed possible advantages at each of the business
model types (Table 8). By doing so, every business model type can potentially benefit digitization technology, depending on the weight one puts on the advantages, and the ways the technology is implemented (Levine and Prietula, 2012).

**Table 8: Influence of BIM on different Business Model Types**

<table>
<thead>
<tr>
<th>Type</th>
<th>Attitude towards BIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>BIM can be used to integrate different roles into the firm.</td>
</tr>
<tr>
<td>Specialization</td>
<td>BIM can be adapted to adhere to the companies specialization.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Might be useful, might not be. Depends on the current task.</td>
</tr>
<tr>
<td>Externalization</td>
<td>When using BIM, it could be also used to communicate in other countries or other types of industry.</td>
</tr>
</tbody>
</table>

Because looking at differences did not yield results, the next step was to look at similarities. The results showed an influence of digitization on all types of business models. This can mean that the impact is distributed over the types, or that the analysis should be modified to uncover other distinctions that did not appear in this analysis. The firms all think that BIM is going to become a standard technology and the concept of BIM seems to fit well with the role of the architect in the process of a construction project. Firms are now struggling with the new tasks that have been added to the role of the architect. The use of BIM forces more design choices to be made earlier on in the process. This work is expected to be done by the architect. However, these extra tasks have not yet been translated into extra revenues.

It is difficult for architectural firms to show how much the addition of BIM in a project benefits the final result of a project. But firms are becoming able to persuade customers to make an additional investment in BIM in order to increase the performance of the project. When architects do not invest to become leaders in BIM, other firms will probably take over this new task. This can be done by other parties in related industries, for example by contractor manufacturers who are also investing in BIM. Also, a new type of firm is becoming more important, so called BIM consultant. These firms offer to manage BIM within a project. Overall, the results on BIM did not provide
5 Discussion
This chapter discusses the three main findings from this study. Two of these findings contribute theoretically. First, four business model types emerged, with each having specific consequences for firms and the industry. Second, the impact of BIM on the business model is increasing. The third contribution is methodological, combining and applying the business model concept an organizational path analysis revealed new dependencies that occurs in the architectural industry and within architectural firms. The chapter closes by providing a practical tool for firms such as architectural firms to assess new business models.

5.1 Theoretical Implications
This study has several theoretical implications. To specify these implications, the abstract research questions is explicated again: "How does Digitization influence the Business Model of the Professional Service Firm?" This questions can be broken down to three explicit concepts and one implicit concept. The explicit concepts are Digitization, Business Model, and the Professional Service Firm. The implicit is related to the word influence. By taking an organizational path perspective, several dependences were exposed.

5.1.1 Analyzing the Four General Business Model Types
From the data four general business model types appeared. Although the importance of general model types has been explicated, they have not been researched extensively (Morris et al., 2005). Each of the types had a particular way of interacting with the business environment, i.e. the architectural industry. These business model types can be grouped as: Integration, Specialization, Flexibility, and Externalization. In order to verify how this distinction is holding up, I compared this with existing studies that focused on each individual group. Taking a business model perspective was an important step in uncovering these findings, as it allowed for multiple business models to operate in parallel in a single firm. Therewith, making a better distinction possible. This was much more difficult if only the firm was examined without this business model lens.

Integration
Jacobides and Billinger (2006) researched how firms set their boundaries in an industry. These decisions are so called make-or-buy decisions. Integrating certain activities into the firm can enlarge the revenues. However, they can also decrease efficiency of the sub parts of the firm. Several vertical integration initiative were observed in this study. These all had a different company structure, which operated in parallel to the regular activities. This allowed the firms to not only target customers looking for the whole integrated package, but also being able to serve the intermediate markets, i.e. architectural services (Delta, Iota). This also spreads the risk when activities of one sub division are not performing well, they do not directly harm the healthier parts of the organization.

Specialization
Cacciatori and Jacobides (2005) studied the British construction industry and found that entrepreneurs in this industry have tried to change the business environment they operate in when the firm does not reach optimal solutions. Influencing the business environment becomes more difficult when a company is specialized in particular activities. However, they did not find evidence that specialization is always inferior to integration. The balance between the capabilities of the firm and the demand of the business environment need to be incorporated to take this business model type decision properly. When relating this to the
current findings, an argument can be that because the Dutch industry is now in a recession for 5 years, specialization business models perform worse than integration business models, because the specialized firms have difficulties interacting with the changing business environment. Many of the interviewed firms followed different business model types. They criticized the specialization of the industry, and blame it for reducing the role of the architect to a mere designer.

**Flexibility**

Rindova and Kotha (2001) describe the flexible business model type. When operating in a highly competitive environments, the firm needs to be able to adapt to the needs of the business environment, and change in relation with it. Normal visions on competitive advantage and sustainability do not apply in this setting. When a firm chooses to integrate or specialize, they are less responsive to the changing environment. Volberda (1996) states how the flexible organization can be managed by dividing it into several inputs, that together form a metaflexibility, and lead to a strategically flexible organization. Flexibility reduces the vulnerability to becoming path dependent. These dependences can be: technological, organizational. Also, customers can become dependent towards a service. These sources of dependence must be properly managed for the company or the service of the company to stay flexible (Verganti and Buganza, 2005).

**Externalization**

The former three types were more related to general management theory. Externalization is slightly different, as it is more a entrepreneurial business model, where connections with other market are made in new ways. This can either be done by looking for similar markets on other locations (i.e. international), or by reshaping the role of the architect (Verganti, 2006), therewith changing its influence on the business environment. Epsilon: “as long as I only communicate from within the architect: I make buildings ... Why would they then go and ask me to design a car? So I’m also working to attract a lot more disciplines to us. So, not only architecture, interior architecture. But we also talk with philosophers, poets, artists... This, of course, creates a different kind of depth, or another kind of insight”. When the firm invests in this type, they may create or discovery new opportunities that previously were not within the reach of the firm (Alvarez et al., 2013; Dell’Era and Verganti, 2010; Verganti, 2006).

**The business Environment**

A surprising finding is that each of the four general business model types have their grounding in top management journals. Also, literature on each of the particular types states the importance of companies to become respectively more integrated, specialized, flexible, or search for external markets. However, a company cannot spend its resources on too many different directions, and strategy needs to have some kind of focus.

The introduction of the concept of a business environment (Sirmon et al., 2007; Teece, 2010) enables the four different business model types to be linked together. The business environment ties to the business model in a new way to describe interactions of the business model. This new way of interaction has remained unstudied, as described by (Morris et al., 2005). The business environment can be defined as the industry in which the focal firm operates (Teece, 2010). The business environment could be determined for each case individually. It is a dynamic entity which is constantly interacting with other industries,
companies in the environment, and macro economical and societal forces (Sirmon et al., 2007). This study adds to the development of the business environment concept by showing that the interaction between the firm and the business environment exists through the business model. Also, business models of different firms in the same industry interact indirectly through the business environment. One very concrete characteristic of the business environment are the industry revenues. These are formalized and measured every quartile by the CBS.

Some firms have reshaped whole business environments. Gambardella and McGahan (2010) examined found that their success was related to either vertically or horizontally specializing the application of certain knowledge assets. Vertically by targeting a large market with an integral technology, or horizontally by targeting a multitude of smaller markets, that share a requirement for a technology. This research found that this is only part of the story; vertical and horizontal specialization are not the only options, at least not in the architectural industry. Depending on the business environment and the dynamic relation with the business model, other business model types can respond better to the business environment.

5.1.2 Business Models
Morris et al. (2005) examined business models and defined a set of components. They stated a lack of progression due to the lack of consensus on the concept. The findings of this study link to the explicated gaps in business model research stated by Morris et al. (2005) and contribute to the progression of the field of study. Few insights are available regarding the conditions that make a particular model appropriate (Morris et al., 2005). This study has applied the business model in such a way that it could be used to analyze a firm, as well as the industry in which the firm operates. To do this, the business model does need to be focused. This was done by applying PSF theory, narrowing down the application field of the business model analysis.

The attempts to decompose the business model support the presence of interdependencies among components. However, the nature of these relation has not been clear (Morris et al., 2005). This study showed that several interdependencies exist among the components. These components did not only interact within the business model, but also through the business environment, on a higher level. By first looking at the different business model components, and then aggregating this data, new insights were created. This could also be moved to another level, for example business unit level, team level, or even the individual level, where even more insights could be gathered to understand how these different levels interact.

5.1.3 Digitization
In this section digitization is linked to the four general business model types. The results showed that digitization was very actively discussed in the architectural industry. Before collecting results, the assumption was that the main reason for implementing BIM in a project is increasing efficiency. This can be done by reducing failure costs, which accounted for as much as 15% of total costs in a project (Nijhof et al., 2008). Data from the visited BIM conference in Leuven revealed that this 15% was not based on actual verifiable numbers, but was more an intuitive guess. In construction every project is basically a prototype, so it is not possible to completely compare them. The value of BIM was therefore not yet
quantifiably supported. The value of BIM was mostly communicated by presenting success stories and analyzing which difficulties were present in these projects (Source: Theta). This could then be used to improve future projects. Additionally, results reveal that using BIM in a project leads to the change of the design process in a construction project. When BIM is used, the project requires having a lot more decisions made in an earlier stage of the project. So, more work needs to be done by architectural firms. When looking at the result of a project, the investment on the front side should be earned back. This additional investment is done by architectural firms, because they are required to put in extra work. However, these expenses are not yet paid by the customer (Source: Beta, Delta, Epsilon, Zeta).

Cooperation and digitization
A more detailed view of how to BIM can support the firms can be attained by diving one level deeper into the digitization concept, in particular on the quality of data, which is essential for increased performance (Rai et al., 2006). However, it is not yet clear how this increased performance will be achieved. An important factor on this quality of data is that different types of firms need to cooperate using a new way of working. This study found that most of the parties in a construction project do not share the same type of information systems (Source: Lambda, Epsilon). For example, maintenance companies often don’t use 3D models to determine how often specific parts of the building need cleaning or maintenance. This is also because in the time where no BIM existed yet, the quality of data was not maintained. Architects made a drawing, which was adopted and adapted by the contractor. But when changes needed to be made, these changes were not reintegrated into the drawings, meaning that many drawings were not valid when the project progressed. So maintenance companies created their schedules by physically walking through the building and observing the current status of the building (Source: Lambda). Beside this different way of working, different technologies are used which are not synchronized to work together. These technologies attempt to optimize the performance of the firm (Rai et al., 2006). This performance is often times not equal in different firm types. For example, design oriented firms tend to see BIM as an extension to CAD, while contractors and project managers expect BIM to improve document management for better planning and project analysis (Gu and London, 2010). This means that, for example, when the design is made by an architectural firm, the installation firm cannot import the 3D data in order to design their installation (Source: Lambda). Some companies are able to better align their systems. However, these firms are often not participating in the same projects. The necessity of better agreement between parties is essential for BIM to succeed within the firm (Gu and London, 2010).

To verify whether cooperation is an important parameter for deciding whether or not to implement the technology, a look at a previous technological transitions can give the insights needed to progress. Boland et al. (2007) have investigated the transition from 2D to 3D visualization technology in the AEC industry. They executed a single case study at Gehry Partners LCC, which was seen as global leader on the use of 3D visualization technology in architecture. Their study is similar to this one in the sense that it also concerns the AEC industry and focuses on a particular information technology (Boland et al., 2007). They found that project partners of Gehry adopted the technology based on economic interests of the firm itself, and not because of an overarching common goal or philosophy of this way of working. This is in line with the findings from this study that state that it is difficult to persuade other parties to use BIM for purposes like maintenance. Benefits could very well
be attained for both the customer and the maintenance company. Findings from the interviews suggest that BIM is able to reinforce the qualities of the architect (Source: Epsilon, Iota, Zeta). So for companies to decide whether or not to implement BIM, they mostly focus on how it can internally improve the results.

**Fitting digitization in a General Business Model Type**

When taking this internal perspective, digitization cannot be linked directly to one of the four general business model types. A clear distinction between the influence of digitization on different business model types did not emerge; results did not show that information systems supported one business model type better than the other. This is because information systems can serve many purposes (Hedman and Kalling, 2003). However, the importance was definitely recognized by all interviewees. Because of the adoption of BIM, new roles in the value chain emerge, being responsible for the correct use of BIM. This role is executed by the so-called BIM-manager (Gu and London, 2010). During the BIM conference in Leuven, it became clear that several companies are entering the AEC industry by adopting in this role. This new role changes the dynamics in the business environment. However, results showed that these new roles are also being fulfilled by architectural firms. When this perspective is transposed to the four business model types, digitization can be linked to the business model type integration. When stating that the role of the BIM manager is new, it is not part of the current architectural firms business environment. The emergence of this external role leaves out specialization and flexibility, because they focus on the current business environment, and how to position the firm within the environment. Externalization is not applicable, because these types are focusing how the resources in the business environment can best be used to infiltrate other markets. On one hand this increases the understanding of digitization in the architectural business environment. On the other hand it reaffirms the distinction between the business model types. So, an interesting addition is that mastering BIM leads to new business opportunities which are related to the current business environment, but are not actually in the business environment yet. This additional business can be incorporated into the industry eventually. Therefore, digitization in the current context of the architectural industry in the Netherlands applies best to the business model type integration.

5.2 Methodological Implications

Three concepts were used in the analysis in a particular order. First, the business models of the different companies were mapped. By comparing the underlying business model components, differences and similarities between companies were observed. Second, by applying a professional service firm perspective several of these similarities could be explained. Third, applying a path perspective on the remaining components revealed several dependencies, which could be aggregated to firm and industry level, which eventually led to four different business model types.

5.2.1 Business Model as analytical tool

The business model concept is often too broadly defined (Casadesus-Masanell and Ricart, 2010; Zott et al., 2011). It is a concept that can used to describe any business, and with that it could lose its meaning (Magretta, 2002). This study acknowledges this, and narrows down its scope analyzing business models in a specific context, namely professional service firms. This makes business models much more appropriate as analytical tool. This contextualization could be seen as a condition in focusing business model research.
5.2.2 Generalizing architecture to PSF

The business model analysis uncovered multiple levels. By first looking at the business model components differences between businesses can be explained. These differences, together with the similarities can be aggregated to create new insights on other levels. This could be business unit level, team level, or even the individual level, depending on the problem statement or research question. The detailed information can also create more insights to understand how these different levels interact, as was done in the current study.

The four general business model types may not only hold in the architectural industry, but also in the larger PSF industry. To determine whether this is the case, the findings from this study are compared with leading PSF literature. Lowendahl et al. (2001) described a set of specific characteristics for the PSF. These are compared with our findings in Table 9. This verification shows similarities on all aspects, so that the findings in the architectural industry can be generalized to other industries which share the characteristics as a PSF. Also, when comparing with the taxonomy by (Nordenflycht, 2010) it is clear that architectural firms qualify as professional service firms.

Table 9: PSF characterization (Lowendahl et al., 2001) compared with research findings

<table>
<thead>
<tr>
<th>Professional Services Firms:</th>
<th>Fit with the architectural context</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘are highly knowledge intensive, delivered by people with higher education, and frequently closely linked to scientific knowledge development within the relevant area of expertise’</td>
<td>Architects are skilled people, have finished education on a Technical University or specialized Design Academy</td>
</tr>
<tr>
<td>‘involve a high degree of customization’</td>
<td>Every building is different as it serves different purposes, and is placed in a different environment.</td>
</tr>
<tr>
<td>‘involve a high degree of discretionary effort and personal judgement by the expert(s) delivering the service’</td>
<td>Architects have to translate the wishes and demands of the customer, which involves an important part of interpretation.</td>
</tr>
<tr>
<td>‘typically require substantial interaction with the client firm representatives involved’, and</td>
<td>To translate the thoughts of the client to a concrete building design, many iterations are needed, where the client and architect are discussing new designs and possibilities. Overarching organizations attempt to formalize the contracts with architects in order to guide both customer and firm in their cooperation.</td>
</tr>
<tr>
<td>‘are delivered within the constraints of professional norms of conduct, including setting client needs higher than the profits and respecting the limits of professional expertise’.</td>
<td></td>
</tr>
</tbody>
</table>

To determine whether the business model concept also apply to the PSF context, I looked for theory in high ranking journals. Fosstenløkken et al. (2003) created the an interaction model of PSFs, explaining the internal interaction of different components of the PSF. This model shows similarities with business models. Several business model components can be identified in this model. Some are explicitly stated, and others are posed in question form. For example: domain choice, which is referring to the prioritizing customers, can be linked to customer segmentation. Service delivery is already linked to the activities explicitly, as well as the identical concept resources (Fosstenløkken et al., 2003).
This implies that the connection between business model components and the application to the PSF context has been made. This supports that business models are an important unit of analysis, and that the research in this area has been recognized by other scholars. Also, the interaction between the business model components within the business models have been addressed, as is visible in Figure 9.

![Diagram](image)

**Figure 9: Implicit interaction between BM components within a PSF (Fosstenløkken et al., 2003)**

What is also interesting is that the same components are perceived as less important. In this model, there is no reference to the cost structure, and revenue streams, as was the case in this study. There are also several key differences between the models. The focus of the model by Fosstenløkken et al. (2003) is the internal interaction between business model components. The four general business model types from this study contribute to this by showing external interactions between the higher level business environment.

**Back to the business model**

Since every business has a business model, the concept is very general. Therefore, it is difficult to compare different companies. However, by focusing on specific industry types, and looking at events that are occurring, the business model becomes a strategic tool which can guide firms in their way of doing business (Amit and Zott, 2012). To generalize the findings to a larger range of firms, the professional service firm (PSF) filter that was applied in the beginning of the analysis is removed.
**Contribution to strategic management**

This thesis does not attempt to overgeneralize the model. However, when the four general business model types in combination with the proposed methods are used, a lot of information can be gathered on whether the strategies of firms within a specific industry are sensitive to disruptive events, for example an economic crisis, or a new revolutionary technology. The results in the architectural industry showed how they became vulnerable to economic decay, because the whole architectural industry focused on the core competence of design, which became more marginalized than other firms when the whole AEC industry shrunk.

The four general business model types do not suggest that one strategy is better than the other. The model suggests that a balance of business models in a particular business environment is needed to create a sustainable competitive advantage over other business environments. By not balancing these business models industry wide, other firms will be able to infiltrate the business environment and take over roles of the architectural firms, and eventually pushing them out of the market.

### 5.2.3 Organizational Paths

Using organizational path theory enabled deeper insight into the architectural industry and architectural firms. This section serves as a bridge between path dependence and path creation theory. Both approaches have been used to map the paths and can be used to suggest interventions for companies. As the main difference between path dependence and path creation are concerned with the influence of human agency (Vergne and Durand, 2010), this is the exact point where this research comes in. In this study the business models of architectural firms have been examined. Results show that architectural firms have seen a dependence because of industry specialization. This dependence was found by applying a method developed by Sydow et al. (2009). This implies a certain path determinacy independent of human influence that has an evolutionary perspective on business models (Demil and Lecocq, 2010).

An important finding is that in the current situation of architects path dependence and path creation are not opposing one another when applying the views to the stated problems. The findings show that path dependence is occurring, even on different levels. But, I stand on the edge of this view, as human agency could have played a role in these paths, and may even did play a role when looking at specific examples. The paths found in the interviews were explicated by the interviewees, although not always with the same terminology. Theoretically, the gap between path dependence and path creation has not been bridged, as this was not the scope of this study. Yet using aspects from both views helped to analyze the problems at hand and determine a course of action. Therefore, we will now move from path dependence to path creation. The next section will give practical implications for decision makers in architectural firms, who can enact on these implications in order to improve their business.
5.3 Practical Implications
Besides the theoretical and methodological implications, the results from this study also have consequences for practitioners. These practical implications are detailed by taking a practitioner’s perspective. A proper advice should be straight to the point, concrete, and it should be action oriented (van Aken et al., 2007). The conclusion of this subsection will therefore be a design principle in CIMO form: in a specific Context, the problem owner should do an Intervention to trigger Mechanisms to reach an Outcome (Denyer et al., 2008).

5.3.1 Problem Definition
Using the methodology from the previous section allows us to create a very concrete problem statement to develop a solution from. The specialization in the industry was logical, as companies focused on the parts where they could add most value, in this case designing a building. This specialization secured their position in the market, however, this was based on the assumption that the economy did not change, i.e. remained growing. When the economy stopped growing in 2008, the architectural industry experienced a large long lasting decline in revenues. Because the firms did not invest in business models other than specializing in design services, this created room in the industry, which was filled up by non-architectural firms. When the whole AEC industry started to shrink, architectural firms were induced with extreme competition, causing lower margins and lower revenues.

5.3.2 Preconditions
Before moving to design principles that deal with the stated problem, several preconditions are set. These are necessary to understand how to interpret the principle.

Human Agency
The principle is based on the assumption that breaking away from an organizational path is important to companies. Although not all research streams appoint power to humans in breaking away from paths (Sydow et al., 2009), this work assumed that human agency can deliberately break the firm from existing paths, and create new or better paths for their business (Garud et al., 2010). This also means that the actor is aware that business cycles and macro-economic forces are not the only explanation for business results going up and down. Companies with a sustainable strategy outperform others even in recessive times.

PSF context
The principle is developed for professional service firms, as these firms share the characteristics of low capital intensity, knowledge intensive work, and a professional workforce. These conditions are important, because it determines how the design principle must be implemented. For example, when looking at firms that are very capital intensive, this may limit the freedom for moving in the proposed solution model. This is because many components of the business model are interrelated. Because of the low capital intensity of the professional service firms, they are more flexible in shifting resources (Rindova and Kotha, 2001).

Business Models
Actors that want to implement the principle must be able to map their current business model. Because of the widespread application of different conceptions of the business model (Zott et al., 2011) the design principle is not confined to a single source. However, because of the practical nature of the business model canvas (Osterwalder and Pigneur, 2010), this approach is recommended as a good starting point.
5.3.3 Design principle
This thesis found that business models can be grouped into 4 general types, integration, specialization, flexibility, and externalization. Each of the individual types have been excessively researched by top management scholars. Using a business model perspective leads to new insights on how a firm is interacting with its environment. Merging the research findings with the preconditions from the previous paragraph, the following design principle is created:

*Professional Service Firms that encounter a strategic decision (C), should evaluate this decision using the four generic business model types (I), so that consequences of the decision are better interacting with current business models of the firm (M), leading to balanced sustainable company strategy (O).*

5.3.4 Applying the design principle to new Business Models
When architectural firms are developing ideas for new business models, they can use the general business model types as a tool combined with business model innovation frameworks. This will create insight in how a new business model fits the current industry and the current business model(s) of the firm. These insights can help to check how the new model will benefit the firm, and whether fundamental changes in the potential model need to be made. This tool is preliminary, and should be tested in practice to validate it.

![Figure 10: Placing business models in the 4 general types](image)

The figure describes the model that emerged from the results of this study, containing the dynamic relationship between the business model and the business environment. The green numbered circles (1, 2) are the current business models of a single firm, that each can be connected to a general business model type. When the business models are placed in the business environment, the average can determined. This is represented by the circle marked with an A. The result is that the business models of these firms are skewed to integration and specialization. This could mean that the firm is vulnerable when the business environment is changing. The firm would have problems adapting to the new business environment, because the fit with the business is reduced. The result also means that the firm has more power to influence the business environment. Because of the integration business model (2), the firm is able to integrate other activities into the firm, therewith enlarging the business environment.
When a firm wants to decide on whether a business model needs changing, or a new business model should be added, the following steps must be executed (see Figure 10 and Figure 11):

1. Map the components of the current business model(s) of the firm (1, 2).
2. Describe the industry by looking at business model components: partners, activities, value proposition.
3. Map the components of the new potential business model (N).
4. Position all business model(s) in the 4 general business model types.
5. Check how the new business model changes the balance of business models in your firm (A).
6. Decide or adapt the business model to fit it with your strategy.
7. Plan the implementation of the decision (take small steps and reflect).

It is important that this is not a Go/NO Go decision tool. It can be used for explicating plans and new potential business. It can be used to gather information on the impact of business models on the industry and the business itself.

![Diagram](image)

**Figure 11: Placing potential business models in the 4 general types**

To verify whether this could impact real firms, the importance is verified by searching for publications on internet that are related to business model, in this case in architecture. Very recent news publications on the BNA website indicate that new business models are being developed and that seminars are being organized to have architects interacting with potential business models are share their stories. This shows that the topic is very active, and that the proposed solution could really benefit practice.

### 5.3.5 Applying the design principle to BIM

The proposed solution can also be used to develop a perspective for the use of BIM. When looking at BIM from a business perspective, an option is to create small experiments responding to new business opportunities. Using and implementing BIM (or any other high impact innovation or technology) in an organization is not an easy and short term task. Therefore, it is important that one should take small steps in the implementation and carefully monitor the progress of the change. An example was put forward implicitly by Theta. Using BIM can generate evidence showing its advantages compared to other project
that do not incorporate the technology: “You then tell the client, look ... when we use BIM, it is also interesting for you. Then you will have something in the end that you can use. And we can also convince the client that BIM demonstrably leads to lower failure costs, and often time accelerated construction time. We have also proven that in the past with project Theta. There was a planned construction time of one and a half years, and we have were able to realize the project within twelve months by using BIM. So with that project we have succeeded”. When executing the proposes steps for a specific technology, it becomes more important to analyze whether and how this new technology can really add to the business strategy and is not just a burden (Levine and Prietula, 2012). For example, when focusing on the flexible business model, implementing a rigid system with related processes will reduce flexibility and move the business model more to specialization. Depending on the assessment of the business environment, this could be very positive of more specialization is your goal. If you want to become more flexible, one may want to consider other options before implementing the technology.

5.3.6 An advice for overarching organizations

The results not only have consequences for individual firms, also overarching organizations can benefit from this analysis. The current tool can be used evaluative for policy recommendations. For example, when these organizations collect information on the general business model types, they can analyze periodically whether shifts in these types occur. This information could be shared with member firms, so these firms can determine make better judgments when taking strategic decisions. The tool can also be used to do scenario testing when important changes are about to occur. An example can be a new type of law that will be applied industry wide, or plans to start large scale governmental development programs.

Organizations like the BNA could for example stimulate business training for architectural students or stimulate experimentation with new business models. They can monitor the progress of these actions to constantly reflect and maintain a progressive role in the business environment (Greenwood et al., 2002).

Diffusion Plan

To have the solution distributed, several options are available. First, the summary of this thesis will be sent to the firms that participated in the research. They will be asked for feedback on the model if they are in the wake of strategic decisions, to verify how the solution influenced their decision, and where it needs improvement. Second, is to provide the tool to architectural students. Because the solution was already used to analyze the current situation, this can help to make the solution comprehensible for architecture students. This business view does not only give inside into the business of architects, but also can teach entrepreneurial skills to students. These skills become more important, as thousands of architects have gone bankrupt in the past years, and new businesses are needed to have the industry recovered. This has also been recognized by the BNA, as they have started a stimulation program to increase entrepreneurship in architecture. The last option is to gain access to this program and share the business knowledge to this community, who are by definition interested in new business models.
6 Conclusions

This chapter concludes the thesis. It answers the research questions posed in the beginning, summarizes its contributions, recognized the limitations of the work, and sets directions for possible future research.

6.1 Answering the research questions

The results and discussion have led to the answering of the research questions. By answering the sub questions in reversed order compared to how they were introduced, the main research questions can be answered. The research question with its sub-questions were as follows:

RQ: “How does Digitization influence the Business Model of the Professional Service Firm?”

SQ1: How can architectural business be described from a Business Model perspective?

SQ2: How does digitization influence architectural firms?

SQ3: How does digitization influence business models of architectural firms?

SQ1: Using the business model canvas developed by (Osterwalder and Pigneur, 2010), the business models of 11 architectural firms in the Netherlands were mapped. Theory on professional service firms (Fosstenløkken et al., 2003; Nordenflycht, 2010) narrowed down the scope by focusing on the most important business model components, which matched coding on the all 9 business model components from the canvas. By analyzing the differences and similarities between the components, and applying a path dependence framework (Sydow et al., 2009), several dependencies on industry level and business level were found. It was found that a lot of firms were having a specialization business model. However, the industry shrunk 40% since 2010, and other business models appeared. All business models were mapped and four general business model types were found.

SQ2: With the information gathered on the business models, more insights on the influence of digitization (BIM) on business models were searched. The four general business model types did not explicate differences when coding them individually with BIM. However, although no indisputable evidence was found stating the importance of BIM, the importance does seem to increase, as all interviewees were already using BIM or were seriously considering the implementation of BIM.

SQ3: Because the technology is still in development, it can still develop in many different directions. This prevents this study to state clear conclusions on how digitization is affecting the business model. Also, because results from the interviews showed that architectural firms are experimenting with different business models, the thesis focused more on what is the potential influence of digitization on the business model. By developing a tool for practitioners, architectural firms (and more general PSFs) can deliberately make decisions on how new potential business models and new digitization technologies (like BIM) are influencing the direction of the business model(s) of the firm. And with that finding this study does not only answer the research, but also guides practitioners to guide new initiatives, and take control over the situation.
6.2 Limitations

Although care has been taken in properly and carefully executing this project, several limitations are acknowledged, which deserve the proper amount of attention. The conceptual model (Figure 1) from Chapter 1 introduces the following limitations. First, the perspective is that of the PSF. This can create a possible bias towards the view of a single group. The model has not been applied to other industries. Only architects were interviewed. This could lead to a bias, because it only provides a perspective of architectural firms. Although arguments of the discussion are in favor of generalizing the 4 business model types to other fields, important differences can be overlooked because this study applied this specific scope. The research can benefit from a more extensive approach to increase both in relevance and quality. Also, the interviewed firms had already survived in the current market, which had been shrinking for 5 years. In general, architects which had a firm which had gone bankrupt were not interested in cooperating in the study, which could have led to a bias.

Methodologically the following limitations are important: the interviews were conducted with a single person in a firm. The coding was done by a single person. Also, some of the findings could be validated with other sources, however, not all findings were subject to triangulation, which can lead to bias in the analysis. The literature concerning the used concepts has been dispersed and led to divergence throughout the project. However, because of the explorative nature of the research, without looking into these literature streams and incorporating enough topics, the research project would not have reached its current status. This research does not analyze digitization itself and stays on the surface of unraveling the technology. Doing this did enable the current solution to be used as a tool to judge how new technologies like BIM may or may not influence the firm. This tool is not validated, so care must be taken when implementing it.

6.3 Further Research

Based on the findings, several interesting directions for future research can be appointed. The first addition can be to further develop the tool for practitioners. This can be done by testing it with practitioners and improve it based on the feedback. Another direction could be to empirically test the four general business model types. This can be done in other fields than architecture to generalize the model more rigorously. Executing this project and talking to all the people concerned with architecture opened up many broader directions in which research can be done. It would be interesting to test the model with hypotheses related to the economic status of an industry. Are firms starting to behave differently when the industry is under pressure by macro-economic forces, or by competing industries. Insights in this area can be valuable for all kinds of firms. As to research specified to the architectural industry: during the interviews it became clear that architects find it difficult to explicate and communicate the added value they deliver in a project. Research in this direction can be done on multiple levels, individual (word of mouth), company (making offers), or industry (policies). As for the practical implications, the proposed principle is based on the first analysis to this specific topic. More advanced models may very well be better in specific situations. Studies in variations of applications can create new insights in how to improve the principle.
References


Appendix A: Table of Figures and Table of Tables

Table of Figures

Figure 1: Research Model .................................................................................................... 1
Figure 2: Applied Research Model ....................................................................................... 2
Figure 3: The Business Model Canvas as developed by Osterwalder and Pigneur (2010) ... 9
Figure 4: The constitution of an organizational path (Sydow et al., 2009)......................... 10
Figure 5: Research–Design–Development Cycle from a Science-Based Design Perspective (Van Burg et al., 2008) ........................................................................................................ 18
Figure 6: Components of data analysis: the Interactive Model (Miles and Huberman, 1994) ........................................................................................................................................... 19
Figure 7: Index revenue development Dutch architectural firms (Source: CBS) .................. 26
Figure 8: Four General Business Model Types................................................................. 30
Figure 9: Implicit interaction between BM components within a PSF (Fosstenløkken et al., 2003) .................................................................................................................................. 43
Figure 10: Placing business models in the 4 general types ............................................. 46
Figure 11: Placing potential business models in the 4 general types ................................ 47

Table of Tables

Table 1: Main Differences Path Dependence and Creation (Vergne and Durand, 2010) .... 13
Table 2: Characteristics of interviewed companies ............................................................. 21
Table 3: Initial Coding Scheme ........................................................................................... 22
Table 4: Table with Digitization versus Business Model Components ................................. 22
Table 5: Coding quantities of the Business Models Components ........................................ 23
Table 6: Path Dependence Analysis .................................................................................... 28
Table 7: Business Model Type Evidence ............................................................................ 32
Table 8: Influence of BIM on different Business Model Types ............................................. 36
Table 9: PSF characterization (Lowendahl et al., 2001) compared with research findings .. 42
Appendix B: Fears lowering prices Architectural Services (In Dutch)

Artikel, maandag 8 juli 2013 9:30, Stijn Krzeszewski en Elena van Kampen

In het eerste kwartaal van 2013 waren zowel de prijzen als de omzet van architecten fors lager dan in dezelfde periode een jaar eerder. Het aantal faillissementen was even hoog als in het eerste kwartaal van 2012. In het eerste kwartaal van 2013 waren architectendiensten 3 procent goedkoper dan in dezelfde periode van het voorgaande jaar. Het is de grootste daling sinds het eerste kwartaal van 2010, toen deze diensten 3,5 procent in prijs daalden. Het vierde kwartaal van 2008 was het laatste kwartaal waarin de prijzen in deze branche stegen. De daling van de prijzen is het grootst voor het ontwerpen van woningen. Door de aanhoudende malaise in de bouwwereld en op de woningmarkt waren deze diensten ruim 4 procent goedkoper dan in het eerste kwartaal van 2012. De tarieven voor het ontwerpen van niet voor bewoning bestemde gebouwen (utiliteitsbouw) daalden iets minder sterk, met 2 procent. De prijzen voor dienstverlening op het gebied van stadsplanning, landinrichting en landschap daalden met 2,6 procent.

In het eerste kwartaal van 2013 gingen er 47 architectenbureaus failliet. Dit hoge aantal is gelijk aan het aantal bedrijven dat in hetzelfde kwartaal een jaar eerder over de kop ging. Voor heel 2012 bedroeg het aantal faillissementen 203. Dit is een stijging van ruim 22 procent ten opzichte van 2011.

(In this article was verified using the source data from Centraal Bureau voor de Statistiek (CBS): “Dienstenprijzen; commerciële dienstverlening en transport, index 2010 = 100” and “Zakelijke dienstverlening; omzetontwikkeling, index 2010 = 100”)
Appendix C: Additional Literature

This appendix serves as an overview for additional literature which do not directly link to the main focus of the study, but have contributed in the development of this thesis.

**Building Information Models (BIM)**

Several subjects have been studied in relation with BIM, including: Safety (Zhou, Whyte, & Sacks, 2012), Adoption of Technology (Linderoth, 2010), Project Management (Bryde et al., 2013), Maintenance (Motawa and Almarshad, 2013), and Education (Andersson et al., 2006). Most of these studies appear in journals like “Automation in Construction”, which is a specific journal for the architecture, engineering, and construction industry. Other journals like “Advanced Engineering Informatics” focus more on the technical implementation of BIM. These topics are not in the focus field of this study. Other relations are with creativity, where the problem arises whether and how digital design systems can influence creativity (Bonnardel and Zenasni, 2010; Edwards, 2001)

**Business Models**

Based on the current status of the literature on business model, gaps can be identified that are also noticed by other scholars. Although the business model as unit of analysis and the impact of business models on firm performance have been widely recognized consensus on definition and application are not yet reached. There are some themes that creates a more unified base for studying. Research seems to cluster around topics as systematic design, activity centered, and value focused, which prove to be fruitful. This makes the theoretical grounding of the concepts difficult and with that it is important to check whether the right questions are asked to progress in this field (Arend, 2013; Zott et al., 2011).

**Organizational Paths, empirical studies**

Several empirical studies on paths have been executed. Most research on paths has been done on technological trajectories. (Gruber, 2010) looked at the creation phase of a path. His study examined the early stages of organizational path creation in a quantitative research design. It combines the fields of behavioral decision making and entrepreneurship by testing hypotheses surrounding individual characteristics of the entrepreneur. Data from 446 company founders was examined. The findings suggest that individual-level characteristics are an important influence on the creation of organizational paths. These include human agency (knowledge and experience), personality and the aspiration level. The results also suggest that many entrepreneurs do not generate and evaluate alternative paths when entering a market with an emerging firm. This process may only have a small influence on the process. These early decision processes may explain why companies get locked in eventually. The author suggests that future research on early decisions of entrepreneurs can create understanding on organizational paths (Gruber, 2010).

Thrane et al. (2010) acknowledge the importance of agency, and dig deeper into the processes of cognitive paths in an innovation or service context. These cognitive paths are defined by so called ‘Blind spots’ in technological knowledge and competencies. The authors did a case study analysis on a large medical technology company, consisting of 25 interviews, document examination and three small surveys. The study separates between technological and innovative path dependence, were innovative path dependence is shaped by a certain strategy, business model, or organizational approach towards innovation. The
two types of path dependence co-exist, and the two types do not reinforce each other per se. One can be breaking technological paths, and in the same time get locked into an innovation path. An example is a Stage-Gate decision process, that reduces technological path dependence, but adhering to this process can lead to innovation path dependence (Thrane et al., 2010). This pleads for a more complex notion of path dependence, and stresses a multidimensional investigation of organizational paths.

Other studies work on the reinforcing mechanism that cause an organization to eventually get locked in. Dobusch and Schüßler (2013) move away from the different theories on path dependence, for example structural inertia or institutional persistence. Scoping technology cases, the authors state that the positive feedback mechanisms do not differ across these different concepts and review a set of different empirical studies in this light. This creates room for a broader analysis. Results show that different mechanisms can interact leading to paths. The authors also found that these mechanisms operated at different levels. For example in the case of Intel, complementary effects between strategy and market effects appeared on both the organizational level and on the organizational field level, against other mechanisms that operated only on the organizational level. Not only the mechanisms operate at different levels. Paths can also interact on different levels. When looking at the lighting industry, the industry behavior and the individual behavior of three major firms in this industry was examined (Bergek and Onufrey, 2013). Results show that the different technological paths persist within a company. But also on an industry level these paths interact, shown by the patenting behavior and available product classes. These show similarities across the three market leaders. However, no evidence for actual lock-in was found, so the direct link to path dependence is not supported.
Appendix D: Interview Protocol (In Dutch)

Interview protocol R02

Graag zou ik het gesprek opnemen? Heeft u hier bezwaar tegen?

Introductie Interviewer: Mijn naam is Luuk Verstegen en ik ben doctoraal onderzoeker aan de TU/e bij Technische Bedrijfskunde. Ik heb een achtergrond in elektronica, en heb een master in innovatiemanagement. Ik ben erg geïnteresseerd in Business modellen van creatieve bedrijven.

Introductie Onderzoek: Dit onderzoek betreft het verbeteren van creatieve bedrijven in de Europese economie. In dit onderzoek werken 11 universiteiten om te bekijken wat creativiteit in de samenleving en economie betekent.

Het interview is als volgt opgebouwd. Eerst stel ik enkele vragen over u/ jou, daarna over het bedrijf. Dan gaan we wat dieper in op digitale systemen en over de rol van u/jou als architect.

Persoonlijk:

Wat is je rol binnen het bedrijf?
Hoe ziet jouw achtergrond eruit?

Bedrijf:

Hoe ziet de geschiedenis van jullie bedrijf eruit?
Wat zijn de belangrijkste bronnen van inkomsten voor jullie bedrijf?
Met wat voor bedrijven werk je (intensief) samen?
Met wat voor type bedrijven concurreren jullie?
Op welke gebieden kiezen opdrachtgevers voor een architectenbureau?
Hoe onderscheidt het bedrijf zichzelf van jullie concurrenten?
Wat voor technologieën worden er binnen jullie bedrijf gebruikt?

Building Information Modeling (BIM):

Op wat voor manieren zijn informatie management systemen voor proces en product van toepassing op jullie bedrijf?
Past hier de term BIM bij? Is BIM hier een belangrijk onderdeel van?
In hoeveel aanvragen is het gebruik van BIM als eis opgenomen?
Wat is de overweging om BIM te gebruiken?
Wat zijn de kosten en opbrengsten van BIM, zowel implementatie als gebruik?
In hoeverre is BIM van invloed op jullie bedrijfsvoering?
Wie zijn er betrokken bij de implementatie van BIM binnen jullie bedrijf?
Wat zijn de voordelen en beperkingen van het gebruik van BIM?

Rol van de architect:

Wat vind je belangrijk bij het uitoefenen van je werk als architect?
Past dit goed binnen de rol en verantwoordelijkheden van jou als architect?
In hoeverre zijn de zaken die je belangrijk vindt onderdeel van de bedrijfsvoering?
Wat zijn de verschillende rollen en verantwoordelijkheden van een architect binnen een project?
Wat zijn de meest belangrijke rollen in een project?
In hoeverre is de rol van jou als architect veranderd over de tijd?

BIM + Rol

In hoeverre is de rol van een architect anders bij het gebruik van BIM?
Wat is de invloed van BIM op het uitoefenen van je rol?
In hoeverre denk je dat BIM de rol van de architect veranderd op de lange termijn?
Zijn BIM systemen afgestemd op de rol van de architect in een project?
Appendix E: Data Sources
In this appendix the data sources are described.

Semi-structured interviews
In a period from August 2013 to November 2013 fourteen interviews were held. Twelve of these interviews were fully transcribed. The average length of an interview was 70 minutes. The transcribed interviews covered more than 200 pages of raw text, which served as a base for data analysis.

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Source Description</th>
<th>Source Type</th>
<th>Additional Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 : Interview_R01_09aug2013</td>
<td>Alpha</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>2 : Interview_R01_13aug2013</td>
<td>Beta</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>3 : Interview_R01_30juli2013</td>
<td>Gamma</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>4 : Interview_R02_21aug2013</td>
<td>Delta</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>5 : Interview_R02_26aug2013</td>
<td>Epsilon</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>6 : Interview_R03_22okt2013</td>
<td>Zeta</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>7 : Interview_R03_25sep2013</td>
<td>Eta</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>8 : Interview_R03_27sep2013</td>
<td>Theta</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>9 : Interview_R03_30sep2013</td>
<td>Iota</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>10 : Interview_R03_30sept2013b</td>
<td>Kappa</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>11 : Interview_R04_29okt2013</td>
<td>Lambda</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>12 : Interview_R03_27aug2013</td>
<td>Field expert</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>13 : Interview_R02_23aug2013</td>
<td>Field expert</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
<tr>
<td>14: Interview_R03_05nov2013</td>
<td>Field expert</td>
<td>Interview</td>
<td>Company Website</td>
</tr>
</tbody>
</table>

BIM Conference
OOF 2011/24 - COM.BI Communicatie en beheer van digitale gebouwinformatie in een multidisciplinair team tijdens het bouwproces
- Five presentations from a visited BIM conference,
- Six informal conversations at BIM conference with BIM related non-architects (+-20 minutes each),
- One interactive workshop attendance,

Company websites
To analyze the industry, and sample companies, 70 company websites were reviewed.

Role of the architect
Analyzing six strategic policy documents on the current and future role of the architect,

Conjecture measurements
Four conjecture measurements analyzing the status of the architectural industry.

Policy Documents
Four policy documents from the Royal Institute of Dutch Architects (BNA),

Statistics
Industry statistics from CBS to support claims on economic forces.
# Appendix F: Coding Scheme

<table>
<thead>
<tr>
<th>First Order Codes</th>
<th>Second Order Theoretical Categories</th>
<th>Aggregate Theoretical Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Public tenders require specific input demands.</td>
<td>Lock-In (Phase III)</td>
<td></td>
</tr>
<tr>
<td>- Laws include specific rules</td>
<td></td>
<td>Rigidity</td>
</tr>
<tr>
<td>- Alternative solutions are better but are not chosen.</td>
<td></td>
<td>Innefficiency</td>
</tr>
<tr>
<td>- Alternative options were not considered.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- More actors adopt and apply a specific institution (i.e., an organizational</td>
<td>Formation (Phase II)</td>
<td></td>
</tr>
<tr>
<td>rule or routine)</td>
<td></td>
<td>Mechanism: Coordination Effects</td>
</tr>
<tr>
<td>- More efficient the interaction among these actors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Costs decrease by this event.</td>
<td></td>
<td>Mechanism: Complementary</td>
</tr>
<tr>
<td>- It becomes increasingly attractive to adopt rules</td>
<td></td>
<td>Effects</td>
</tr>
<tr>
<td>- Economies of scope.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Synergy resulting from the interaction of two or more separate but</td>
<td></td>
<td></td>
</tr>
<tr>
<td>interrelated resources, rules, or practices.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Synergies are increasingly becoming more attractive.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sets of activity patterns become progressively dominant.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Activity sets increase in organizations structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The more an activity is performed, the more efficient it is executed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Focus on the advantages of exploitative learning may increasingly drive out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>exploitative learning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The motivation to look for fresh alternatives and to critically examine well-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>established organizational practices is likely to shrink.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Increased simplicity of tasks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Others have done this, so it is done here as well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- This was done because I don't want to be an outsider.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Making assumptions about human behavior.</td>
<td></td>
<td>Path Dependence</td>
</tr>
<tr>
<td>- Mechanisms trace back to event.</td>
<td>Preformation (Phase I)</td>
<td></td>
</tr>
<tr>
<td>- Critical Event</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- This event initiate a re-enforcing mechanism.</td>
<td>Critical Juncture</td>
<td></td>
</tr>
<tr>
<td>- Shock, Crisis, Catastrophe.</td>
<td>Path Breaking</td>
<td></td>
</tr>
<tr>
<td>- Insidious change in organizational demography.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Incomplete socialization of new organizational members.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Coincidental delocking in terms of a by-product of other organizational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>decisions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Influence on decision by second-order observer.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 1. Value Proposition
- 2. Customer Segments
- 3. Channels
- 4. Customer Relationships
- 5. Revenue Streams
- 6. Key Resources
- 7. Key Activities
- 8. Key Partnerships
- 9. Cost Structure

---

62
# Appendix G: The Role of the Architect (In Dutch)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Role Architect</th>
<th>Changing Role</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alpha</strong></td>
<td>We hebben altijd veel energie gestopt in, uhh, niet alleen maar voor die opdrachtgever een goed plan maken, maar ook een plan maken wat door de maatschappij gedragen wordt of door de Gemeente. We proberen echt altijd alle partijen goed bij mekaar te brengen.</td>
<td>B: Ik weet niet of de rol veranderd is. Wat er veranderd is, is dat ik meer ervaring heb. Dus dat ik anders in een project sta... Het zal ongetwijfeld anders zijn, dan dat het twintig jaar geleden was. Maar dat is heel moeilijk af te zetten tegen je eigen persoonlijke ontwikkeling. Dat is natuurlijk het lastige van het verhaal.</td>
<td>Role has not changed</td>
</tr>
<tr>
<td><strong>Beta</strong></td>
<td>...</td>
<td>waarbij je dus eerst veel meer als bouwpastoor de functie had, ben je nu een van de partijen die aan tafel zit, die veel meer naast elkaar staan. En daarom ben ik voorstander van dat met name in dat adviseursgebeuren die architect juist de verantwoordelijkheid krijgt en ook de gelegenheid krijgt om die te nemen. Heel meer als regisseur, als integraal regisseur, zeg maar, dat product en dat proces stuurt, controleert, eigenlijk de duvelstoejage is. Ja, en uhm, waar de architect zeg maar toch in het verleden best wel veel aanzien heeft, ja, is dat ook een van de partijen die nu maar aan tafel zit.</td>
<td>Role has changed, cut into little pieces</td>
</tr>
<tr>
<td><strong>Gamma</strong></td>
<td>Wat ik als architect belangrijk vindt is dat de vraag van de klant beantwoord wordt. Kijk, mensen komen niet hier bij mij omdat ze willen ouwehoeren. Ze komen hier omdat ze een probleem hebben. Of eigenlijk geen probleem, een vraag. En als ze het zelf kunnen oplossen, of een ontwerp zelf konden maken, deden ze het zelf, maar dat kunnen ze niet, dus ze zoeken daar professionele hulp bij. En dat is eigenlijk de kern van het hele verhaal.</td>
<td>Maar waar dat je wel heel erg merkt is dat, dat de rol van je bureau, van jou, wat jij levert, verandert doordat andere partijen functies gaan overnemen. Dus waar eerst de architect alles regelde, wordt de architect steeds meer een niche. Dus, die maakt het ontwerp.</td>
<td>Role changes, role of the architect gets smaller</td>
</tr>
<tr>
<td><strong>Delta</strong></td>
<td>Een heel belangrijk onderdeel van de architect is toch wel empathie, en die empathie die houdt in dat je je afvraagt: wat zou degene die aan de andere kant van de tafel zit, of tegenover je staat, van, wat zou die willen weten? Nou, als hij dus dan hier komt met dat soort vragen, dan wil je eigenlijk ook weten van, hoe is dat ontstaan eigenlijk enzo, en waar, wat altijd de grote hamvraag is, is waarom? 'He he, heb je iets gedaan? Maar waarom?'</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

63
Vroeger was de arch, ja dat hoor je denk ik wel vaker, maar dan was de architect zeg maar de bouwheer. Die was gewoon de adviseur van de opdrachtgever en die stond hem altijd aan zijn zijde, bij alles, bij het hele traject. Dat is zeg maar in twee decennia geleden dat gaan veranderen, dat architecten puur zich veel meer met het ontwerpen bezig wilde gaan houden. Want wij zijn de creatielingen. Toen ontstond zo iets, die hebben enorm afgestoten, de feitelijke uitwerking van de projecten, de details, het materiaalgebruik, het managen van het project, etc. Daar zijn andere partijen op in gedoken. De bouwmanagers, de aannemers, etc. En in al die tijd, is denk ik, zijn de architecten onvoldoende in staat geweest, uit te leggen aan de markt wat hun toegevoegde waarde is... Nou ja, zeg maar de hele verschraling, van de waardering voor het vak, van architect. Die hebben ze zelf veroorzaakt. Ja, ze zeg ik, maar we, wij ook. Alleen, ja als je dus alleen maar blijft roepen van; ik ben voor die kunstmatige mooie schetsen enzovoorts. En daar wil ik dan goed voor betaald worden. En je komt nu in een fase waarbij men veel meer behoefte heeft aan een advies wat is gebaseerd op de vraag van; goh, ik ga nu een investering doen. Wat betekent die investering voor mij, voor de komende 40, 50 jaar. De tijd dat dat gebouw er staat. Ja, daar kunnen die architecten helemaal geen antwoord op geven. En dat laatste is veel belangrijker geworden. We zijn veel meer toe aan het gaan naar een markt, gewoon met beide benen op de grond. Al dat star-architecture dat bestaat nog wel. Maar dat is eigenlijk niet, nou om eerlijk te zijn vind ik dat geen architectuur, ja dat is niet echt architectuur. Dat is een ander soort vak.

Role has become smaller, because the architect has thrown away several roles. That particular role has become less important.

Dan kom je bij de competenties van een architect uit en dat is een helikopterview kunnen hebben boven de vraag. Het in staat zijn om die oplossing voor een opdrachtgever te bedenken wat zij zelf nog niet weten dat het de oplossing is, niet alleen qua concept, maar ook functioneel en financieel. Architecten hebben de neiging om iets geweldig creatiefs te maken en dat is mooi, maar om dat nog eens te combineren met de markt, dat de markt dat ook trekt wat je doet. Je moet iedere keer weer inschatten: wat is mijn opdrachtgever.

Role has become smaller, because the architect has thrown away several roles. That particular role has become less important.
### Theta

Wij werken tegenwoordig ook met Revit en met BIM, volgens mij wil je daar zo ook nog iets over weten. Wij waren een van de eersten bureaus in Nederland die dat hebben opgepakt, hebben geïntroduceerd. Dat was een beetje een gok. We hebben denk ik inmiddels goed gegokt, want het begint toch een soort standaard te worden. En daarmee willen we ons meer en meer profileren als we ook een beetje weer die centrale positie terug kunnen bemachtigen, want de rol van een architect in het hart van zo'n bouwproces is in de loop der jaren versnipperd geraakt. Daar kom ik eigenlijk tot het punt, want onze klassieke opdracht was je doet alles van het ontwerp tot en met de uitvoering. Dat is niet meer zo vanzelfsprekend tegenwoordig. Als architect kun je tegenwoordig ook alleen gevraagd worden voor een voorlopig ontwerp en vanaf dan neemt de aannemer het over. Alle mogelijke vormen van opdrachten zijn inmiddels mogelijk. In Nederland is het echt een beetje een chaos aan het worden gek genoeg, waar het in Duitsland alnaal nog heel erg bij het oude is. Daar is men eigenlijk niet veranderd. Is men hier alle kanten op geschoten. Elke aanbesteding die bij doen is weer anders geformuleerd.

---

### Iota

Wij vinden dat de architect een adviseur moet zijn. Opdrachtgever heeft een probleem wat ruimtelijk moet worden opgelost binnen tijd, geld en kwaliteit kaders. En ik vind dat de architect als adviseur zijn rol moet spelen. Ik vind wel dat die architect Primes Inter Pares is in het ontwerpen. Want hij is degene die het concept van het gebouw bepaalt hé, dus het idee erachter. En dat ook tot en met de uitvoering moet kunnen bewaken. Maar wel binnen de kaders van de opdrachtgever.

---

### Kappa

Het moet zeker appellen aan de wens van de opdrachtgever. Dus als je zo’n verbouwing maakt dan.. ja.. het moet gewoon voldoen aan de vraag. Maar ik denk dat je ook nog eens die vraag moet overstijgen. Dus er komt een bepaalde vraag vanuit de opdrachtgever en vervolgens moet je als Architect daar een meerwaarde aan zien te geven, aan de opgave.

---

### Lambda

Je moet weten wat een ander interesseert. Wat ons tekent in onze ontwerpen, wij denken na: hoe gaat die gebruiker ermee om, hoe gaat de constructeur ermee om, wat heeft die nodig, wat heeft de installatietraditie nodig. Je moet ook even voor anderen gaan nadenken en daarop acteren. Dat is in wezen heel lean. Blijkbaar is het zo uitzonderlijk dat het een naampje moet hebben. Dat is mijn grootste bezwaar ten opzichte van lean.

Het heeft ons vak niet goed gedaan dat er heel veel ontwerpers waren die alleen nog maar ontwerpen deden en verder niks, die niet in de bouwphysica zaten, niet in de productielijnen, die alleen maar ontwerpen maakten en dat door er doorheen donderden en dat vervolgens naar een aannemer ging. Geen bouwphysica, geen bouwtoetsen begeleiding.

---

The process has become more fragmented.

Role has changed, but wants to get it back.

Role changed because a lot of architects became design specialists.