# Creating Spin-Off
# Designing Entrepreneurship Conducive Universities

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction: Research questions

University spin-offs such as Genentech and Google are companies founded to exploit university intellectual property. They serve to transform technological breakthroughs from university research, which would probably remain unexploited otherwise. Therefore, policy makers have become very interested in university spin-offs as a means for technology transfer and economic growth. However, creating university spin-offs is not easy. Some universities generate more spin-offs than others (e.g., Di Gregorio and Shane, 2003; Klofsten and Jones-Evans, 2000; Kondo, 2004). Furthermore, university spin-off activity creates several difficulties, such as the potential conflict of interest between commercial and academic work and the risk to university reputation if founders of spin-offs act inappropriately (Bird et al., 1993; Shane, 2004; Slaughter and Rhoades, 2004). On the other hand, academic entrepreneurs feel sometimes that their behavior is not welcomed by the university, or that the university procedures hinder the development of their venture. Therefore, there is a need for knowledge that guides designing universities to foster the creation of university spin-offs, while balancing the different activities, cultures, objectives and interests of universities. Here, this study aims to create design knowledge to develop entrepreneurship conducive universities, which informs both science and practice. The related main research question of this dissertation is:

*How can a university organization be designed that fosters the creation and development of university spin-offs?*

In this study, a university spin-off is defined as "a new company founded to exploit a piece of intellectual property created in an academic institution" (Shane, 2004: 4). University spin-offs therefore are a subset of all start-up companies created by students and employees of universities. As such, this definition focuses

on the opportunities (based on intellectual property of a university) exploited by new business start-ups, rather than on the business founders themselves. The intellectual property exploited by university spin-offs typically involves patented inventions; other spin-offs draw on copyright protection. The founders of these university spin-offs are called 'academic entrepreneurs' in this study.

This dissertation study searches to answer five subquestions underlying the main research question. These questions address both the university side as well as the academic entrepreneur's side of the main question. The first question is related to the objective to make a connection between pragmatic knowledge about *how* to create university spin-offs to scholarly work explaining *why* certain practices in this field work and others do not. This question deals with the design activities at the university level:

1.   *What principles can be established to design a university organization that stimulates (rather than discourages) the creation and development of university spin-offs?*

The next two subquestions deal with one particular issue that arises at the entrepreneur's level when universities seek to foster the creation and development of spin-off companies. This issue concerns the formation of fairness perceptions by the entrepreneurs of the relationship with the university and the effect of those fairness perceptions on the development of the university spin-off companies. Insight in this phenomenon is needed to enable designing a smooth spin-off process and to understand the generative mechanisms of rules and procedures guiding spin-off creation. The first related subquestion aims to provide insight in how the use of entrepreneurship-specific fairness heuristics differs from the use of more traditional fairness rules as currently described in the literature:

2.   *What are the heuristics underlying the formation of fairness perceptions of academic entrepreneurs?*

The other subquestion related to the fairness issue aims to explore *how* and *when* fairness perceptions influence the development of new ventures over time:

3.    *How does the perceived fairness of the relationship with the university influence the development of the spin-off?*

The design knowledge that results from the set of design principles and the understanding of the role of fairness perceptions has to be integrated into design solutions at university level by organization designers. These designers also have to adapt the design knowledge to the contextual specificities of the situation at hand. Therefore, we aim to explore the cognitive strategies that designers employ to use knowledge in the design process and the contribution of these strategies to the performance of the design process. This leads to the following subquestion:

4.    *What are the cognitive design strategies that can be followed to design effectively and efficiently a support unit that stimulates the creation and development of university spin-offs?*

The topic of this dissertation – the engagement of universities in commercialization of research by means of university spin-offs – raises moral questions. For example, if one of the main goals of universities is to produce sound knowledge that is free of monetary interests, would the usage of this knowledge for economic benefits not corrupt research 'objectivity'? As a result, the engagement of universities in commercializing research raises the question whether this engagement is good or bad. These issues lead to the final subquestion:

5.    *How can moral issues regarding spin-off creation be mitigated?*

## 1.2 Study approach: Entrepreneurship as a design science

As an overarching perspective, this dissertation views entrepreneurship as a design science. This view implies that research is oriented at developing scientific knowledge serving to (re)design practices such as university spin-off creation, while simultaneously developing new scholarly insights (Jelinek et al., 2008; Romme, 2003; Van Aken, 2004). Some of the chapters of this dissertation have an outspoken design orientation (i.e., chapter 2 and 7). Other chapters focus on understanding the mechanisms behind particular practices and effects (i.e.,

chapter 3 and 4), needed to develop a better performing design. On the level of the complete dissertation, the design science lens serves to integrate the individual studies and to realize the main objective and answer the key research question.

*1.2.1 Reasons for choosing a design science lens*

This design science lens is adopted for three reasons. First, viewing entrepreneurship as a design science does justice to the nature of entrepreneurship as a creative phenomenon. Here, entrepreneurship is defined as the creation of new organizations to exploit opportunities by the creation of goods and services (cf. Shane, 2003). As such, entrepreneurship is about creation of newness, based on different combinations of individuals and opportunities (Shane, 2003; Shane and Venkataraman, 2000). In its very nature, this is a process phenomenon involving the simultaneous creation of new structures and destruction of old ones (Giddens, 1984; Schumpeter, 1942). This particularly requires research methods that capture the dynamics of this process of exploring and exploiting entrepreneurial opportunities (Ireland et al., 2005) and can capture the newness and particularity of creation processes (Gartner, 2010; Pandza and Thorpe, 2010).

In this respect, mainstream longitudinal research methods, such as those employing panel or archival data, are helpful to describe what has happened ex post. This provides the much desired insight in causes, contingencies and probability of the occurrence of specific events and their effects. More and more researchers are taking this more advanced route – compared to cross-sectional studies – to examine entrepreneurship. These studies could, ideally, deliver an almost perfect representative model of the entrepreneurship phenomenon, with the ability to predict outcomes given a set of conditions. For example, insight can be obtained in the processes leading to a firm with sustainable competitive advantage (Alvarez and Busenitz, 2001).

However, these research methods are not capturing the newness involved in the creation process ex ante, as they do not engage in the actual creation of artifacts (Gartner, 2010; Sarasvathy, 2004). Here, viewing entrepreneurship as a design science may provide complementary insights, needed to understand how firms come into being, and how new combinations of individuals and

opportunities can be created and exploited. In this respect, mainstream research is developing knowledge about what 'already is', while design science research contributes with developing knowledge about creating something that does not exist yet (Simon, 1996).

Designing in the context of entrepreneurship implies that existing tools, practices and knowledge are used to create new, previously unknown business possibilities (Sarasvathy, 2003; 2004). In this respect, a design science approach to the study of the entrepreneurial phenomenon is situated at the pragmatic middle ground between descriptive research and the creative entrepreneurial practice itself (Romme, 2003; Van Aken, 2004; Van Aken and Romme, 2009). Design science research on the one hand draws on descriptive research and on the other hand engages in developing knowledge for creating new and unknown futures, while also feeding back this design knowledge to the body of research (Trullen and Bartunek, 2007; see also section 2.2). As such, design science provides a complementary perspective on entrepreneurship, as it can account for the creative nature of the development of future goods and services.

Second, approaching entrepreneurship as a design science facilitates the integration of dispersed and divergent streams of literature. Various studies have demonstrated that the focal object of a design approach – the artifact to be created or improved – helps to synthesize new insights from different research traditions (e.g., Denyer et al., 2008; Dougherty, 2008; Romme and Damen, 2007; Tranfield et al., 2003). The study of university spin-offs in the last few decades has identified different antecedents and consequences. Researchers have conducted detailed studies of factors fostering the creation and growth of technology-based university spin-offs (Rothaermel et al., 2007; Shane, 2004). For example, some have studied individual level factors, such as academic productivity (e.g., Van Looy et al., 2006; Zucker and Darby, 1998), institutional level factors, such as policies, procedures and facilities (e.g., Bird et al., 1993; Debackere and Veugelers, 2005; Vohora et al., 2004) or national level factors such as intellectual property policies (e.g., Mowery et al., 2004). As such, the literature on university spin-offs has been growing in diverging directions, with a lack of integrative theorizing and research synthesis (Djokovic and Souitaris, 2008; Shane, 2004). As such, researchers need to draw on multiple disciplinary backgrounds, such as sociology and psychology, to cover the diverse aspects of entrepreneurship (Davidsson,

2008; Shane, 2003). Design science may enable this integration around the focal design artifact, resulting in practical design principles as well as new research opportunities, ideas and hypotheses (Trullen and Bartunek, 2007). Design science therefore offers a complimentary approach to integrate different streams of literature, for instance in design principles, while investigating the underlying theoretical generative mechanisms and acknowledging contextual contingencies (Denyer et al., 2008; Romme and Endenburg, 2006; Van Aken, 2004).

Third, a design science approach supports bridging the 'relevance gap' between science and practice (Mohrman, 2007; Starkey et al., 2009; Van de Ven, 2007). In search of a research domain and a theory of entrepreneurship, researchers have diverged from practically relevant questions. This can be nicely illustrated by attempts to define on the one hand the 'societal' practical dimension of entrepreneurship, while on the other hand specifying the research domain (e.g., Davidsson, 2008). These attempts can create scientific clarity, but also strengthen the boundaries between science and practice. Moreover, policy fashions rather than empirical evidence or well-established theory tend to influence the actions adopted by organization designers and policy makers (Bower, 2003; Mowery et al., 2004; Weick, 2001). Also previous attempts to develop practice-oriented design recommendations from 'thick' case descriptions (e.g., Debackere, 2000; Kirby, 2006; Lockett et al., 2005; Roberts and Malone, 1996) provide only a partial view of spin-off policy or have refrained from specifying the contextuality of design recommendations. This raises difficulties in formulating design recommendations that bear contextual validity and synthesize scholarly insights (Zahra, 2007). In other words, there is a major risk that organization designers miss out on key scholarly insights and lack a solid basis from which adequate programs and measures can be developed for stimulating technology entrepreneurship in university settings. In this respect, design principles, grounded in sound research and theory, can deliver practical principles for designing organizations and policies. The design principles in this study especially acknowledge and incorporate the environment of the university spin-off firms (i.e., the university organization). Earlier studies have suggested the design of the environment is one of the important factors influencing entrepreneurship (Aldrich, 1990; Baumol, 1990). Thus, a design science approach

can serve practitioners by providing valid and state-of-the art knowledge to design entrepreneurship conducive universities.

*1.2.2 Key concepts of design science research*
Design science research involves the development of design principles grounded in research and practice (Pandza and Thorpe, 2010; Romme, 2003; Van Aken, 2004). Fully developed design principles specify "what to do, in which situation, to produce what effect and offer some understanding of why this happens" (Denyer et al., 2008: 396). These design principles are not the final design solution itself, but serve to construct detailed design solutions in a particular situation. As such, design principles function as a 'boundary' object between the descriptive and explanatory nature of entrepreneurship research and the prescriptive and pragmatic nature of design processes (Romme and Endenburg, 2006).

The results of this thesis are a number of these design principles. These principles can subsequently be employed by researchers as a framework to assess spin-off practices and entrepreneurship programs at other universities (cf. Barr et al., 2009; Phan et al., 2009). Moreover, the identification of the generative mechanisms which are codified into these principles (cf. Denyer et al., 2008) often provides significant contributions to theory. In particular, these design principles have practical relevance for university policy and decision makers, and people involved in university spin-off creation. From the design principles, design solutions can be developed which can be implemented in practice. Design solutions are representations of the practices being (re)designed with help of an integration of the design principles (Romme and Endenburg, 2006). Such solutions are more contextualized than design principles, that is, solutions tend to include elements specific to the local setting.

The process of formulating design principles is structured by separately developing principles based on practice (practice-based principles) and principles merely based on scholarly knowledge (research-based principles). The synthesis of practice-based and research-based principles results in design principles, which thus draw on both practitioner knowledge and research knowledge. This set of design principles in turn serves to identify areas in which additional research is required to understand the underlying generative mechanisms (Denyer et al., 2008). Therefore, chapter 3 and 4 explore such a relatively

unexplored research area, identified by the construction of the set of design principles in chapter 2. In Chapter 2, we further develop the methodology of design science research as applied in this dissertation.

## 1.3 Data

A comparison of several cases, selected on the basis of variation and constants, can inform theory development about meaningful differences and similarities by uncovering interesting patterns (cf. Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2003). Therefore, this dissertation is not only based on a systematic literature review, but also on data from the in-depth study of three universities: Eindhoven University of Technology (TU/e) and Wageningen University and Research Center (WUR) in the Netherlands and Technical University of Catalonia (UPC) in Spain.

### 1.3.1 Data sources

The empirical studies are based on diverse sources of data, such as interviews, documents and observation. In total, we performed 73 interviews with 62 entrepreneurs and university representatives. Moreover, frequent (informal) interactions with entrepreneurs and spin-off support staff provided useful observations. Furthermore, at the university level we collected documentation describing formal policies and protocols. Documents at the unit of analysis of the entrepreneurs included business plans and other papers such as subsidy proposals written by the entrepreneurs, newspaper articles, interviews, brochures and website information. For each chapter of this dissertation, different parts of the database are employed. Therefore, the specific characteristics of the data as well as the precise analysis methods will be introduced per chapter. So, each chapter forms a study that can be read independently.

### 1.3.2 Case characteristics

The three universities, whose data are analyzed in different parts of this dissertation, share a number of important characteristics. All three universities have a strong focus on science and technology, which provides a fertile soil for new venture creation (cf. Shane, 2004). Each of the three universities performs a

critical role in its region, in terms of both education and economic development. With regard to economic development, all three universities seek to increase knowledge and technology transfer from their university to the market, to contribute to societal and economic development. In the second half of the 1990s, the senior management of each of the three universities recognized the need to support efforts to spin-off new ventures from university research, to transform technological breakthroughs that otherwise would remain unexploited because of their radical nature and/or early stage of development. All three universities attempted to design a similar ideal-type of support system for technology transfer and new venture stimulation, primarily based on the example of MIT and similar benchmarks (cf. O'Shea et al., 2007; Roberts and Malone, 1996; Shane, 2004).

The differences of these cases enable exploring the effect of different design contexts. Within different national, geographical, cultural, organizational and temporal contexts, the initial focus on a similar ideal-type solution led to different design processes and solutions, as will be discussed in detail in Chapter 5. The Spanish and Dutch national and institutional contexts differ evidently, whereas we are able to assess the effect of the regional and university context by studying two universities from the same country. Furthermore, the cases differ in their hierarchical setup, departmental structure and history. Table 1.1 displays the main characteristics of the universities analyzed in this study.

These three universities are similar to most other universities in Europe with regard to policy, structure, education and research. Compared to universities in the US, in particular frequently studied ones such as MIT and Harvard (cf. Rothaermel et al., 2007), key differences arise from the local institutional environment which tends to be less supportive for entrepreneurship in Europe (cf. Powers and McDougall, 2005a), the smaller size of the universities, and their somewhat lower intellectual eminence (THES between 50 and 150; cf. Di Gregorio and Shane, 2003). At the national level, intellectual property (IP) laws and educational policy have effects that are similar to those of the Bayh-Dole Act (Mowery et al., 2004). The three cases are briefly introduced below. When necessary, some of the case details will be recapitulated or will be supplemented with additional details in each of the different chapters.

## Table 1.1: Main characteristics of the universities

| Characteristics | TU/e | WUR | UPC |
|---|---|---|---|
| *National and regional* | | | |
| Intellectual property rights | University owns the IP of inventions by employees, but the university compensates the inventor for developing the patent. | | University owns the IP of inventions by employees. Free usage of national patents by a university. |
| New venture and higher education policy | Since the 1990s, several funding schemes for new venture support exist; these funding schemes have become more structured since 2002.<br>Faculty is allowed to have equity in companies. | | Since 2001, structural funding for new venture support. Until 2006 the inventor's equity was limited to 10%, now faculty can have more than 10% if the university also gets a stake. |
| Access to capital | Many (national) subsidy-schemes have been established, especially the last 10 years. The importance of Venture Capital and informal investors is increasing, but still moderate with regard to investments in new ventures. These investments are also closely related to particular sectors (e.g., biotech), and less to national or regional characteristics. | | Many subsidy-schemes are established, in particular since 2001. The importance of venture capital and informal investors is increasing, but still moderate regarding investing in new ventures. |
| Regional clusters | Strong high-tech cluster, mainly due to the proximity of several large multinational firms in electronics and chemistry. | Strong life sciences cluster. In addition, an incubator for new ventures was established in 2001. | Strong high-tech cluster, in particular with regard to biotech and information technology. |
| *University* | | | |
| Size | 2006: about 7000 students, and 5000 employees. | 2006: 9000 students and about 6000 employees. | 2006: about 35000 students and 4000 employees. |
| Organization | 9 faculties and 12 other departments (among which TU/e Innovation Lab). Board of | 8 faculties and 21 other departments (among which WBG). Board of Directors | 41 faculties and 19 other departments (among which program Programa Innova); |

| | | | |
|---|---|---|---|
| | Directors appoints the vice-chancellor, who is responsible for education and research, as well as the president who is responsible for general management of the university. | appoints the vice-chancellor, who is responsible for education and research, and is also responsible for general management of the university. | election of the vice-chancellor by employees of the university. |
| History | Founded in 1950s with a focus on electronics and industrial engineering. Since the beginning, TU/e had strong ties to industry. | Founded in 1880s, with a focus on education for agriculture. Merged in 1997 with a research institute in this field (DLO) and in 2004 with a university of professional education. Especially the DLO has a long history of collaboration with industry and government. | Founded in 1970s with a focus on industrial engineering and architecture. Later UPC broadened its scope toward other fields and also locations, partly as a result of a number of mergers. The university has a long history of contract research with industry. |
| Intellectual eminence of the university | THES[1] ranking 2006 (selection year): 67; 2009: 128. | THES ranking 2006 (selection year): 97; 2009: 155. | THES ranking 2006-2009: none |
| Overview of new venture policies and support infrastructure | Since 1998, TU/e has started with explicit new venture policy by establishing an incubator and making substantial equity investments in companies (up to 100%). Since 2004, there is more support for new ventures. Patents are usually sold to the companies for a certain equity and royalty share. | Since 1999, WUR defined policies to stimulate new ventures. Since 2004, WUR has a new venture policy targeted at investments in a sample of high-potential companies, providing them much support. In turn, WUR typically acquires a substantial equity share. Patents are usually sold for an equity share. Since 2001, space and other facilities of the Business Centre are available to new ventures. | Since 1998, UPC has started with support for new venture, especially targeted at training and culture change. The university rarely invests in companies. Limited facilities and incubation space. |
| Financial | 2006: € 45 mln. revenues from industry collaboration; revenues from patents and new ventures not public (total turnover € 265 mln.). | 2006: €169 mln. revenues from industry collaboration, €6 mln. from patents and new ventures (total turnover €590 mln). | 2006: € 26 mln. revenues from industry collaboration, revenues from patents € 0,1 mln. (total turnover € 269 mln.). |

[1] Times Higher Education Supplement, http://www.timeshighereducation.co.uk.

*1.3.4 Eindhoven University of Technology (TU/e)*

Until the late 1990s, Eindhoven University of Technology (TU/e) strongly focused on applied technology research and education, with strong linkages to several multinational firms in high-tech industries in the region. TU/e therefore excelled in commercializing some of its technological inventions by means of selling or licensing these inventions to established firms. As a result, many technologies and their potential applications remained unexploited – in particular those that were not relevant or too immature for the multinational firms the university typically partnered with.

With the appointment of a new chairman of the board in 2002, TU/e's top management decided to change this situation by investing in the creation of an infrastructure that would serve to commercialize key inventions by spinning off new technology ventures. An external professional was hired to set up a spin-off support unit (called TU/e Innovation Lab), involving spin-off advisors and intellectual property (IP) support professionals. The staff of the spin-off support unit initiated the creation and implementation of a number of key solutions, including education and training programs, a protocol for transferring IP to spin-off firms, and a regional network, involving eight organizations.

*1.3.5 Wageningen University and Research Center (WUR)*

The origins of WUR go back to the 19th century. Over a period of more than 100 years, this school developed into Wageningen University (Agricultural University, Landbouwuniversiteit). In 1997, this university merged with Dienst Landbouwonderzoek (Agency for Agricultural Research, DLO) into WUR. Furthermore, in 2004, the Hogeschool (University of Applied Sciences) Van Hall Larenstein became part of WUR. As a result, WUR currently is an institute with a broad range of educational and research activities focused on life sciences and natural resources, organized in five departments – each with a large autonomy and its own (financial) responsibility.

Until 1981, efforts to commercialize research findings were primarily made by individual researchers, staff and students. At that time, however, there hardly was any attention for creating new ventures. On the other hand, at the DLO side has always been a strong focus on cooperation with industry. In the late 1990s, new venture support started receiving more attention as a particular instrument

for transferring technology, also as a result of the merger with the more industry and business oriented DLO. A business support office was founded on instigation of the vice-chancellor and president of the university. The goal of this business support office was to commercialize university inventions by means of selling patents and licenses and supporting (new) companies to commercialize these inventions. In 2004, the Wageningen Business Generator (WBG) was founded to increase these activities and to enable investments in university new ventures. In addition to the technology commercialization activities within the WUR organization, in 2001 WUR created an incubator with financial support from the national government. This incubator is partly owned by WUR, but is a separate organization with its own funding. In 2005 a larger network consortium was created – again with support from governmental funds – to promote entrepreneurship in the field of food production.

*1.3.6 Technical University of Catalonia (UPC)*
Located in the autonomous Catalonia region in Spain, the Technical University of Catalonia (UPC) is a public university founded in the 1970s. The current UPC is a merger of different institutions and universities, now encompassing seven campuses. In 1998, a specific program was initiated to stimulate the creation of university new ventures, called Programa Innova. Over the years, this program has evolved into an organization involved in support, IP advice, entrepreneurship training, and the management of European programs. Furthermore, Programa Innova created a business plan competition to stimulate researchers and students to write a business plan. Moreover, the university board allocated part of the funding obtained from government to found an investment company, targeted at investing in the new ventures. This investment company is completely separated from the Programa Innova new venture support program. In 2007, Programa Innova launched a new program pilot targeted at involving more students and more departments in the actual creation of new ventures.

## 1.4 Thesis outline

Figure 1.1 presents a brief roadmap of this thesis. The main aim of the thesis contains the development of a set of design principles to stimulate the creation of university spin-offs. The construction of this set of design principles involves an interaction between the body of scientific knowledge and the codification of practitioners' experience. In the endeavor of developing design principles to advise these practitioners and to provide scientists with a framework to assess the state-of-the-art of the scientific knowledge, we identified a number of areas that needed further investigation. Therefore, we performed a number of studies particularly focused on the formation and effect of fairness perceptions and the ethical evaluation of the university spin-off phenomenon. Finally, the integration of design knowledge, as among others provided by the design principles, can be performed by different design strategies. The chapters that contain the body of this thesis are introduced in more detail below.
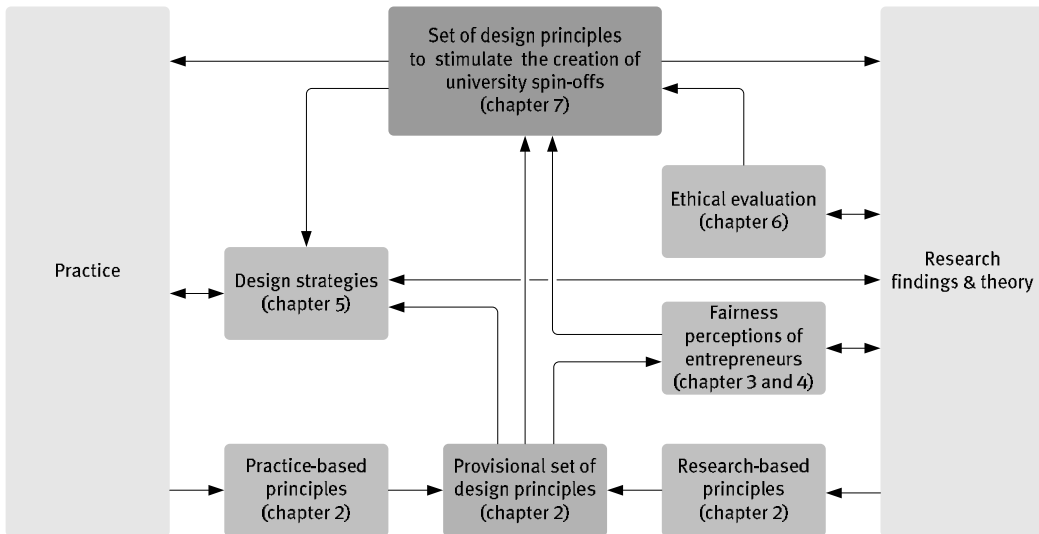


**Figure 1.1: Overview of the thesis**

### 1.4.1 Chapter 2

In Chapter 2, research subquestion 1 is answered by developing an initial set of design principles. This set of design principles is developed by codifying both the practitioner's design knowledge in practice-based principles as well as synthe-

sizing the body of scientific literature on spin-off creation in research-based principles. Practice-based principles result from a study of the TU/e case. The initial sets of practice-based principles and research-based principles are integrated into one set of five design principles. In this chapter, the analysis of TU/e also serves to illustrate the interplay between initial processes characterized by emergent design and the subsequent design process that was more deliberate in nature. This case study also suggests two fundamentally different phases in building capacity for university spin-off creation. The results of this chapter also reveal that theoretically and practically important questions around fair distribution of revenues of the spin-off activities are under researched. These fairness perceptions of the entrepreneur influence the development of the venture and are therefore further explored in Chapter 3 and Chapter 4.

*1.4.2 Chapter 3*

As fairness perceptions appear to influence the creation and development of university spin-offs, it is important to understand how these fairness perceptions are formed by the entrepreneur. Existing fairness theory describes the use of rules guiding the formation of fairness perceptions in workplace settings. However, these fairness rules may not necessarily be applicable within an entrepreneurial context. Compared with more regular workplace settings, entrepreneurship is characterized by a higher degree of uncertainty and the importance of venture governance issues (cf. Baron, 1998; Busenitz and Barney, 1997; Shane and Venkataraman, 2000), which may severely influence the formation of fairness perceptions by entrepreneurs. Therefore, Chapter 3 identifies the heuristics underlying the formation of fairness perceptions of entrepreneurs, thus answering research subquestion 2. The analysis involves academic entrepreneurs who have started 26 companies, 19 from TU/e and 7 from WUR. Although the results imply that established organizational justice rules are used by entrepreneurs, we also find nine new fairness heuristics that are specific to the entrepreneurship setting. These new fairness heuristics complement established fairness rules and serve to theorize about the formation of fairness perceptions by entrepreneurs. The results of this chapter serve to better understand how entrepreneurs form fairness perceptions as well as to contextualize existing

organizational justice theory to the entrepreneurship setting. This delivers ingredients to refine the design principles for university spin-off creation.

### 1.4.3 Chapter 4

The precise effect of fairness perceptions on the development of university spin-off companies is explored in this chapter. As such, Chapter 4 answers subquestion 3. We assess the influence of entrepreneur's fairness perceptions on their cooperation behavior. A sample of 17 of the new ventures originating from TU/e is studied with regard to the founders' fairness perceptions of their relation with the university. The analysis of 232 start-up events of these ventures suggest that the perception of unfairness relates to delayed venturing events because of reduced cooperation, while perceived fairness involves a more rapid pattern of development. These perceptions are found to be associated with the experience of the entrepreneur. The results of this chapter deepen understanding of the venturing process and can be used to improve the design principles.

### 1.4.4 Chapter 5

Subquestion 4 is answered in Chapter 5 by means of a study of the longitudinal development of the three different university spin-off support units. This chapter addresses the design process and the interaction with the complex context, which is an intriguing yet little understood endeavor. The results show how organization designers use three strategies in the design process: off-line reasoning and planning, feedback-driven learning, and associative reasoning by way of analogies. These strategies can serve to integrate design knowledge (such as design principles) in the act of designing. Moreover, we depict the relationship between context characteristics and the use of the different design strategies and we specify the contributions of these strategies to the performance of the design process in these contexts. Our findings suggest that associative reasoning is the primary design strategy in contexts characterized by a high degree of near-decomposability and hierarchy. In addition, feedback-driven learning appears to be necessary in anchoring the designs to make the designed unit viable over time.

*1.4.5 Chapter 6*

Chapter 6 reviews, structures and evaluates the moral issues generated by efforts to commercialize university research by means of spin-offs in order to address subquestion 5. The review suggests that spin-off creation has three substantial advantages: 1) knowledge utilization, 2) economic growth, and 3) learning from the other 'culture'. Furthermore, three substantial disadvantages are identified: 1) the potential change in research direction, 2) the anti-commons effect, and 3) the threat to objectivity. Subsequently, deontological and teleological ethical evaluations serve to identify distinct lines of reasoning which result in different evaluations of the university spin-off phenomenon. Based on these ethical evaluations a reflective equilibrium is constructed that can be used as a moral criterion. The conclusion of this chapter is that commercializing science by means of university spin-offs is ethically desirable under the condition that disadvantages can be mitigated by designing the right organizational structures, which are specified in the design principles presented in the concluding Chapter 7.

*1.4.6 Chapter 7*

Finally, Chapter 7 presents the main conclusions from this dissertation and constructs a final set of design principles. Moreover, theoretical and practical implications are specified and a number of avenues for further research are described.

# CHAPTER 2

# DESIGN PRINCIPLES: A SYNTHESIS FROM PRACTICE AND SCIENCE[2]

## 2.1 Introduction

Academic entrepreneurship by way of university spin-offs is an emerging field of research focusing on the process of creating, discovering and exploiting technological opportunities created by university research. More broadly, the field of entrepreneurship is currently searching for a methodology that would fit its research object (e.g., Davidsson, 2004; Sarasvathy, 2004). Shane and Venkataraman (2000) propose a framework that focuses on explaining and predicting entrepreneurship as a unique set of empirical phenomena. This framework now is an important benchmark in entrepreneurship research (e.g., Davidsson, 2004); this suggests (academic) entrepreneurship research is increasingly being modeled after mainstream management research, drawing on causal frameworks, models and theories. This type of research has brought a growing understanding of university spin-offs including, among others, the role of different technological regimes (Shane, 2004), the selectivity of the incubator model adopted (Clarysse et al., 2005), the role of the technology transfer unit in providing access to resources and support services (Bekkers et al., 2006; Debackere and Veugelers, 2005), and the differential ability of universities to generate start-ups (Di Gregorio and Shane, 2003).

This growing body of literature focuses on spin-offs that have been established already. However, *how* they got established in the first place tends to remain unaddressed. In this respect, causal explanation and reasoning helps to explain existing artifacts, but may be inadequate to understand the creation of such

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[2] This chapter is partly based on E. van Burg, A.G.L. Romme, V.A. Gilsing & I.M.M.J. Reymen (2008), Creating university spin-offs: A science-based design perspective. *Journal of Product Innovation Management*, 25(2), 114-128; and some parts of this chapter are published in V.A. Gilsing, E. van Burg & A.G.L. Romme (2010), Policy principles for the creation, growth and success of corporate and academic spin-offs. *Technovation*, 30(1), 12-23.

artifacts (Romme, 2003; Sarasvathy, 2001; 2004; Van Aken, 2004). A more integral understanding of the process of *creating* university spin-offs is therefore still in its infancy (Shane, 2004).

To analyze this process, a *design science* approach is adopted in this study (see Section 1.2). This design science approach connects the (emerging) body of research to the pragmatic, action-oriented knowledge of practitioners (Romme, 2003; Romme and Endenburg, 2006). To deepen understanding of the process of spin-off creation, this chapter will connect this scientific body of knowledge with the design principles that are tacitly applied by practitioners. This serves to answer the following question (subquestion 1):

> *What principles can be established to design a university organization that stimulates (rather than discourages) the creation and development of university spin-offs?*

In this chapter, we present a case study of how a university infrastructure for the creation and development of spin-offs was established. The spin-off practices in this case study were, initially, strongly driven by a more pragmatic approach and subsequently reshaped by insights derived from scholarly knowledge. This study connects pragmatic knowledge about *how* to create university spin-offs to scholarly work explaining *why* certain practices in this field work and others do not. As such, it makes two contributions to the literature. First, the design science approach adopted in this chapter is fundamentally different from design approaches in other work. Previous studies tend to conceive design as either an emergent process (e.g., Garud et al., 2006; Sarasvathy, 2001) or a deliberate process driven by design principles (e.g., Romme and Endenburg, 2006; Van Aken, 2004). This chapter explores the initiating role of an emergent process toward a more deliberate one. In other words, we focus on the interplay between emergent and deliberate design, and explore how this interplay can serve to develop a cumulative body of knowledge that is relevant for both practitioners and scholars. Second, this chapter provides an in-depth analysis of a specific case. Such an in-depth study may yield new insights that are relevant beyond the local context of this particular university. Moreover, it may deepen understanding of the creative tension between general theories and principles and the specific local contexts in which universities engage in spin-off creation.

This chapter is structured as follows. We start by discussing the role of emergent and deliberate design in section 2.2 and then discuss the method adopted in section 2.3. Section 2.4 describes the practice-based principles as employed by the practitioners in the case study. Next, section 2.5 discusses the research-based principles, derived from the body of scientific knowledge. Both sets of principles are synthesized in design principles in section 2.6. Subsequently, section 2.7 illustrates how these design principles can serve (re)designing university spin-off practices as well as drawing implications for future research. Finally, key findings from this study as well as the merits and limitations of the methodology adopted are discussed in section 2.8.

## 2.2 Emergent and deliberate design

In the context of entrepreneurship and innovation, design processes tend to be as much emergent as deliberate in nature (Hargadon and Douglas, 2001). The framework in Figure 2.1 suggests there are ample opportunities for experimentation (practice) to drive the creation of, for example, design solutions and principles. This more emergent design process arises from what Schön (1987) calls reflection-in-action: that is, the rethinking that leads to on the spot experiments as well as the further thinking "that affects what we do – in the situation at hand and perhaps also in others we shall see as similar to it" (Schön, 1987: 29). Weick (2004) characterizes the experience of engaging in emergent design as 'being thrown' into an continuously evolving and ambiguous context. This emergent quality of the research-design-development cycle in Figure 2.1 is likely to prevail when design principles are non-existent, underdeveloped, or unknown to practitioners. In a more mature discipline, this cycle is as much emergent as it is deliberate: the emergent dimension serves to respond to and account for the unique and dynamic nature of the local setting, whereas the deliberate dimension serves to build a body of knowledge that cuts across multiple settings. The field of entrepreneurship, and of university spin-offs in particular, still lacks a widely accepted methodology or theoretical framework. Therefore, the deliberate and emergent dimensions of (academic) entrepreneurship need to interact and converge in building a cumulative body of knowledge and practice.

The two faces of design also reflect the need to decontextualize and contextualize design principles and solutions (see Figure 2.1). The process of abstracting solutions and their underlying principles from, for example, a first sample of new ventures processed through a university-based incubator involves *decontextualization*. Similarly, effectively applying a set of general principles to for example the creation of spin-offs in university X implies adaptation to the institutional and regional setting of this university. Moving from right to left in Figure 2.1, knowledge therefore becomes increasingly *contextualized*, also in view of the rapidly diversifying nature of organizational, industrial, technological, regional and cultural settings (cf. MacCormack and Verganti, 2003; Orlikowski et al., 1995; Rousseau and Fried, 2001).

EMERGENT DESIGN
(decontextualization)

| Practices | → ← | Design Solutions | → ← | Design Principles | → ← | Research Findings |

DELIBERATE DESIGN
(contextualization)
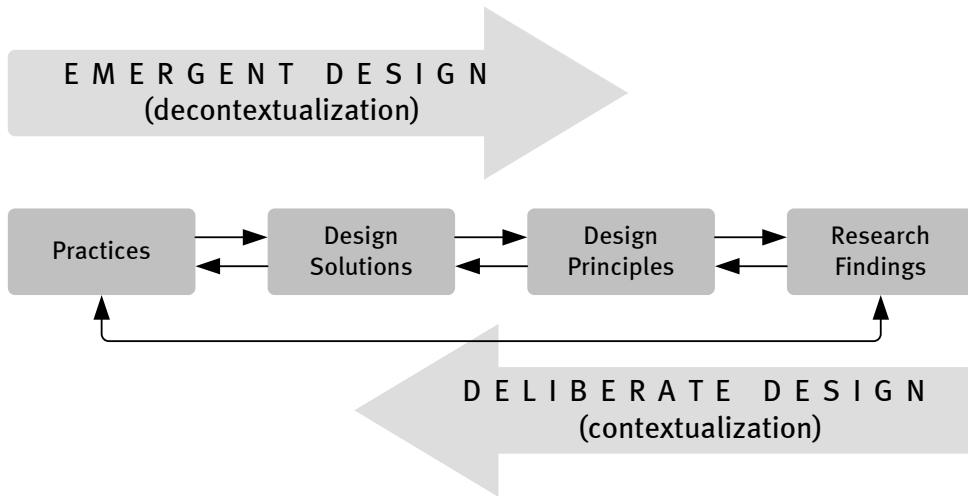
**Figure 2.1: The research-design-development cycle from a design science perspective**

Design science can also be understood in terms of the interplay between causal and effectual reasoning (cf. Sarasvathy, 2001). The scholarly body of research findings largely draws on causal propositions and empirical studies testing these propositions. By definition, these studies focus on existing artifacts: for example, spin-off firms generated by a sample of universities in the past ten years. By contrast, the experimentation and implementation stage in Figure 2.1 largely draws on effectual logic that is inherently creative. For example, the attempt to create a technology-based firm heavily draws on resources such as personal skills,

patented technology, and social as well as professional networks (Sarasvathy, 2001; Shane, 2004). Using these resources, the entrepreneur imagines and tries out possible effects that can be created with them.

## 2.3 Methods

The case study in this chapter serves to illustrate both emergent and deliberate design dimensions and, in particular, the pivotal role of design principles in the interplay between both dimensions. The case study involves the creation and implementation of an infrastructure for generating and facilitating spin-offs at a Dutch university of technology, namely Eindhoven University of Technology (TU/e). The study draws on data collected in the period 2005-2007. The data were gathered in two different roles. One of the supervisors of this thesis (Romme) participated in the design processes with regard to the university support infrastructure for spin-offs at TU/e (cf. participant-observer data). Semi-structured interviews and collected documentary data were performed from the usual 'outsider' perspective. The interviews were transcribed, checked with the interviewees, and coded according to the procedures outlined by Strauss and Corbin (1998). The general interview guide that was used for these semi-structured interviews can be found in Appendix 1. Interviewees involved a large number of (potential) entrepreneurs involved in spin-offs, several managers of the spin-off support unit, two spin-off advisors, an IP advisor, and several entrepreneurship professors. In total, 25 interviews were conducted for the study reported in this chapter. Table 2.1 provides an overview of the different data sources.

In tracking the deliberate and emergent design dimensions, we took three steps to identify, create and use design principles:

1.  so-called practice-based principles are developed by converting the largely tacit knowledge of key agents in university spin-off creation into explicit principles (cf. Plsek et al., 2007);
2.  principles are derived from a review of the literature; these research-based principles then serve to understand (and possibly improve) practices and solutions already in place as well as create entirely new solutions (cf. Romme and Endenburg, 2006);

3.  the practice-based and research-based principles are synthesized in a set of
    design principles – defined as principles that are tested in practice as well
    as grounded in the existing body of research (Romme, 2003; Van Aken,
    2004).

*2.3.1 Development of practice-based principles*

The practice-based principles were derived from the data by means of a careful
coding and reduction process (Strauss and Corbin, 1998). First, we coded all
different practices and experiences which starters and support advisors reported
and those that were described in key documents. This resulted in a wide range of
codes, reflecting recommendations and positive and negative experiences. Next,
the coded practices were clustered by common themes and reduced to a small
number of categories. This involved dropping those categories that had little
quantitative support (less than three sources) or qualitative support (e.g.,
reflecting only expectations or recommendations but no real experiences) in our
data. For each category, crucial elements of the solutions were identified. Finally,
for each of the final eight categories, practice-based principles were formulated
and the different experiences of entrepreneurs and support staff were narrated.

**Table 2.1: Data collection**

| Interviewed university representatives | Interviewed entrepreneurs | Examples of other data sources |
|---|---|---|
| Managing director TU/e Innovation Lab (2x) | Founder of *Alpha* | University policy documents TU/e |
| Coordinator Technology Entrepreneurship program (2x) | Founder of *Beta* | History descriptions of TU/e |
| | Founder of *Gamma* | Subsidy proposals |
| Spin-off and start-up advisor 1 | Founder of *Delta* | Newspaper articles |
| Staff member IP, Subsidies & Contracts | Founders of *Zeta* | Brochures |
| Spin-off and start-up advisor 2 | Founder of *Eta* | Company websites |
| Staff member TU/e Innovation Lab | Founder of *Theta* | Annual reports of Innovation lab |
| Professor chemistry department | Founder of *Iota* | and TU/e |
| Professor of entrepreneurship | Founder of *Kappa* | |
| Managing director TU/e Holding | Founder of *Nu* | |
| Managing director of chemistry department | Founder of *Rho* | |
| | Founder of *Sigma* | |
| | Founders of *Tau* | |
| | Founder of *Omega* | |

*2.3.2 Development of research-based principles*

Research-based principles were derived by means of a systematic literature review. The domain of this review was defined in terms of all research in the area of university spin-offs. The purpose of the review was to derive normative (general) principles rather than to provide a comprehensive overview. Therefore, the review protocol took several existing literature reviews as a starting point, complemented by research not included in these reviews. Three recent literature reviews were identified at the time of this review: Shane (2004), Djokovic and Souitaris (2008), and O'Shea, Allen, O'Gorman and Roche (2004). The findings from these three reviews were synthesized into research-based principles by way of a so-called meta-synthesis approach, a technique for synthesizing studies (Denyer and Tranfield, 2006; Tranfield et al., 2003; Tranfield et al., 2004).

The meta-synthesis approach adopted here is analogous with the grounded theory approach of open coding (Strauss and Corbin, 1998; Tranfield et al., 2003). The primary source for this coding procedure were the findings from these reviews, which were written down in a separate file. In the process of gathering research findings, these "data are broken down into discrete parts, closely examined, and compared for similarities and differences. Events, happenings, objects, and actions/interactions that are found to be similar in nature or related in meaning are grouped under more abstract concepts termed 'categories'." (Strauss and Corbin, 1998: 102). Key concepts and findings of individual studies were 'translated' in the terms of one another and findings obtained in a certain institutional or cultural setting were decontextualized, to arrive at more general patterns and guidelines. (Denyer and Tranfield, 2006). This process resulted in about twelve key concepts, which were subsequently clustered by searching for common or overarching themes. This resulted in a set of six concepts. The latter result was compared and extended with about fifteen publications and working papers (not used in the three previously published literature reviews). Subsequently, this set of concepts was linked to any general theories that explain the key generative mechanisms addressed by these principles (cf. Denyer et al., 2008; Pawson, 2001). Finally, the six research-based principles were formulated based on the collected research findings.

*2.3.3 Development of design principles*

We composed a set of design principles by confronting, comparing and synthesizing the list of practice-based principles with the list of research-based principles. This synthesis is performed by grouping similar themes and concepts from the two sets of practice-based and research-based principles. This synthesis procedure is illustrated more in detail in section 2.6.

These design principles are subsequently applied to the TU/e case to illustrate the application of these principles (in section 2.7). As such, the case study approach is a clinical rather than descriptive one. The clinical nature of the case study arises from its dual purpose to improve the spin-off performance of the incumbent university as well as to analyze and understand the underlying processes in this case.

## 2.4 Practice-based principles

This section starts with a description of several key events and issues in building capacity for spin-off creation at Eindhoven University of Technology (TU/e). Subsequently, we discuss the inventory of practice-based principles derived from practitioners' experiences at TU/e.

*2.4.1 Key events*

Until the late 1990s, Eindhoven University of Technology (TU/e) was strongly focused on applied technology research and education, with strong linkages to several multinational firms in high-tech industries in the region. TU/e therefore excelled in commercializing some of its technological inventions by means of selling or licensing these inventions to established firms. As a result, many technologies and their potential applications remained unexploited – in particular, those that were not relevant or too immature for the multinational firms the university typically partnered with.

With the appointment of a new chairman of the board in 2002, TU/e's top management decided to change this situation by investing in the creation of an infrastructure that would serve to commercialize key inventions by spinning off new technology ventures. An external professional was hired to set up a spin-off support unit (called TU/e Innovation Lab), involving spin-off advisors and IP

professionals. The staff of the spin-off support unit initiated the creation and implementation of a number of key solutions, including:

- An undergraduate minor program in entrepreneurship was created and made available from the management school of TU/e (as of 2005). This minor program is now one of the two most popular minors at TU/e.
- A protocol for transferring IP to spin-off firms and distributing revenues among the internal stakeholders (inventor, research group, university, and entrepreneur) was created in view of the first set of experiments in starting up technology firms (in 2003-2004), involving a high level of anxiety among university representatives, inventors, (student) entrepreneurs and investors about revenues distribution. This protocol was developed to create transparency about key standards in the process while maintaining sufficient flexibility in negotiating tailor-made deals about the transfer of IP to spin-offs.
- At the level of all MSc programs, a so-called Technology Entrepreneurship certificate program was tested and implemented.
- A regional network, involving eight organizations, was created to pool resources and to provide access to each others' contacts and resources.

The last two design solutions and their redesign will be discussed in more detail in section 2.7.

Until 2005 the experiments with these design solutions were self-contained, in the sense that they were driven by a local search for ideas, benchmarks, and so forth. In other words, the initial stages of the design process were largely emergent in nature (cf. Figure 2.1). In the summer of 2005, a research team came on board and engaged in studying the design and practice of spin-off creation at TU/e; this included a sustained effort to develop design principles grounded in research findings to assess and improve the solutions already in place as well as construct new solutions. Since 2005 the process thus evolved as a more balanced interplay between emergent and deliberate design.

*2.4.2 Practice-based principles*
In the TU/e case, the spin-off support practice is codified in the following eight practice-based principles. For a summary we refer to Table 2.2.

1.  *Establish a physical infrastructure for spin-offs and allow spin-offs to use university resources.*

When respondents tell about university spin-offs, one of the first aspects that surfaces is the need for physical infrastructure for spin-offs. At universities, office space for ventures – science parks and incubator facilities – and the use of university lab space are often established first, in our case in one of the past waves of attention for research commercialization.

The possibility to rent office space at the university campus and to use university labs is a prerequisite for many companies that start from the university. Because a start-up has limited financial resources, being able to arrange the use of university laboratory is very important to ventures that need this expensive lab space for developing their products or services. By renting office space at the university campus, spin-offs can maintain a close relationship with their knowledge base that resides in the university's faculty and can profit from close proximity to people who can advise them. Besides that, academic entrepreneurs can use facilities like a front desk with a receptionist, a post office box and a canteen. As the founder of a spin-off reported:

> Why are we located here at the university campus? Because the university is here and we like to be in the proximity. We like to maintain a bond with TU/e, and thus we are located perfectly here. (...) Furthermore, facilities like a canteen are important. That is very practical, in particular when we have visitors. When we would have to manage that ourselves, it would be quite a lot of work.

Another reason that spin-offs like to be located at the university campus and to use university labs instead of private lab facilities is that the university offers good contract conditions and flexibility. As one of the starters reported:

> We are able to stop renting every month; we don't have an agreement for five year. That's quite unusual at other places. The prices are, however, equal to market prices. Maybe somewhat below, with the discount we've got. But it's not very inexpensive here. We are not located here because of the prices.

## Table 2.2: Practice-based principles

| Practice-based principles | Elements of solutions and practices in the TU/e case |
| --- | --- |
| 1. Establish a physical infrastructure for spin-offs and allow spin-offs to use university resources | Provide office space with the possibility to use different services<br>Create arrangements for spin-offs to use university labs and other resources<br>Create flexible contracts and good conditions, but with prices similar to the market |
| 2. Embed entrepreneurship education in the curriculum targeted at spin-off stimulation within the curriculum | Involve spin-off advisors in entrepreneurship education<br>Enable students to combine their thesis work with the preparations of starting a venture<br>Create student venturing teams from multiple fields |
| 3. Make potential entrepreneurs (students, PhD-students, faculty) aware of opportunities to start a venture based on a research finding | Give students early in their study information about entrepreneurship possibilities<br>Create commitment at faculty boards<br>Appoint a local technology transfer officer within the different departments<br>Offer newly hired employees a training regarding technology commercialization<br>Cultivate successful entrepreneurs as role models |
| 4. Provide spin-offs with advice and coaching from skilled people | Advise spin-offs on their business plan, facilities, financing, subsidy requests, start-up team, patenting, et cetera<br>Get spin-off advisors who are creative in finding solutions and are able to approach spin-offs in a personalized way<br>Create start-up teams with the right mix of skills, by training or by adding people to the team<br>Develop and sustain a pool of experienced entrepreneur-coaches that are willing to advise spin-offs<br>Create a board of commissioners to advise the spin-offs |
| 5. Support spin-offs in building their network | Enable spin-offs to use the academic network of the university<br>Establish a network around the support organization of investors, industry contacts and financers<br>Hold regular meetings with the core network partners to discuss spin-offs<br>Cultivate the prestige of the university to gain credibility<br>Organize networking events with spin-offs |
| 6. Create financing opportunities for spin-offs and advise them in acquiring financial resources | Create funds to support prospective academic entrepreneurs in de orientation stage<br>Create ways to obtain significant amounts of funding<br>Permit equity investments of the university in spin-offs, in exchange for payments<br>Provide advice regarding acquiring grants |
| 7. Develop obvious and supportive rules governing the exploitation of university-assigned technology | Establish fair rules regarding the distribution of revenues from exploitation of findings<br>Create procedures to govern and judge the balance between academia and business<br>Allow faculty to have shares in spin-offs |
| 8. Establish a clear support and management structure, embedded in the university, but decoupled from the academic activities and departments | Establish a clear and accountable structure, with high commitment of the university board<br>Create a structure that enables the university to have participations in spin-offs<br>Establish an organization that operates 'businesslike' |

As spin-off support staff reports, it is important that the conditions are comparable to market conditions, to avoid creating a high barrier between the incubation phase and the market environment. But the university offers flexibility in the rental period, and also supports searching means to finance the costs of renting facilities. Rental prices contain a negative incentive structure to use the scarce capacity at the university as efficient as possible and to stimulate spin-offs to become completely self-sustaining. The first three years a spin-off gets a discount that decreases every year. So, after three years, the prices are equal to or above market level. As one of the support officials said:

> After three years, the entrepreneur starts thinking: this place is as expensive as the industrial park, I will just move to that place. That's also our intention. When you aren't able to move to the industrial park after three years, you should ask yourself if you are on the right track. It could be three or four years, but at a certain moment one has to move to the industrial estate, voluntarily or less voluntarily.'

2.  *Embed entrepreneurship education in the curriculum targeted at spin-off stimulation within the curriculum.*

To pay serious attention to the stimulation of university spin-offs, more is needed than office space and labs for new ventures. In the past, the office space was the most important and visible aspect of spin-off support. It was even for a large part rented to companies that did not have relations with the university. As one respondent entitled it, in the past the physical facilities were just 'window-dressing':

> The government says: universities have their societal responsibility, and we will provide the money. Then, as a university, we started to make much smoke, but the fire was hardly visible, at least not at the university.

One of the means to stimulate spin-off formation is by training students and faculty. Regarding this training, embeddedness in curricula and faculty structures is important to prepare students and faculty to become entrepreneurial, and to

make them aware of the possibilities.[3] One of the older programs at TU/e is the entrepreneurship course, provided as an elective course to all university students. In this course, support professionals give a presentation, and students are informed about the opportunities to start a company from the university. A number of entrepreneurs told that their decision to start a company was influenced by the entrepreneurship course. For instance, one founder reported:

> We ended up as starters through the entrepreneurship course. (...) Entrepreneurship is nice; maybe I can do something with it. That's very much due to the professor; he is quite good in generating ideas and ambitions. He inspires.

In the undergraduate (Bachelor) phase, all university students can choose to participate in an entrepreneurship minor program and an entrepreneurship project. In the graduate (Master) phase, students can participate in courses and most importantly in a multidisciplinary group project in which they explore and prepare the start of a company based on a university finding (since 2004). The group project is combined with the final thesis work. This group project, in combination with the master courses and master class, is called the 'Technology Entrepreneurship Program' (cf. Section 2.7.1).

3. *Make potential entrepreneurs (students, PhD-students, faculty) aware of opportunities to start a venture based on a research finding.*
One of the challenges at TU/e is that many people are not interested in becoming an entrepreneur, or even if they want to, they are not aware of the possibilities and the support that could be provided. At the front end of the spin-off process, there have to be potential entrepreneurs with ideas to start business from the university. Many times, students discover the possibility to start a spin-off company, when they are almost finished with their course work and final thesis. At that stage, it is hard to get them involved in starting a company, because they often do not want to spend two other years exploring the possibility to start a

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[3] Because of the importance of the awareness and opportunity recognition issue as it appears from our interviews and from literature (Shane and Venkataraman, 2000), we created a separate principle regarding this aspect (see practice-based principle 3).

company, if they can get a nice job at an established company. Ideally, they should have gained skills and knowledge prior to their final thesis work and have combined their thesis research with exploring the possibilities for a company (see also practice-based principle two). As one of the coordinators of the entrepreneurship program reported:

> I have guys visiting me, who say: I read on the website that there is this and this. But, I already started with my final thesis work. Can I still start with the 'Technology Entrepreneurship certificate program'? No. We get them too late. And because we get them so late, we cannot make a selection, because we don't have sufficient candidates.

Thus, one of the consequences that students are not aware of the entrepreneurship possibilities is that they could not start timely to prepare themselves to start a company. In addition, also faculty is not known with the possibilities and the support. Consequently, findings with commercial potential probably remain unexploited or are badly patented.

To increase awareness among students and faculty, TU/e took several initiatives. Regarding students, the entrepreneurship education was redesigned. Now, students learn early in their undergraduate phase about entrepreneurship education and spin-off possibilities and they can find this information in publications and on a website. Moreover, entrepreneurship education bears fruit in increasing awareness. Targeted at the faculty are the attempts to create commitment from department boards, and the appointment of local technology transfer officers at every faculty. These officers have the responsibility to scout for ideas with commercial potential and approach the inventor and the spin-off support staff about this. Furthermore, a training regarding commercializing research is offered to PhD students and new faculty members. Finally, both students and faculty are made aware of the spin-off possibilities by the cultivation of successful entrepreneurs as role models. The spin-off support staff has academic entrepreneurs sharing stories at many events at the university and in university publications or in newspapers. All these activities appear to have effect. In the words of one of the spin-off support staff members:

> In the past, one was not allowed to talk about entrepreneurship. Of course, not everybody wants to become an entrepreneur or has to. But now, a number of people is triggered by the attention to it, and says: that's funny, I will do it.

*4.  Provide spin-offs with advice and coaching from skilled people.*

At TU/e, two advisors are fully dedicated to support spin-offs and a number of other officers part-time. These advisors are experienced in entrepreneurship and entrepreneurship support. Starting at the front end of the spin-off process, their task is to scout for ideas (with help of the decentralized officers) and to screen and select the potential entrepreneurs that present their ideas or proposals. Depending on the ideas' potential and the characteristics of the entrepreneurs, they decide whether they support them or not. After these advisors have committed themselves to a spin-off, they advise them on issues like their business plan, facilities, financing, subsidy requests, start-up team, patenting, et cetera. According to our respondents, a crucial element for spin-off support staff is the personal approach to spin-offs and the flexibility and creativity of the advisors:

> There is always an arrangement for a spin-off, that's probably also part of the culture around here.

A topic that got special attention from the support staff is the assessment of skills and characteristics of the start-up team. One of their instruments to assess and develop the skills and characteristics is a special assessment tool and a workshop of several days with much interaction between entrepreneurs. If necessary, the advisors try to develop or to complement the skills of the founders. As one of the advisors reported:

> The researcher says: Nice, I will commercialize this research. However, he became researcher to remain a researcher. (...) He is actually more the future CTO than the future CEO. Then we have to organize the CEO competences next to this researcher. So, we end up with duos or trios with the right skills.

To increase knowledge of inventors, coaches are introduced. Coaches are experienced entrepreneurs that are not involved in the daily management of the company but give advice from the sideline, for example once a month. The spin-off advisors have quite a database with coaches, from different industries and backgrounds. When they observe that a start-up team needs such coaching, or when the start-up team asks for it, they will try to make a match with one of the coaches. A board of commissioners constitutes a special form of coaching. Even when spin-offs are still in the pre-start phase, spin-off advisors will recommend forming such a board. Through regularly meeting with the commissioners and reporting to them, spin-offs are urged to reflect and get some steering. As one of the starters told:

> The commissioners embody extra years of experience that we can use, that we can count on.

*5.    Support spin-offs in building their network.*
It is very important for the spin-off to establish a network to gain access to resources and to develop a value proposition for a particular market. Sometimes spin-offs already have a well-established network. But in many cases network development is welcome. One of the most natural starts is within the academic network: the inventor or his/her colleagues probably know people with specific experience, resources, facilities, or demands (as a customer). As most academic entrepreneurs reported, the academic network is a rich source and can serve as an important launching customer. Besides the academic network, the university incubator is participating in a regional incubator network, and participating in national and international networks. Especially the regional network, where also banks and people from industry participate, plays an important role (cf. Section 2.7.2). This network is helpful to provide the spin-offs with industrial coaches and to provide applicable advice, and networking tips.

The university can also be an important source to draw upon in terms of credibility. A founder reported:

> In the beginning, we had the opportunity to walk with a potential customer to the research group and to show the things we have done

> there. Otherwise, we wouldn't have had any reference. (...) It helps, when one can walk to the university and show them: this is the knowledge we can draw on.

However, the more established university spin-offs, founded between 5 and 15 years ago, reported that this reputation effect is limited. In this respect, companies have to profile themselves as independent firms and not as part of the university:

> Quickly, you want to get rid of the student image. You want to be a professional company. It is not just an experiment you are providing, but a reliable product.

6. *Create financing opportunities for spin-offs and advise them in acquiring financial resources.*

TU/e has established a wide range of financing opportunities for spin-offs, for each of the start-up phases. For the very start of a student-entrepreneur, a small loan is provided by a bank involved in the university network. This loan helps to bridge the first 17 months after graduation when the student is starting up a venture. Furthermore, from a pre-seed fund, a new venture can borrow € 35k up to € 50k. A third loan is the innovation trust of maximum € 25k, from the same bank. All loans are subordinate and will be remitted if the worst comes to the worst. In the pre-seed phase, entrepreneurs can also make 'in kind' arrangements with the university: formally, spin-offs have to pay for resources from the university, but payments can be delayed or converted into equity in the spin-off company. After the entrepreneurs have crystallized their ideas and proved that their approach will work, they can often acquire governmental grants. These grants are typically obtained by close cooperation with the university through formulating a joint project. They can also apply for about € 200k up to € 500k of investments from the so-called Technostars fund, which is created by the university and a number of network partners. Finally, after the spin-off is founded as a legal entity and the business idea appears to be sound, venture capitalists and banks can be approached to provide capital.

An important role of the spin-off support staff is to support spin-offs in acquiring this financing and funding. This in particular applies for subsidies and

grants, because these applications are due to specific procedures and writing such proposals requires specific skills and experience.

7.   *Develop obvious and supportive rules governing the exploitation of university-assigned technology.*

TU/e has established a rule for the value distribution of both royalties and revenues from the exploitation of a license in a spin-off firm: one third is allocated to the university's research group of the inventor, one-third is assigned to the inventor(s), and one third is allocated to the university's general finances. This rule intends to prevent frictions and frustrations of long negotiations, and to create clarity for inventors. According to the managing director of the technology transfer and spin-off support unit (TTO), the rules around spin-offs are established to create fairness in the distribution of the shares:

> This means: fair for the entrepreneur, fair for the faculty, fair for the university, and fair for society.

Another issue is the balance between activities that are considered as the core activities of the university – research and education – and the entrepreneurial activities. TU/e has attempted to create rules supportive for entrepreneurship that also maintain the balance between the different activities. Faculty is allowed to be active in spin-off activities and is permitted to own shares in such ventures. Especially the last aspect increases the motivation of faculty to become involved in spin-offs. To keep track of the balance with their more academic work, one measure is that all the side activities of university faculty are registered and discussed with their superiors.

Although these regulations appear to have solved some tensions and improved the entrepreneurial motivation, there are still remaining issues. This shows even more the importance of this aspect. Many entrepreneurs are positive about their negotiations with the university about intellectual property, resource usage and faculty involvement, but some entrepreneurs are very critical. The double mission of the university confuses these entrepreneurs: on the one hand the university wants to support spin-offs, and on the other hand it also wishes to create deals that are beneficial for the university. Another issue is that some

research groups are less committed to entrepreneurship than others and to some extent discourage entrepreneurial behavior of faculty.

8.  *Establish a clear support and management structure, embedded in the university, but decoupled from the academic activities and departments.*

The spin-off support and technology commercialization organization at TU/e is responsible for all activities in the technology transfer area. The managing director is directly accountable to the university board, and manages an organization that is autonomous within the university structure and part of the holding of the university. This creates clarity and accountability, and enables this organization to act 'businesslike' in their approach to spin-offs, different from the 'bureaucratic' university organization. As one of the officials reflected:

> It is important that the start-ups are responsible for their activities. When it goes well, it's their credit. But if they fail, that's their problem. We have to lay down that responsibility directly at the starters.

The semi-autonomous position of the spin-off support organization also creates the possibility for the university to have equity participations in spin-offs – often as a substitute for direct payments for facilities and the license. But the drawback is that the same officers are providing support and doing the negotiations, which causes sometimes confusing situations. As one entrepreneur observed:

> The support organization has three roles: they coach, they facilitate and they act as the negotiation counterpart. And what's very amazing: all these roles are completely mixed up in every discussion.

The management of the support organization itself is functioning quite well; it has a core team of managers and professors involved in the incubating and education activities, meeting each other every two weeks. These frequent meetings of the key executors of the entrepreneurship program enable quick solutions to bottlenecks and streamlined communication. Each of the members of this meeting can disseminate and implement decisions in their respective areas.

## 2.5 Research-based principles

The meta-synthesis of the literature results in a set of principles presented in Table 2.3. These research-based principles served to redesign and/or fine-tune several practices previously developed at TU/e, which will be illustrated in section 2.7. The remainder of this section outlines the research evidence for each principle. Table 2.3 gives an overview of the six research-based principles and outlines components of design solutions related to each principle. Table 2.4 provides examples of empirical studies and underlying theories for each principle.

1. *Screen technologies and ideas for new ventures, and subsequently provide spin-offs with advice and coaching from skilled people.*

Recruiting potentially successful ideas and entrepreneurs among both faculty and students is an important mechanism to provide inflow of incubatees (Fini et al., 2009). Relatively successful and fairly common are business plan competitions, running throughout the academic year as races among groups of students and faculty who commit themselves to specify their business ideas. In these competitions, on the one hand students and employees can be trained and on the other hand the most successful teams and ideas can be selected (Djokovic and Souitaris, 2008). Evidently, business ideas also arise outside business plan competitions.

The rigidity and form of the selection process apparently depends upon the goals of the spin-off support unit. Clarysse et al. (2005) distinguish three different incubator models, based upon 43 case studies and an extensive literature review. In the first model, labeled 'low selective', the goal is to maximize the number of spin-offs and therefore the selection criteria are extremely low and all types of spin-offs are selected. The 'supportive model' aims to create spin-offs with growth opportunities; therefore, among the criteria growth orientation is especially important. Typically, the entrepreneurs have to prepare a business plan that will be evaluated. The last model, called 'incubator', aims to create financially attractive spin-offs. The selection criteria resemble those of venture capitalists. The decision is based upon financial and strategic arguments about the interest of the research institution.

### Table 2.3: Research-based principles: Overview

| Research-based principles | Components of a design solution (based on literature) |
| --- | --- |
| 1. Screen technologies and ideas for new ventures, and subsequently provide spin-offs with advice and coaching from skilled people | Develop programs targeted to the emergence of entrepreneurial ideas within the faculty and among students<br>Set goals for spin-off creation and develop (weak versus strong) criteria for screening ideas and plans accordingly<br>Create start-up teams with the right mix of entrepreneurial skills and technological knowledge<br>Support academic entrepreneurs in the start-up process<br>Coach the start-up team, giving them time and freedom to learn |
| 2. Develop clear rules and procedures governing the exploitation of university-assigned technology | Allow exclusive licensing to entrepreneurs<br>Allocate a lower share of royalties to inventors<br>Permit spin-offs to use university resources<br>Develop clear procedures governing exploiting university-assigned technology<br>Make disclosure of inventions by faculty mandatory<br>See also under research-based principle 6. |
| 3. Provide spin-offs, throughout their development, with sufficient access to different sources of capital | Create university funds to support students and faculty in the orientation (pre-seed) stage<br>Create ways to obtain significant amounts of industry funding<br>Facilitate access to subsidies and other governmental grants<br>Permit equity investments in spin-offs |
| 4. Create a network of investors, managers and advisors around spin-offs | Create networks for the spin-off to integrate in industry and to acquire access to resources<br>Create networks with financiers (e.g., venture capitalists, business angels and banks)<br>Build long-term partnerships with other key agents to support spin-offs<br>Cultivate the prestige of the university to gain access to external resources for the spin-off |
| 5. Provide spin-offs with support services, but avoid too much embeddedness of these services in the academic environment | Provide licensing offices with skilled staff and abundant resources<br>Establish physical support infrastructures (e.g., incubators and science parks), but avoid too much embeddedness in the academic environment<br>Create a decentralized support infrastructure to secure a sufficient level of autonomy |
| 6. Shape a university culture and reward system that reinforces rather than discourages entrepreneurial behavior | Provide faculty with entrepreneurial programs<br>Develop a clear career-reward structure that stimulates entrepreneurial activities<br>Create an appropriate mix of incentives targeted to the research group and to the individual researcher(s)<br>Present successful academic entrepreneurs as role models<br>Be flexible in dealing with entrepreneurship matters (no 'one-size-fits-all' solution)<br>See also under research-based principle 2. |

Once new business ideas have been selected to include in spin-off support programs, the road to commercially unfolding products and services is still very uncertain. To improve the success chance, it is very important that the entrepreneurial team is composed in an appropriate manner, in particular with regard to knowledge and skills. Usually, inventors have sufficient technological knowledge, but their entrepreneurial skills are underdeveloped. According to Shane (2004), building a successful technology company demands three types of knowledge: about the management of a new company, about the process of product development and production, and about the potential market in which the company will operate. To create the right mix of skills and knowledge in the entrepreneurial team, it can be helpful to compose a team with people with complementary backgrounds. Empirical research shows that for example adding experienced (so-called surrogate) entrepreneurs to the team serves to enlarge the competencies of the team (Shane, 2004; Vohora et al., 2004), which often increases the potential and effectiveness of the venture (Djokovic and Souitaris, 2008; Franklin et al., 2001). These surrogate entrepreneurs can also be a good solution for a situation where the inventor has low commitment to the venture, because surrogate entrepreneurs tend to be more committed to work hard for the spin-off, thus increasing its success chance (Franklin et al., 2001; Shane, 2004).

Another solution to create the right mix of skills and knowledge of the venturing team is to provide training and support to academic entrepreneurs, thus helping them to develop the required business knowledge (Djokovic and Souitaris, 2008; Meyer, 2003). With regard to support from staff of the spin-off support unit, the skills and expertise of the staff appear to be particularly important – rather than the experience itself (in number of years) the staff has (Lockett and Wright, 2005; Mowery et al., 2004; Siegel et al., 2004). The kind of expertise needed is in the area of firm formation, because helping to start a firm requires different skills than those needed for licensing technology to established firms (Shane, 2004). In addition to the expertise of the spin-off support staff, experienced entrepreneurs can coach the start-up process (Djokovic and Souitaris, 2008).

2.  *Develop clear rules and procedures governing the exploitation of university-assigned technology.*

Clear rules and procedures for academic entrepreneurs foster new businesses. In this respect, rules and procedures serve to reduce uncertainty and prevent frictions due to the negotiations with stakeholders elsewhere in and around the university (Vohora et al., 2004). Developing clear procedures leads toward greater comfort and satisfaction with commercial activity within an academic institution,

**Table 2.4: Research-based principles:**
**Examples of empirical studies and underlying theories**

| Research-based principles | Examples of empirical studies the principle is grounded in | Examples of underlying theories |
| --- | --- | --- |
| 1. Screen potential new ventures and subsequently provide spin-offs with advice and coaching from skilled people | Clarysse et al. (2005), Shane (2001), Franklin et al. (2001), Siegel et al. (2004) | Opportunity identification (Djokovic and Souitaris, 2008; Shane, 2000; Shane, 2004) Knowledge theories (Djokovic and Souitaris, 2008) Resource based view (O'Shea et al., 2005) Organizational development theories (Clarysse et al., 2005) |
| 2. Develop clear rules and procedures governing the exploitation of university-assigned technology | Vohora et al. (2004) | Organizational justice theory (not yet applied) (Hosmer and Kiewitz, 2005) |
| 3. Provide spin-offs, throughout their development, with sufficient access to different sources of capital | Degroof and Roberts (2004), Audretsch, Weigand and Weigand (2000) | Social capital theory (Nicolaou and Birley, 2003a) |
| 4. Create and cultivate a network of investors, managers and advisors around spin-offs | Gübeli and Doloreux (2005), Hackett and Dilts (2004) | Social capital theory (Nicolaou and Birley, 2003a) |
| 5. Provide spin-offs with support services, but avoid too much embeddedness of these services in the academic environment | Bekkers et al. (2006), Debackere and Veugelers (2005) | Organizational development theories (Clarysse et al., 2005) |
| 6. Shape a university culture and reward system that reinforces rather than discourages entrepreneurial behavior | Bird and Allen (1989), Kirby (2006) | Organizational culture theories (not yet applied) (Schein, 1992) |

which will make it less necessary to leave the university when starting a new venture (which would result in high switching costs) (Bird et al., 1993). These clear policies, implemented by strong top-down leadership, support academic entrepreneurship and merge traditional academic values with an entrepreneurial orientation (O'Shea et al., 2004), thus reinforcing the entrepreneurial culture (see also research-based principle 6).

An important rule is to allow exclusive licensing to entrepreneurs, because they have to bear the risk of developing the new technology; exclusive licenses increase the success rate of attempts to acquire commercial funding of the new venture (Shane, 2004). Another rule fostering the start of new ventures is to allocate lower shares of royalties to inventors; this motivates faculty to (help to) start new ventures, because these may generate substantially higher gains compared to licensing the technology to established companies (Bekkers et al., 2006; Fini et al., 2009; O'Shea et al., 2004). Furthermore, permitting spin-offs to use university resources – for example laboratories, equipment, and office space (see research-based principle 5) – allows new firms to use expensive equipment and facilities at a lower cost (Fini et al., 2009; Shane, 2004).

Moreover, making disclosure of inventions to the technology transfer office (TTO, also referred to as spin-off support unit) mandatory will prevent loss of exploitable inventions (Shane, 2004). In most western countries, patenting legislation demands that an invention should be unique and is not based upon 'public knowledge'. When an inventor decides to publish his finding in a journal before it is patented, it will be very difficult to obtain a patent later on. Mandatory disclosure can prevent this situation (Mowery et al., 2004; Shane, 2004).

Finally, a clear reward-structure enabling entrepreneurial activities will reinforce entrepreneurship (this is discussed more extensively under research-based principle 6).

3. *Provide spin-offs, throughout their development, with sufficient access to different sources of capital.*

Access to pre-seed capital allows entrepreneurs to prove concepts and develop prototypes, with which the interest of investors from the private sector can be raised (Shane, 2004). Pre-seed funding can be obtained from university funds, particularly in case of spin-offs with early-stage technologies (Fini et al., 2009). In

addition, innovation grants and other public sector subsidies can provide this kind of capital (Djokovic and Souitaris, 2008; Rasmussen and Borch,2006). To acquire these grants and subsidies, advice and help will be necessary, to be provided by skilled staff (see research-based principle 5).

Because a start-up has limited financial resources, it should be able to arrange the use of university facilities in return for equity investments of the university in the start-up, thus reducing cash outlays (Bekkers et al., 2006; Shane, 2004). After the business idea is somewhat crystallized, proof of concepts and/or prototypes need to be developed. The latter helps to acquire commercial (seed) funding, because the business proposition of the start-up then tends to be clearer and more convincing (Degroof and Roberts, 2004).

*4.   Create a network of investors, managers and advisors around spin-offs.*

In general, networks around spin-offs have four potential benefits: augmenting the opportunity identification process, providing access to loci of resources, engendering timing advantages, and constituting a source of trust (Djokovic and Souitaris, 2008). Because of these benefits, establishment of a network is closely related to the success of the spin-off (Hackett and Dilts, 2004). First, network relations with industry are critical because networks of academic entrepreneurs are usually centered in the university and the academic community (Meyer, 2003; O'Shea et al., 2004). Networking with industrial representatives is helpful to develop technology and to learn sales and acquisition competencies (Gübeli and Doloreux, 2005). A second type of networks is that with venture capitalists and other financiers (e.g., informal investors). These networks help spin-offs to acquire access to capital, in particular for setting up production facilities (Lockett et al., 2005; O'Shea et al., 2005; Shane, 2004).

In building the network around a spin-off, the prestige of the university can serve to open doors (Fini et al., 2009; Gübeli and Doloreux, 2005). Enabling the spin-off to use the name of the university facilitates the acquisition of resources (e.g., venture capital) under conditions of uncertainty and information asymmetry (Shane, 2004).

To facilitate the development of networks around individual spin-offs, the university should consider building long-term partnerships with other actors to support the spin-off in certain phases of the process (Degroof and Roberts, 2004).

Such a network around the university can be created by, for example, supporting mobility between university and industry (in both directions), collaborative research and consulting, and contacts with alumni (Rasmussen and Borch, 2006).

5.  *Provide spin-offs with support services, but avoid too much embeddedness of these services in the academic environment.*

Central in the support infrastructure of a university are services in the area of contracting, dealmaking, networking and coaching (provided by a spin-off support unit). This infrastructure enables the valorization of academic research (O'Shea et al., 2005). Regarding these support services, the literature suggests specific elements for their design:

-   Provide licensing offices with abundant resources to support university spin-off formation, because firm formation is more expensive and time-consuming than licensing to established firms (Shane, 2004; Vohora et al., 2004).
-   Incubators provide physical facilities, advisers, coaches et cetera; as such, they are widely seen as playing a critical role in science-driven innovation (Fini et al., 2009; Kirby, 2006; Meyer, 2003). Incubators also support spin-offs by providing external legitimacy and networking with outside actors (Rasmussen and Borch, 2006) and they allow spin-offs to develop university technology in close proximity to inventors by providing office space. Incubator staff often also helps negotiating the use of university resources like labs and equipment in academic departments (Bekkers et al., 2006) (see also research-based principle 2).
-   Although incubators appear to have mainly positive effects, some studies suggest incubators may keep weak start-ups alive. The latter problem can be prevented by proper arrangements and the requirement to pay a price for the facilities of the incubator (Bekkers et al., 2006).
-   In addition, too much embeddedness of the spin-off support in the academic and university environment can have negative effects, because the networks of spin-offs could then develop primarily in the academic world. Moreover, if the latter networks are primarily in academic in nature, industrial and other external parties are likely to consider the spin-off as an academic venture rather than a real business (Bekkers et al., 2006; Vohora et al., 2004). The support infrastructure should therefore be organized to secure a sufficient

level of autonomy, which enables developing relations with industry without creating conflicts of interest between commercialization and research/ teaching activities (Debackere and Veugelers, 2005).

6. *Shape a university culture that reinforces rather than discourages entrepreneurial behavior.*

The university culture, in terms of its key norms and values, positively or negatively affects entrepreneurial behavior of faculty members (Bird and Allen, 1989; Djokovic and Souitaris, 2008). A university culture facilitating and motivating academic entrepreneurship helps to increase the awareness of students and scholars of opportunities to commercialize technologies developed in the university. When social norms exclude entrepreneurial activities, less people would tend to start a new venture from their university. Research and education are valued far above entrepreneurship at most universities. If this is the case, it will be necessary to shape an entrepreneurial culture. Shaping such a culture takes much time, because faculty has to adopt altered values (Debackere and Veugelers, 2005). The literature suggests some guidelines for developing an entrepreneurial culture. Sometimes these guidelines overlap with others, previously mentioned, but they are listed here for their explicit contribution to an entrepreneurial culture within the university.

- Provide faculty with entrepreneurial educational programs because this reinforces entrepreneurial culture, which enhances the creation and development of spin-offs (Bird and Allen, 1989; Djokovic and Souitaris, 2008; O'Shea et al., 2005; Rasmussen and Borch, 2006).

- Adjust the reward structure toward more support for entrepreneurial activities. Usually, in universities the reward-structure is build upon publications and not on entrepreneurial activity (Siegel et al., 2004). Thus, the academic careers of scholars engaging in entrepreneurial activities could come to a dead end. For many scholars this would be very unfavorable, because their entrepreneurial activities have very uncertain outcomes. Therefore, it is important to develop clear rules and rewards for how faculty can engage in entrepreneurial activities. These clear rules can include offering leaves of absence for inventors who wish to found companies (Shane, 2004); other rules may be about temporarily freezing the tenure clock (Fini et al.,

2009)**.** Including recognition and rewards for entrepreneurial activities in the individual performance evaluation system would cause a change in norms and subsequently in values toward higher valuation of entrepreneurship (Kirby, 2006; O'Shea et al., 2004; Rasmussen and Borch, 2006; Vohora et al., 2004).

- Create an appropriate mix of incentives targeted to research groups as well as to individual inventors and entrepreneurs, allowing them to participate in the financial benefits of their activities (Debackere and Veugelers, 2005; Siegel et al., 2004). This creates more commitment and tolerance toward academic entrepreneurship (Bird et al., 1993).
- Present successful academic entrepreneurs as role models, because these help to educate potential entrepreneurs about formation of new firms and serve as examples that motivate others to found new firms (Kirby, 2006; O'Shea et al., 2004; Rasmussen and Borch, 2006; Shane, 2004; Vohora et al., 2004).
- Be flexible in dealing with entrepreneurship matters. For example, flexibility is required when it comes to negotiating and accepting equity stakes in spin-offs (Siegel et al., 2004). In general, a university should try to enable a spin-off to build a profitable business while allowing the university to appropriate some of the rents of the invention. Such an approach to stimulate entrepreneurship can only succeed with a decentralized management approach (see also under research-based principle 5) that implies sufficient freedom to engage in and act upon opportunities (Debackere and Veugelers, 2005).

The rules and procedures guarding the exploitation of technology also influence entrepreneurial behavior. Particularly the clarity of rules and procedures is important here, because the latter translate the university's mission regarding entrepreneurship into operational terms. For more detailed guidelines with regard to rules and procedures, see also under research-based principle 2.

To shape an entrepreneurial culture, the key agents should be aware of the disadvantages of and objections against strong links between university and industry. Slaughter and Rhoades (2004) argue that faculty's entrepreneurial engagements more or less undercuts their commitment to teaching and services. Policies targeted to stimulate entrepreneurial behavior also shift attention toward areas with more patenting possibilities (Shane, 2004). To balance academic values

such as autonomy and rigor with valorization activities (incl. spin-offs), the discussed design principles as well as the right set of intentions are crucial.

Regarding these intentions, university administrators need to realize that universities should not engage in university spin-offs because of the expected financial benefits; there is hardly any, as the evidence collected by Shane (2004) suggests. If universities decide to commit themselves to entrepreneurship and support of spin-offs, they should do this to help commercialize technologies that would otherwise remain unexploited into applications with large potential benefits to society. The side-effect, of course, is that the university's reputation and prestige will very likely also benefit. The highly contentious issue of university-industry links underlines the importance of creating clear rules and procedures for spin-off creation (see research-based principle 2).

## 2.6 Design principles

The process of comparing and synthesizing the two sets of principles leads to the following set of design principles: *To build and increase capacity for creating spin-offs, universities should design and implement practices that:*

1. Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty.
2. Support start-up teams in composing and learning the right mix of venturing skills and knowledge by providing access to advice, coaching and training.
3. Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors.
4. Set clear and supportive rules and procedures that regulate the university spin-off process, enhance fair treatment of involved parties, and separate spin-off processes from academic research and teaching.
5. Shape a university culture that reinforces academic entrepreneurship by creating norms and exemplars that motivate entrepreneurial behavior.

Table 2.6 links this set of design principles to aspects of practices created in Eindhoven University of Technology as well as to the theories that explain the processes in these principles.

To illustrate the process of constructing these design principles from practice-based principles and research-based principles, we provide one example of how we arrived at one of the five principles. Moreover, Table 2.5 shows how all the research-based principles and practice-based principles relate to the final set of design principles.

*2.6.1 Constructing design principle 1*

In Section 2.4, we have reported the following practice-based principles:

Practice-based principle 2: *Embed entrepreneurship education in the curriculum targeted at spin-off stimulation within the curriculum.*

Practice-based principle 3: *Make potential entrepreneurs (students, PhD-students, faculty) aware of opportunities to start a venture based on a research finding.*

In the reviewed literature (see section 2.5) several programs and practices dealing with the incubation, selection and support of (proposed) ventures are found and assessed. These research findings are captured in the following research-based principle:

Research-based principle 1: *Screen technologies and ideas for new ventures, and subsequently provide spin-offs with advice and coaching from skilled people.*

In addition, we listed theories describing the generative processes underlying this principle (see Table 2.4): opportunity identification theory provides a theoretical framework that explains the role of programs targeting the emergence of entrepreneurial ideas (Ardichvili et al., 2003; Djokovic and Souitaris, 2008; Shane, 2000; 2004); moreover, knowledge theory explains how (previous and current) training, coaching and advice processes affect the entrepreneurial dispositions and intentions of students and faculty (Djokovic and Souitaris, 2008).

## Table 2.5: Synthesis of practice-based and research-based principles

| Design principles | Practice-based principles | Research-based principles | Underlying theories |
|---|---|---|---|
| 1. Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty. | 2. Embed entrepreneurship education in the curriculum targeted at spin-off stimulation within the curriculum<br>3. Make potential entrepreneurs (students, PhD-students, faculty) aware of opportunities to start a venture based on a research finding | 1. Screen technologies and ideas for new ventures, and subsequently provide spin-offs with advice and coaching from skilled people | Opportunity identification<br><br>Knowledge theories |
| 2. Support start-up teams in composing and learning the right mix of venturing skills and knowledge by providing access to advice, coaching and training. | 4. Provide spin-offs with advice and coaching from skilled people<br>8. Establish a clear support and management structure, embedded in the university, but decoupled from the academic activities and departments | 5. Provide spin-offs with support services, but avoid too much embeddedness of these services in the academic environment | Resource based theory<br>Organizational development theories |
| 3. Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors. | 1. Establish a physical infrastructure for spin-offs and allow spin-offs to use university resources<br>5. Support spin-offs in building their network<br>6. Create financing opportunities for spin-offs and advise them in acquiring financial resources | 3. Provide startups, throughout their development, with sufficient access to different sources of capital<br>4. Create a network of investors, managers and advisors around spin-offs | Social capital theory |
| 4. Set clear and supportive rules and procedures that regulate the university spin-off process, enhance fair treatment of involved parties, and separate spin-off processes from academic research and teaching. | 7. Develop obvious and supportive rules governing the exploitation of university-assigned technology | 2. Develop clear rules and procedures governing the exploitation of university-assigned technology | Organizational justice theory |
| 5. Shape a university culture that reinforces academic entrepreneurship by creating norms and exemplars that motivate entrepreneurial behavior. | | 6. Shape a university culture and reward system that reinforces rather than discourages entrepreneurial behavior | Organizational culture theories |

**Table 2.6: Set of design principles**

| Aspects of practices/solutions in case study | To build and increase capacity for creating spin-offs, universities should design and implement practices that: | Underlying theories |
|---|---|---|
| Involve spin-off advisors in entrepreneurship education.<br>Enable students to combine their thesis work with the preparations for starting a venture.<br>Give students early in their study information about entrepreneurial opportunities.<br>Appoint a local technology transfer officer within each school<br>Offer newly hired employees a training regarding technology commercialization.<br>Screen and select potential entrepreneurs based on their potential. | 1. Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty. | Opportunity identification (Djokovic and Souitaris, 2008; Shane, 2000; 2004)<br><br>Knowledge theories<br>(Djokovic and Souitaris, 2008) |
| Create student (start-up) teams from multiple disciplines.<br>Advise spin-offs with regard to their business plan, facilities, finance, subsidy requests, start-up team, patenting, et cetera.<br>Spin-off advisors need to be creative in finding solutions and approach spin-offs in a personalized way.<br>Create start-up teams with the right mix of skills, by training or by adding people to the team.<br>Build a pool of entrepreneur coaches that are willing to advise spin-offs from practice.<br>Create a board of commissioners around each spin-off.<br>Provide advice regarding the acquisition of grants. | 2. Support start-up teams in composing and learning the right mix of venturing skills and knowledge by providing access to advice, coaching and training. | Resource based theory<br>(O'Shea et al., 2005)<br>Organizational development theories<br>(Clarysse et al., 2005) |
| Create arrangements for spin-offs to use university labs and other resources.<br>Provide office space with the possibility to use different services.<br>Create flexible contracts and good conditions, but market prices.<br>Enable spin-offs to use the academic network of the university. | 3. Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors. | Social capital theory<br>(Nicolaou and Birley, 2003a)<br>Organizational development theories<br>(Clarysse et al., 2005) |

## Table 2.6: Set of design principles (continued)

Establish a network around the support organization of investors, industry contacts and financers.

Set up regular meetings with the core network partners to discuss start-ups proposals, etc.

Cultivate the prestige of the university to gain credibility.

Organize networking events with spin-offs.

Create funds to support prospective academic entrepreneurs in de orientation stage.

Create ways to obtain significant amounts of funding.

Permit equity investments of the university in spin-offs, in exchange for payments.

Create a structure that enables the university to have participations in spin-offs.

| | | |
|---|---|---|
| Establish fair rules regarding the internal distribution of revenues from the exploitation of inventions.<br>Create procedures to manage and assess the balance between academia and business.<br>Allow faculty to take equity in spin-offs. | 4. Set clear and supportive rules and procedures that regulate the university spin-off process, enhance fair treatment of involved parties, and separate spin-off processes from academic research and teaching. | Organizational justice theory (not yet applied)<br>(e.g., Hosmer and Kiewitz, 2005) |
| Create commitment at faculty boards.<br>Cultivate successful entrepreneurs as role models.<br>Establish a clear and accountable structure, with high commitment of the university board.<br>Establish an organization that is operating 'businesslike'. | 5. Shape a university culture that reinforces academic entrepreneurship by creating norms and exemplars that motivate entrepreneurial behavior. | Organizational culture theories (not yet applied)<br>(e.g., Schein, 1992) |

A comparison of this practice-based principles and the research-based principle results in the following observations. The practice-based principles involves educational embeddedness, information provision, visible support, and scouting potential entrepreneurs. The research-based principle deals with emergence of ideas, goals for spin-off creation, advice, coaching and training. Both principles focus on the idea generation phase of the spin-off process; in addition, the research-based principles deal with advice, coaching and training. Because other practice-based principles (4 and 8) and a research-based principle (5) also consider the advice, coaching and training aspects, we included those in a different design principle (principle 2). This results in the following design principle (see Table 2.5):

Design principle 1: *Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty.*

*2.6.2 Constructing design principle 3*
In Section 2.4, the following practice-based principle is developed:

Practice-based principle 5: *Support spin-offs in building their network.*

From the literature, the findings regarding network development are summarized in one research-based principle:

Research-based principle 4: *Create and cultivate a network of investors, managers and advisors around spin-offs.*

The research findings underlying this principle have been discussed in the previous section. We also identified the main theory underlying this principle, namely social capital theory (Nicolaou and Birley, 2003a) (see Table 2.4).

This practice-based principle and the research-based principle overlap to a large extent. Thus, it appears obvious to combine these two into one design principle. However, social capital theory covers multiple research-based principles (3 and 4) and practice-based principles (5 and 6 and the main aspects of

1, see Table 2.5). All principles refer to aspects of resource acquisition: by network building, but also through providing finance and establishing guidelines for investing in spin-offs. Thus, research-based principles 3 and 4 and practice-based principles 5 and 6 are synthesized in one design principle dealing with access to resources (see Table 2.6):

> Design principle 3: *Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors*.

## 2.7 Using design principles

This section illustrates the use of design principles as well as the interaction between emergent and deliberate design (see Figure 2.1). To illustrate how emergent design and deliberate redesign – informed by design principles employing research findings – interact, we discuss in section 2.7.1 and 2.7.2 how two key practices at TU/e emerged (which are codified into practice-based principles) and then turn to how a more deliberate approach, drawing on additional insights from research-based principles, served to redesign these solutions. Furthermore, section 2.7.3 discusses how the design principles can serve to identify and address remaining (future) design challenges. In section 2.7.4 we discuss how the set of design principles serves identifying issues to be addressed by research and theory development.

### 2.7.1 Technology Entrepreneurship Program
The first idea for a university-wide entrepreneurship program for Master students arose from an experiment set up by a professor in chemical technology, who formerly worked in the lab of a multinational firm:

> Over there, I got infected by the high tech entrepreneurial attitude: the combination of research into technology and the attempt to commercialize this research. This is a research mentality of not just doing funny things in the lab, but also bringing them to the market.

In 2003, this professor collaborated with a visiting professor from Brown University (USA), and they decided to experiment with implementing ideas from Brown University's engineering entrepreneurship program (cf. Creed et al., 2002). They formed three teams with students from both the management and chemistry schools; the two initiators and an entrepreneurship professor supervised these teams. The teams conducted applied research on a patented invention from the chemistry school's lab. For example, in one of the teams a chemistry student worked on a graduation (MSc) project in which an application of the technology was prototyped in the chemistry lab, whereas the management student did his MSc final project on the market, strategic and financial approach toward commercializing this application; together, these two students wrote a business plan for the new venture. Two team projects failed to generate a valid business proposition, but the third team was able to develop a successful spin-off. This venture attracted its first major clients and recently built its first plant.

This initial experiment motivated the spin-off support unit to develop a university-wide program along the same lines (see practice-based principle 2, Table 2.2). The program was further developed, renamed, and embedded in the management school. Compared to the pilot developed in the chemistry school, the program was further developed in terms of an on-line self-assessment system; a contracting stage to align the perceptions of inventor, university, and entrepreneurs; several courses offered by the management school; a master class in entrepreneurial skills; and a coaching system. An important aspect of the redesigned program is that students can obtain the certificate in Technology Entrepreneurship (TE) by completing their individual final projects and the educational components of the program, even when the effort to start up a new firm fails.

These adaptations and extensions of the initial pilot were motivated and constructed with help of principles derived from research on university spin-offs and entrepreneurship education. In particular design principle 1 has been guiding this redesign (see Table 2.6). In this respect, the Technology Entrepreneurship program links entrepreneurial intentions to explorative activities to set up and realize a venture. Several scholars report a positive effect of entrepreneurship education on intentions to create ventures and spin-offs (e.g., Peterman and Kennedy, 2003; Vesper and Gartner, 1997). However, the challenge is to move from intentional to actual, nascent entrepreneurship because there is a

gap, or at least a time lag, between intention and action (Souitaris et al., 2007). Nascent entrepreneurs are people who actually are performing activities to establish a company – for example, by developing prototypes, acquiring personal commitments, searching for financial support, contacting clients (cf. Lichtenstein et al., 2007). Souitaris et al. (2007) found evidence that entrepreneurship programs that include teaching, business-planning, interaction with practice and university support, enhance students' propensity to become entrepreneurs. The Technology Entrepreneurship program at TU/e attempts, and in certain cases succeeds, to bring students from being intentional entrepreneurs to become nascent entrepreneurs or even actually found a new firm. Typically, the new firm is founded after graduation, so the program primarily deals with the nascent stage.

Since the formal start of the university-wide program in Technology Entrepreneurship in 2004 until 2007, 18 projects have been kicked off with 28 students involved. In the meantime, three projects have produced a spin-off firm. Eight projects were completed, but without starting a spin-off; that is, all students involved completed their MSc degree and obtained the TE certificate, but the process of writing a business plan led the participants to conclude that the intended business is not (yet) feasible.

In case of the aborted attempts to generate spin-offs, our interview data suggest that in most cases the technology was still too immature to be commercialized. Moreover, the students aborting these spin-off projects did not want to invest in further work on start-ups with a highly uncertain payback (period). Overall, the program has produced several successful technology spin-offs in a relatively short period, and in the other cases, the program has created graduates with valuable entrepreneurial experience.

*2.7.2 Incubator Network*

In 2003, TU/e's spin-off support unit set up a regional incubator network. In this network, eight regional organizations work together to support start-ups. Involved are three regional development organizations (Syntens, NV Rede and NV BOM) a local bank (Rabobank), the incubator of a multinational firm (Philips), an applied research organization (TNO), two undergraduate colleges (Fontys and Design Academy), and TU/e. The incubator network was created to pool resources as well as to provide access to each others' contacts and resources.

Every two weeks, representatives of all eight organizations meet to discuss ideas, plans and presentations by (would be) entrepreneurs - including students and faculty from TU/e. In these meetings, people get direct feedback on their ideas and plans and the representatives from the eight organizations are invited to explore how their networks and contacts can contribute to the proposed new ventures. The group of representatives also frequently provides starters with experienced coaches. For example, one of these representatives explains:

> It gives them possibilities at Philips Research and at TNO. The first time a spin-off needs something, they can use equipment from these research sites for free or with a discount. So, they can use such equipment to see if their concept 'works' or not.

Around the eight formal partners in the incubator network, about another 20 firms are committed to help spin-offs with advice or services against reduced fees (e.g., lawyers, tax consultants, and recruitment and selection firms). In addition, the incubator network has created a fund to directly support spin-offs and it frequently provides start-ups access to banks, informal investors and venture capital firms. This fund helps to make the first investments to develop a prototype (as a proof of principle), thus bridging the first stages of the 'valley of death' from invention to innovation (Auerswald and Branscomb, 2003). Each year, about 75 students from TU/e ask for assistance from the incubator network, and if they are selected, they get access to the resources and services of the network. Annually, about 50 applications are granted.

The interview data collected suggest the incubator network helps spin-offs in developing their own networks as well as in acquiring financial and other resources. For most spin-offs, the single most valuable aspect is that the network helps them build relationships with investors, coaches, other new ventures, potential clients and other (support) organizations. In addition, the incubator network also creates reputation value for the new venture (e.g., in approaching and dealing with potential clients, investors, and the tax office). These practices have been codified in practice-based principle 5 and 6.

The incubator network was pioneered by TU/e's spin-off support unit. When a research team (the author and the thesis supervisors) came on board in 2005, it

started identifying key opportunities for further development of the network. A core issue here was the development of the personal and professional networks of the participating starter-entrepreneurs in the incubator network. The incubator network at that stage merely served to refer starters to helpful contacts, rather than motivate and facilitate spin-offs to build interpersonal relationships.

Both network and entrepreneurship researchers, however, have emphasized the importance of these interpersonal ties – especially those with relevant people outside academia (Nicolaou and Birley, 2003a; Ring and Van de Ven, 1994; Shane, 2004). This is in the core of research-based principle 4 (see Table 2.3 and the resulting design principle 3 (see Table 2.6). In this respect, people involved in university spin-offs start out with interpersonal networks that are primarily academic in nature; if they do not invest in ties with the industrial and financial world, industry representatives and investors are likely to consider the spin-off as an academic venture rather than a real company (e.g., Bekkers et al., 2006; Vohora et al., 2004). Drawing on social capital theory, Nicolaou and Birley (2003b) argue that networks around spin-offs have four potential benefits. First, networks augment the opportunity identification process, as it enhances the entrepreneurs' recognition capabilities because entrepreneurs can discover the opportunity through the right personal contact. Second, networks provide access to loci of resources, for example to acquire access to capital, as is offered in the TU/e case by the cooperation with the bank in the incubator network. Third, networks engender timing advantages, because the entrepreneur is able to know and utilize opportunities quicker. Fourth, a network such as the incubator network constitutes a source of trust and credibility with regard to the spin-off company, because these network partners are credible organizations that back the start-up (Nicolaou and Birley, 2003b). Because of these benefits, the establishment of a network is closely related to the success of the spin-off (Hackett and Dilts, 2004).

Therefore, the incubator network decided to invest more resources and effort in recurrent events intended to motivate and facilitate the development of interpersonal ties. Within the incubator network program, starters can now attend a variety of network events, including so called Meet & Match sessions where starters pitch their propositions to investors and representatives from industry. These sessions are perceived to be very useful for skill development, feedback

received, and opportunities to develop new ties. For example, one of the starters evaluated the last Meet & Match event he attended:

> Last time, there was a Meet & Match, where starters and business sit down together. We got three useful contacts out of it. That's the way we get our first clients.

### 2.7.3 (Re)designing spin-off creation at TU/e

The TU/e case illustrates how a more emergent design process, driven by practitioners, can be extended and enhanced by means of a more deliberate approach. The two discussed practices – the Technology Entrepreneurship program and the incubator network – were pioneered by practitioners and subsequently fine tuned with help of research-based insights.

Table 2.7 provides an overview of the annual number of spin-offs, exploiting intellectual property developed at TU/e. The spin-offs in 2005 and 2006 include three spin-offs developed from the Technology Entrepreneurship program. The trend in Table 2.7 suggests that TU/e is on track in terms of increasing its ability to commercialize intellectual property by means of spin-offs.

However, the design principles in Table 2.6 also expose blind spots and therefore major areas of improvement, as illustrated in the remainder of this section. Many interviewees observed that TU/e still misses an entrepreneurial culture. Faculty tend to focus on academic research and education; technology transfer and in particular spin-off formation is rather foreign to most faculty in this university. This is therefore a major barrier to spin-off creation. For example, the coordinator of the Technology Entrepreneurship program observed:

> Students experience resistance. They say: I'm allocated to a research group and I would like to combine my graduation project with exploring the start of a spin-off in the Technology Entrepreneurship program. However, my supervisor from the subdepartment is not convinced, because he has his own agenda and says: I 'd like that you do this research, because that's what I'm involved in. That clashes sometimes and causes some students to abandon the program. These students were

quite enthusiastic, but when they go back to the research group they're graduating in, they may talk them out of it.

Table 2.6 indeed implies that TU/e has hardly developed solutions and practices implied by the fifth design principle regarding an entrepreneurial culture. Evidently, this is enormous challenge. More than any other principle in Table 2.6, the creation of an entrepreneurial culture requires a university-wide effort and long-term commitment by all stakeholders involved. Once such a university culture starts to develop, it helps to increase the awareness among scholars and students of opportunities to commercialize inventions developed in the university (Bird and Allen, 1989; Djokovic and Souitaris, 2008). Shaping such a culture takes much time, because both scholars and administrators need to adopt altered values (Clark, 1998; Debackere and Veugelers, 2005).

Some initial measures to create conditions for an entrepreneurial culture to arise have recently been adopted at TU/e including, for example, the cultivation of successful entrepreneurs as role models (see design principle 5 in Table 2.6). Important other changes, such as adjusting the career-reward structure toward

**Table 2.7: Number of IP-based spin-offs from TU/e (1997-2008)**

| Year | IP based spin-offs |
|------|--------------------|
| 1997 | 1 |
| 1998 | 0 |
| 1999 | 0 |
| 2000 | 5 |
| 2001 | 3 |
| 2002 | 2 |
| 2003 | 0 |
| 2004 | 8 |
| 2005 | 8 |
| 2006 | 10 |
| 2007 | 8 |
| 2008 | 8 |

explicit incentives and rewards for entrepreneurial effort and performance (Siegel et al., 2004), have not been implemented at TU/e. At most universities the key incentives for academic scholars motivate them to focus on publications rather than entrepreneurial activity (Siegel et al., 2004). Thus, many scholars in TU/e and elsewhere tend to believe that engaging in entrepreneurial activities (with highly uncertain outcomes) will undermine their academic career.

Therefore, it is important to develop clear standards and rewards that specify how and why faculty can engage in entrepreneurial activities: for example by offering leaves of absence for inventors who wish to found companies (Shane, 2004); temporarily freezing the tenure clock (Fini et al., 2009); and individual performance evaluation systems that are likely to increase the respectability of entrepreneurship (Kirby, 2006; O'Shea et al., 2004; Vohora et al., 2004). Moreover, Slaughter and Rhoades (2004) argue that faculty's entrepreneurial engagement may undercut their commitment to teaching and services, particularly those irrelevant to the pursuit of patents and spin-off companies. Strong incentives for entrepreneurial behavior may also shift attention from research areas with few patenting opportunities toward those with more patenting potential (Mustar et al., 2006). In addition, the patenting of university technologies, as an important basis for spin-offs, may prevent a free flow of knowledge within the academic world (cf. Argyres and Liebeskind, 1998; Vallas and Kleinman, 2007; Welsh et al., 2008). Creating a balance between incentives for research and teaching and those for entrepreneurship is therefore a delicate matter.

### 2.7.4 Reflecting on research and theory development

The developed design principles serve to reflect on the comprehensiveness of research efforts and theory development and explore to what extent the practice of university spin-off generation is described and explained in scholarly work. In this respect, Table 2.6 illustrates that some design principles are not yet incorporated in theory about university spin-offs. A major example is design principle 4: *Set clear and supportive rules and procedures that regulate the university spin-off process, enhance fair treatment of involved parties, and separate spin-off processes from academic research and teaching*. This principle and some of the practices observed in the TU/e case are not yet grounded in any theoretical frameworks. Theory adopted from organizational justice literature may serve to develop a

theory of the formation and effects of fairness perceptions on university spin-off processes and the role that clear procedures and rules play to foster perceptions of fairness (e.g., Hosmer and Kiewitz, 2005).

## 2.8 Discussion and conclusions

This chapter proposes a design science approach to the creation of university spin-offs. This approach was applied in developing a spin-off support infrastructure at a Dutch university of technology. The latter case study illustrates some of the benefits as well as challenges of a design science perspective.

As argued earlier, design science research connects the body of scientific knowledge to the pragmatic, action-oriented knowledge of practitioners. In order to develop deeper understanding of the spin-off creation process, this study started with codifying practitioners' knowledge. As such, we discussed how an emergent design approach developed at a particular university enhances the ability to create more university spin-offs. Once a number of components of the infrastructure were in place at this university, a more deliberate design process served to extend and improve the existing practices and solutions.

In this respect, two important issues arise. First, a largely emergent design process induced the design process, not a deliberate design process per se. This counters the prevailing view in the literature on the dominant role of a deliberate design approach, which tends to ignore the role of emergent processes. By contrast, the role of deliberate design in the TU/e case was mainly to fine-tune and improve the solutions created by pioneering practitioners.

Second, the TU/e case suggests two fundamentally different phases in the design process, with one phase involving the creation of an infrastructure for spin-off creation that creates conditions for a subsequent phase focusing on spin-off support. This differentiation into phases has been largely ignored in the university spin-off literature, which focuses on spin-off formation in terms of 'hands-on support' but has overlooked the role of an important phase preceding this. Thus, the literature tends to implicitly assume a certain university-wide infrastructure being in place and in operation. In this respect, the case study in the previous section suggests that it is critical to embed spin-off incubation in educational activities as well as network ties with industry, investors and other external stakeholders. These pre-incubation activities are likely to increase the

inflow of people, ideas and resources in the process of actually creating ventures that may result in successful spin-offs. With the design and implementation of pre-incubation systems and processes, any investment in direct support to spin-offs is more likely to pay off.

*2.8.1 Theoretical and practical implications*

This study has several implications. The case study suggests that emergent design processes can be essential in getting started as well as in experimenting with potential solutions. It also shows that a deliberate design approach can assure that the process stays on track by safeguarding and improving it, particularly by codifying design solutions and principles. The emergent and deliberate approaches therefore complement each other. The emergent design process underlines the complexity of the processual side of university spin-off creation, whereas deliberate design pushes an emergent process to go beyond its informal and at times chaotic ways of operating. Therefore, the confrontation and interaction of the two approaches helps to build a cumulative body of knowledge *and* practice, as an essential step to a common theoretical framework in the field of entrepreneurship and spin-off creation by universities.

More specifically, the set of design principles resulting from this study provides a benchmark for any future work that deliberately links efforts to increase spin-off creation capacity to scholarly research in this area. The principles described in Table 2.6 are preliminary in nature, in the sense that other case studies will adapt and extend these results. Moreover, these five design principles refer to basic conditions and practices (cf. minimum requirements) that need to be created to build some capacity for spin-off creation. That is, they apply to universities that experience major difficulties in creating spin-offs, rather than those already performing effectively in this area.

*2.8.2 Limitations and future research directions*

A limitation of the approach taken in this chapter is its restriction to a single case. The single case study approach provides opportunities to develop an in-depth understanding of the process of spin-off formation at a particular university, but it limits the generalizability of our findings. In particular, it is difficult to generalize findings to other disciplines and university types. Previous studies

imply spin-offs mainly originate from the sciences instead of the arts and the social sciences; within the sciences most start-ups tend to arise from the life sciences – for example biotechnology, pharmacy, and medical devices (e.g., Meyer, 2003; Shane, 2004). Thus, as TU/e is a university specializing in the sciences and technology, the developed design principles d may not equally apply to other university types and research areas.

Moreover, future developments in the institutional context of universities may undermine the findings from this chapter. For example, the findings that produce the design principle regarding supportive rules and procedures (design principle 4) assume the IP and educational regime that is currently prevailing in most countries in the western part of the world (e.g., Bayh-Dole Act in the USA and similar regulations elsewhere). If this regime changes significantly, related design principles will also have to be revised.

Overall, this chapter produces a number of new insights that carry relevance beyond the context of the case studied. Any university that wishes to stimulate spin-off activity needs to start by creating an infrastructure for pre-incubation as well as support of spin-offs. The TU/e case illustrates how this can be done. The experiences and resulting design principles can serve as a basis for other universities wishing to engage in university spin-off creation as well as for future research in this area.

The case study also produced two design principles that need further development. The design principle regarding supportive rules and procedures is not yet grounded in the university spin-off literature. Here, the results of this chapter reveal that theoretically and practically important questions around fair distribution of revenues of the spin-off activities are under researched. In particular, an organizational justice framework, adapted to the entrepreneurship context, could help to develop a deeper understanding of the role of rules and procedures regarding spin-off formation by universities. This direction will be followed in the next two chapters. Moreover, the design principle regarding entrepreneurial culture implies a major deficiency in the current practices of spin-off formation at TU/e. These findings suggest that building an entrepreneurial culture constitutes a challenging agenda for future studies.

A specific challenge is to decontextualize some of the issues arising from the TU/e case and to adapt them in such a way that they fit with another institutional

context. In this respect, most previous studies suggest a 'general logic' regarding the process of spin-off formation. The approach chosen in this study implies that research findings following this general logic have to be adapted and contextualized in view of the local institutional contingencies (cf. Figure 2.1). When done effectively, two potential risks in the complex process of university spin-off creation can be diminished: 'getting lost' in the potentially overwhelming local complexity of spin-off creation on the one hand and developing too generic theories overlooking local idiosyncrasies on the other hand. In Chapter 5, this interaction between designing and context will be further explored.

Evidently, any set of design principles grounded in practice and research evidence is no guarantee for success. The issues raised by university spin-offs are extremely complex, even when participants have access to a body of knowledge and experience codified in design principles. Moreover, any body of knowledge will continue to evolve as a result of new empirical findings as well as experiences obtained in new settings.

In sum, a design science approach provides a relatively new perspective on researching and practicing the creation of university spin-offs. This perspective suggests that studying and practicing academic entrepreneurship are two sides of the same (future) coin, involving a coherent body of explanatory and normative knowledge in this area.

# CHAPTER 3

# CREATING FAIR DEALS: FAIRNESS HEURISTICS[4]

## 3.1 Introduction

Fairness perceptions influence human attitudes and behavior. This has been demonstrated convincingly by research in both organizational and interorganizational settings (Ambrose, 2002; Luo, 2008; Xia et al., 2004). In this respect, fairness refers to the individual, subjective assessment of what is just in a certain relationship or transaction (Colquitt et al., 2001). Studies on the fairness perceptions of entrepreneurs have demonstrated that perceptions of fairness have a positive impact on the degree of learning between investors and entrepreneurs as well as on the amount and quality of knowledge exchange between them (Busenitz et al., 2004; Howorth et al., 2004; Lubatkin et al., 2007). In contrast, perceived unfairness negatively affects these social exchange processes that are crucial for a venture's development and performance (Busenitz et al., 1997; De Clercq et al., 2010). These insightful findings on the role of fairness in entrepreneurial processes notwithstanding, most previous studies have assumed that fairness perceptions by entrepreneurs are formed in the same way as in employer-employee relationships. The current wisdom on the effect of entrepreneur's fairness perceptions draws on established organizational justice theory, which describes the use of fairness rules guiding the formation of fairness perceptions in workplace settings (e.g., Busenitz et al., 1997; De Clercq et al., 2010; Sapienza and Korsgaard, 1996). However, these fairness rules may not necessarily be applicable within an entrepreneurial context, as also in other contexts different rules are found (Hollensbe et al., 2008; Maxwell, 2002).

Compared with more regular workplace settings, entrepreneurship is characterized by a higher degree of uncertainty and the importance of venture governance issues (cf. Baron, 1998; Busenitz and Barney, 1997; Shane and

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Venkataraman, 2000). These different conditions are not covered in the 'traditional' established fairness rules, suggesting that the formation of fairness perceptions by entrepreneurs may be guided by different or complementary fairness rules than those employed in more regular organizational settings. The purpose of this chapter is to identify the heuristics underlying the formation of fairness perceptions of entrepreneurs. As such, this chapter serves to answer the following question (subquestion 2):

*What are the heuristics underlying the formation of fairness perceptions of academic entrepreneurs?*

Here, the term 'fairness heuristics' signals the explorative nature of these fairness rules. This chapter also examines how the use of entrepreneurship-specific fairness heuristics complements the use of the more established fairness rules, which are usually grouped in four dimensions (Colquitt, 2001).[5] In addition, we explore whether different entrepreneurs employ these heuristics and rules in different ways. We focus on two characteristics which surfaced from this study and earlier studies: experience and formal position. A better understanding of the formation of fairness perceptions not only enhances our measurement of fairness perceptions by entrepreneurs (cf. Hollensbe et al., 2008), but is also instrumental to improve knowledge exchange and collaboration with entrepreneurs by, for instance, investors or universities (De Clercq et al., 2010; Lubatkin et al., 2007; Sapienza and Korsgaard, 1996). In this way, our study also contributes by suggesting measures to nurture this open exchange of knowledge, which in turn is beneficial for the effective exploitation of entrepreneurial opportunities.

In this chapter, we study the formation of fairness perceptions by entrepreneurs exploiting university inventions in university spin-off companies. We study the perceived fairness of these 'academic entrepreneurs' with their 'host' university. In parallel with studies that identified new fairness rules in

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[5] The notion of fairness in this chapter refers to the (inter)subjective account of individuals if something is perceived as 'fair' or 'reasonable' with regard to procedure and distribution (discussed later in this article). In this respect, in line with Rawls (1999), we prefer to use the notion of 'fairness' instead of 'justice', because the latter has a more objective connotation attached to it (cf., Lind and Tyler, 1988: 30-34).

workplace settings (Bies and Moag, 1986; Hollensbe et al., 2008), we focus on finding the heuristics these academic entrepreneurs draw on when assessing the fairness of the transaction with their host university. These entrepreneurs started their venture from a university and acquired the venture's intellectual property there. For these entrepreneurs, the relationship with this university is extremely critical; both in the conception phase of their venture – to receive support to start the venture, acquire and develop the technology, and obtain access to facilities – and in the subsequent development phase. As fairness perceptions are especially important in relationships with unequal power distribution (Husted and Folger, 2004; Sapienza and Korsgaard, 1996), we expect that fairness perceptions play an important role in this context given the asymmetric power distribution between an individual entrepreneur and a large, institutionalized university (Feldman et al., 2002).

This study employs an inductive approach using qualitative data and procedures. The sample includes entrepreneurs related to two different university settings. Perceptions have been analyzed from in-depth interviews with the entrepreneurs, in combination with interviews with university representatives. This approach served to identify the heuristics underlying the entrepreneurs' fairness perceptions as well as to explore two individual characteristics associated with the use of these heuristics.

The chapter proceeds as follows. First, we briefly introduce the theoretical background of this study. Subsequently, the methods adopted to identify fairness heuristics and explore the use of these heuristics are described. In the results section, the findings are described. Finally, we discuss the contribution of this study, explore its limitations, and present the main conclusions.

## 3.2 Theoretical background

The theoretical background of this study consists of three different parts. First, we discuss the role of 'traditional' fairness rules as identified and described in the organizational justice literature. Next, some key differences between entrepreneurship and organizational settings are discussed, which provides the basis for developing inferences about how the formation of fairness by entrepreneurs may be guided by different heuristics. Finally, we briefly discuss

two characteristics of (academic) entrepreneurs and how these characteristics may influence the formation of fairness perceptions.

*3.2.1 Established fairness theory*

Organizational justice theory refers to the fairness perceptions of agents with regard to the distribution of outcomes of an exchange, the procedures that govern this distribution, and the implementation of these procedures (Husted and Folger, 2004). Colquitt (2001) operationalized this in a construct validity study along four dimensions. Distributive justice refers to the perceived fairness of the allocation of outcomes in an exchange; it is enhanced when implicit norms of equity are met. Procedural justice refers to the perceived fairness of the process and is, for example, fostered by applying procedures consistently during the decision making process. Interpersonal justice refers to polite and respectful execution of procedures and determining outcomes. Informational justice refers to the explanations and information regarding the procedures and outcomes (Colquitt, 2001).

These dimensions of fairness are established by means of laboratory experiments and field studies which investigated fairness formation in the context of employer-employee relationships. Some studies have extended the field setting to different areas, such as the cooperative relationship between corporate headquarters and subsidiaries (Kim and Mauborgne, 1993), cooperation in supply chains (Kumar et al., 1995) or cooperation between alliance partners (Jap, 2001; Luo, 2005). A small number of studies also applied these fairness dimensions in the entrepreneurship context, and explored the effect of procedural fairness perceptions in particular. For example, drawing on a study of the cooperative relationship between venture capitalists and entrepreneurs, Busenitz et al. (2004) found procedural justice is positively related to long-term venture performance. This is in line with earlier work in this area by Sapienza and Korsgaard (1996), who observed that perceived procedural justice is an explanatory factor of the degree of cooperation by entrepreneurs and investors. In addition, in a corporate context, De Clercq et al. (2010) observed that procedural fairness enhances the relationship between entrepreneurial orientation and performance, probably because fair perceptions stimulate the amount and quality of the shared knowledge. So, previous research has shown that fairness perceptions by

entrepreneurs affect the degree of learning as well as the amount and quality of knowledge exchange between investors and entrepreneurs, which are crucial for a venture's performance (Busenitz et al., 1997; Busenitz et al., 2004; De Clercq et al., 2010; Howorth et al., 2004; Kim and Mauborgne, 1998). Thus, these studies have demonstrated in particular that fair perceptions lead to more cooperation. However, these studies do not address to what extent the established fairness conceptualization is applicable to entrepreneurship and whether these fairness dimensions need to be complemented with fairness heuristics specific to the entrepreneurship setting. Yet, this insight in the formation of fairness perceptions is key to understand how a venture's performance can be improved by enhancing effective knowledge exchange through the establishment of cooperative relationships which are perceived as fair.

### 3.2.2 *Specificities of the entrepreneurship setting*

High degrees of uncertainty and the importance of venture governance issues characterize the entrepreneurship setting, but these characteristics are not represented in the established fairness rules underlying the four dimensions (cf. Baron, 1998; Busenitz and Barney, 1997; Shane and Venkataraman, 2000). Uncertainty may affect the formation of fairness perceptions by, for example, disagreements about the expected and the eventual value of the contributions of different founding parties (Alvarez and Parker, 2009; Alvarez and Barney, 2005). Different parties involved in starting a new venture may have provided resources at startup. Due to the uncertain development of the venture and its revenues, the eventual real values of these resources for the venture can substantially differ from their initial value. This may lead to perceived unfairness when parties try to change agreements or, in contrast, want to stick to the initial agreement. Venture governance can affect fairness perceptions by means of an endowment effect (Thaler, 1980). For example, entrepreneurs exploiting university intellectual property (IP) tend to believe they personally own and control their invention and the related entrepreneurial opportunity, although for example IP laws say otherwise (Rappert et al., 1999). This can easily lead to perceived unfairness when the university claims part of the venture's revenues and control.

While in regular workplace settings uncertainty and governance are affecting the organization as such, these characteristics affect founder-entrepreneurs of

new ventures personally, as the organizational level corresponds here with the personal level (i.e., they identify themselves with the venture). As a consequence, these differences with a more regular organizational setting are likely to have a different impact on the formation of fairness perception by entrepreneurs than what is expected by traditional organizational justice theory.

### 3.2.3 Individual entrepreneur characteristics

With regard to the entrepreneur's individual characteristics influencing the formation of fairness perceptions, earlier studies have identified two characteristics: 1) experience and 2) the formal position of the entrepreneur within the university organization. Experience is personal capital accumulated by previous business or startup experiences. As such, this characteristic is individual in nature and unrelated to the university. Busenitz et al. (1997) found that entrepreneur's prior experience in different firms and industries positively influences perceived fairness. Previous experiences appear to provide a cognitive stock of transactions which constitutes the frame of reference against which the cooperation and contract is evaluated (Kahneman, 1992; Lehner, 2000; Ordonez et al., 2000). As such, the entrepreneur's experience shapes decision making and evaluation because thoughts may become increasingly channeled by past experience (Burmeister and Schade, 2007; Dew et al., 2009; Shepherd et al., 2003).

Furthermore, the formal position of entrepreneurs within the incumbent (university) organization reflects their relational capital and organizational embeddedness. The formal position is related to the amount and quality of relations and resources within the organization. Individuals with a higher formal position in the organization tend to have more internal relationships and possess more resources and. As a result, they are more likely to conform to existing practices (Bercovitz and Feldman, 2008; DiMaggio, 1988). Existing practices sustain and reinforce the positions of these more central players, not the least because they may have contributed to shaping these practices. Moreover, the extensive work on relational models of fairness stresses that people who strongly identify with a group or organization are prone to judge group processes as fair (Tyler and Blader, 2003). This especially applies to situations with informational uncertainty regarding procedures (Blader, 2007). In contrast, more peripheral people are less connected to the central norms and existing practices, and they

may be disadvantaged by prevailing institutions (Greenwood and Hinings, 1996). These individuals do not identify themselves strongly with this organization, and may therefore be less prone to judge processes as fair ex ante.

As a result, the formal position of the entrepreneur in the hierarchy of the host organization is also likely to affect the degree of conformation to existing practices and impact the fairness judgments. A higher degree of conformation and identification implies that processes within the incumbent organization are more likely to be evaluated as fair. Hence, this factor may also influence the formation of fairness perceptions related to the specific institution.

## 3.3 Methods

This study aims to extend existing fairness theory by specifying the formation of fairness perceptions by entrepreneurs. As explained in the introduction, we expect fairness perceptions to play an important role in academic entrepreneurship, which thus provides a setting where the object of our study is likely to be observed (Eisenhardt, 1989). A qualitative approach is adopted in order to be able to identify fairness heuristics that have not been described in previous fairness or entrepreneurship studies (Lee, 1999).

### 3.3.1 Case selection

This chapter employs a multicase design, in which successive cases are analyzed to confirm or disconfirm emerging concepts and patterns (Yin, 2003). The cases involve academic entrepreneurs who have started 26 companies, exploiting an invention owned by the university. As individual entrepreneurs form fairness perceptions, the entrepreneur is the unit of analysis.

The cases are embedded within the context of the two universities in The Netherlands introduced in Chapter 1. The majority of ventures originate from TU/e. The spin-offs originating from WUR serve to analyze to what extent the identified fairness heuristics are used in a different context, that is, the context-dependency of the use of particular fairness heuristics (cf. Yin, 2003). Technology developed within the university provides the basis for the first product or service that the start-ups (intend to) bring to market. In this respect, commercializing this technology is critical for the survival of these spin-offs, whereas the relationship with the university is essential for acquiring the IP of the invention and the

intellectual capital to exploit it. Typically, the invention is far-from-commercialization and substantial development work is still required. As a consequence, the relationship between the entrepreneur and its university is characterized by an asymmetric power distribution (Feldman et al., 2002). As previous work suggests, fairness perceptions are critical in cases characterized by unequal power distribution and high dependency (Husted and Folger, 2004; Sapienza and Korsgaard, 1996). This is in line with earlier studies on academic entrepreneurship that have pointed at the importance of fairness perceptions for maintaining a cooperative relationship between entrepreneur and university (e.g., Ambos et al., 2008; Rappert et al., 1999). Fairness perceptions in this context are related to the negotiations about the intellectual property and the control over the venture by the university (Steffensen et al., 2000). Therefore, academic entrepreneurship provides an excellent setting to study the fairness perceptions of entrepreneurs, because the object of study is likely to be observed (Eisenhardt, 1989).

Since many years, the two universities have cooperated with industry by means of collaborative research and licensing activities. More recently, since the end of the 1990s, they have started to actively support the creation and development of spin-off companies. In this endeavor, an infrastructure is established of support professionals, office space and lab facilities was established. In addition, a number of practices were developed over the last decade at the two universities. First, in return for the university's technology that the entrepreneur wants to license, the university claims payback in the form of a share in the company's equity, royalty payments, or a fixed fee. At WUR, this is accompanied by an active investment strategy in these new ventures by the university's technology transfer office. The exact details of the agreement with the entrepreneurs depends on the technology (how far it is developed), the entrepreneurs (to what extent do they wish to use university facilities, etc.), and the negotiation process itself. Another issue is the balance between entrepreneurial activities and the traditional core activities of the university (research and teaching). Faculty members are allowed to engage in venturing activities and take equity in such ventures. To keep track of the balance with their more academic work, non-academic activities of faculty are registered and discussed with their superior(s). At both universities, these practices aim to

accommodate the different goals within the university and to stimulate entrepreneurship.

In order to explore individual characteristics of entrepreneurs, we used the following sampling criteria. We searched for a selection of entrepreneurs with sufficient variety regarding entrepreneurial experience, formed by prior new venturing efforts, and the formal position within the university. To reduce sample bias, we searched variance regarding the survival of the company (a number of ceased spin-offs are included), the development stage of the company (ranging from early stage to mature companies), the industry and technology (e.g., information technology, biotech and automotive), and the outcome of negotiations with the university (i.e., the percentage of shares owned by the university and the royalty percentage). In addition to these entrepreneurial, contextual and venture characteristics, we searched for variety in our sample with regard to the values of the dependent variable (i.e., 'fair' and 'unfair' perceptions).

To select new ventures, we searched the list of all IP-based companies from both universities. In consultation with the spin-off advisors from each university, we made an inventory of how the ventures related to our sampling criteria. Next, a selection was composed with substantial variance according to the sampling criteria. We selected 26 different new ventures, 19 from TU/e and 7 from WUR. As prior knowledge about the situation of the venture, the background of the academic entrepreneur and the perceptions was absent, we iteratively composed a final selection during the process of interviewing and analyzing. This ensured the collected data involved sufficient variation, which mitigates the risk of sample selection bias and enhances the development of reasonably textured theory (Eisenhardt, 1989). Table 3.1 shows the variance in the new ventures that were selected.

*3.3.2 Data collection*

The main source of data were 36 open-ended interviews with entrepreneurs representing the 26 spin-offs; the interviews were semi-structured, drawing on a topically structured interview protocol. The interview protocol followed the start-up process with general open-ended questions about motivation, networks, technology, training and education, support and coaching, financing, intellectual property and the university context in general. The questions were rather open

with regard to experiences and perceptions, but we made sure that we covered all relevant aspects of the relationship with the university. All interviews were recorded and fully transcribed. The first interviews with the entrepreneurs served to streamline the protocol and reword some of the questions. In four cases, follow-up interviews were conducted to clarify issues that remained ambiguous in the analysis. In three other cases, follow-up interviews were conducted after the negotiations with the university were completed, which was not the case at the time of the first interview. These three cases were instrumental in exploring whether the use of fairness heuristics changed during the negotiations. In addition, these follow-up interviews, combined with our frequent interactions with academic entrepreneurs and university representatives, mitigated biases associated with retrospection by combining retrospective data with current data (Leonard-Barton, 1990). Table 3.1 introduces the cases and the main data sources.

In addition to the interviews with entrepreneurs, we performed interviews with different people within the university. This served to triangulate the stories of the academic entrepreneurs (Jick, 1979). Using a similar protocol as for the academic entrepreneurs, we interviewed 11 people in 15 interviews at TU/e and 5 people in 6 interviews at WUR. These interviews included the director and several other staff members of each technology transfer and spin-off support unit (abbreviated as TTO), as well as entrepreneurship trainers and advisors. Interviewees also included the officers who represented the university in the negotiations with the entrepreneurs. By means of these interviews, data was collected regarding general policies and practices dealing with start-up advice, facilities, financing, and networking, IP policies, negotiations about IP and costs of the facilities, and the procedures and regulations. Moreover, these respondents were questioned about the negotiations and their thoughts about the fairness perceptions of the entrepreneurs in the sample. As a next step in the triangulation procedure, we consulted archival data. These included business plans and other documents such as subsidy proposals written by the entrepreneurs, newspaper articles, interviews, brochures and website information. At the university level, we collected documentation describing formal policies and protocols.

**Table 3.1: Cases, data collection and fairness perceptions**

| Name | Interviews | Formal position | Experience | University equity shares and royalties | Fairness evaluation |
|------|-----------|-----------------|------------|----------------------------------------|---------------------|
| *TU/e* | | | | | |
| Alpha | 1 | Low | High | ‹10% + royalties | Fair |
| Beta | 2 | Low | High | 20%-30% | Fair |
| Gamma | 1 | High | High | 50-60% | Fair |
| Delta | 1 | Low | High | 30%-40% + royalties | Fair |
| Epsilon | 2 | Low | High | None | Unfair |
| Zeta | 2 | Low | Low | 90-100% | Fair |
| Eta | 1 | Low | High | 10-20% | Unfair |
| Theta | 1 | High | High | 90-100% | Unfair |
| Kappa | 1 | High | High | None | Fair |
| Lambda | 1 | Middle | High | ‹10% | Fair |
| Mu | 1 | Low | Low | ‹10% | Fair |
| Xi | 1 | Middle | Low | ‹10% | Fair |
| Rho | 2 | Middle | Low | ‹10% | Unfair |
| Sigma | 3 | Middle | Low | ‹10% + royalties | Unfair |
| Tau | 3 | Middle | Low | ‹10% + royalties | Fair |
| Upsilon | 1 | Middle | High | None | Fair |
| Phi | 1 | Middle | Low | None | Unfair |
| Psi | 1 | Middle | Low | 50%-60% | Fair |
| Omega | 3 | Low | Low | 10%-20% | Fair |
| | | | | | |
| *WUR* | | | | | |
| Aleph | 1 | High | High | None | Unfair |
| Beth | 1 | High | High | None | Fair |
| Gimel | 1 | High | Low | 40%-50% | Unfair |
| Daleth | 1 | Middle | Low | None | Fair |
| Vau | 1 | Middle | High | None | Fair |
| Yod | 1 | Low | Low | None | Unfair |
| Lamed | 1 | Low | Low | None | Unfair |

*3.3.3 Data analysis and coding procedures*

Prior to analyzing the data on fairness perceptions, we described the universities' practices and procedures with regard to commercializing technology. This description was built on the documents outlining the strategy and procedures in combination with the interviews with university officials. Interviews with academic entrepreneurs were at this stage only used to check for consistency of the procedure description. Subsequently, this description was discussed with two officers of the technology transfer unit to correct any misinterpretations.

Detailed analysis of fairness formation was performed by following coding procedures similar to those used by Hollensbe et al. (2008) and Butterfield et al. (1996). The transcribed interviews with academic entrepreneurs were first coded to identify fairness-related expressions they employ to assess the fairness of the transaction and relationship. QSR NVivo software served to build a code database. The coding dictionary contained both pre-defined codes and new codes. The pre-defined codes consisted of the rules underlying the existing four fairness dimensions as reported by Colquitt (2001). For example, procedural fairness was coded strictly in terms of the seven rules used by Colquitt (2001) (e.g., quotes reflecting consistently applied procedures or the unbiased application of procedures). When a reported fairness heuristic did not reflect any of the predefined established rules underlying the four existing dimensions, it was given a new code and assigned to the category of specific 'fairness heuristics' that did not fit the existing rules (cf. Hollensbe et al., 2008). This open coding process for the specific heuristics became saturated at the 15th transcript, when no more new codes were added. After coding all the transcripts of TU/e and WUR, the coding categories and their content were assessed to group similar codes. Moreover, to ensure the robustness of the findings, we excluded specific heuristics reported by three or less respondents (cf. Hollensbe et al., 2008). This assessment resulted in nine final codes for specific fairness heuristics. Furthermore, we also coded each transcript in terms of fair or unfair perceptions.

To check the reliability of the coding, the secondary coding procedures advocated by Butterfield et al. (1996) and Hollensbe et al. (2008) were applied. Two independent coders unfamiliar with the study (two graduate students) applied the nine final codes for the identified specific fairness heuristics. These coders received the final codes and their definitions, together with a selection of

passages from the transcripts of all interviewees. The coders were instructed to make first a yes/no judgment whether a passage reflected a fairness evaluation. Subsequently, they were asked whether this passage reflected a specific fairness heuristic or an existing fairness rule, and if so, which one. We calculated the *P*-statistic of overall agreement (.83), which was well above the threshold (.70), suggesting that the final codes sufficiently fitted the data. Moreover, the same procedure was used to check the accuracy of coding fair versus unfair perceptions, which resulted in 100% agreement.

To explore the use of the existing fairness rules and the specific identified fairness heuristics, we ran Boolean searches in NVivo. In these searches, we checked for co-occurrence of certain codes within one interview transcript – in line with Miles and Huberman's (1994) procedures regarding qualitative data analysis by means of tabular representations. This resulted in identifying patterns of how existing fairness rules and identified specific fairness heuristics are used. We especially explored the effect of entrepreneurial experience and formal position (see also Table 3.1). The coding of the transcripts with regard to entrepreneurial experience and formal position was also informed by additional information – such as business plans, websites and interviews with university officials.

Entrepreneurial experience is operationalized as follows: the experienced group involves academic entrepreneurs who had been involved in new venturing activities before. The inexperienced group involves entrepreneurs who were graduate students when starting a company, or faculty members without any business experience. In ventures with multiple team members, experience can differ among team members. This effect is taken into account in coding experience characteristics; for example, if most of the entrepreneurs in the team are experienced, the case is coded as experienced.

The academic entrepreneurs can be allocated to three groups with regard to their formal position in the organization's hierarchy. First, a number of entrepreneurs have a formal position in which they are able to control resources. This group includes tenured faculty with a position in the university as full or associate professor. Notably, these people have an important role in their department, also in terms of relationships with industry and funding performance. If these scholars start to exploit a technology (invented by

themselves) in a new venture, they must negotiate a deal with the university about the transfer of this technology; this is an implication of the formal employment conditions. Here, national and university policies play a role – in particular, national law implying that IP created during an employment contract is university property. The second group of entrepreneurs, academic entrepreneurs with a 'middle' formal position, involves in particular PhD students. PhD students are formally employed by the university, but only for four years and with the single goal of delivering a doctoral dissertation. These entrepreneurs started a new venture based on an invention which was part of their doctoral research. As such, they are part of the faculty, but without managerial tasks and only for a restricted period of time. Third, external entrepreneurs or MSc students exploiting a technology developed by someone else at the university are categorized as entrepreneurs with low formal positions.

## 3.4 Results

In this section, we describe the heuristics underlying the fairness perceptions of the entrepreneurs and we examine to what extent these entrepreneurs draw on existing justice rules. In addition, we explore individual characteristics (experience and formal position) associated with the use of these heuristics.

### 3.4.1 Specific heuristics versus existing rules

Table 3.2 lists the specific fairness heuristics reported by entrepreneurs. These heuristics are 'specific' to the entrepreneurship setting and are not reflected in the existing fairness rules underlying the four fairness dimensions identified by previous studies. Table 3.2 also provides a definition of each heuristic and examples of quotes. In this section, we will refer to these heuristics by their shorthand description. For example, the heuristic 'Draw on practices at other universities to assess the fairness of the transaction with the university' is abbreviated as 'other universities'. The set of specific heuristics includes the following nine heuristics.

'Other universities' and 'market norms' involve heuristics in which the entrepreneurs use a different situation or scenario to compare their transaction with. The similarities or differences highlighted by this comparison serve to evaluate the fairness of the transaction. Sometimes, these market norms or

## Table 3.2: Specific heuristics used by academic entrepreneurs to form fairness perceptions

| Specific heuristic (abbreviated) | Number (percentage) of respondents reporting heuristic | Description | Sample quotes |
|---|---|---|---|
| Other universities | 9(38) | Draw on practices at other universities to assess the fairness of the transaction with the university. | I have talked with other entrepreneurs, who negotiated with other universities. What I learned is that it's really impossible at other universities. I'm very happy I have started from this university. (...) And I think this university is constructive, more than other universities. (Alpha) |
| Market norms | 12(50) | Use a transaction in the market to assess the fairness of the transaction with the university. | They [the TTO] ask some serious offers. In particular when you experience what your idea is worth in the venture capital market, you start to think: you are just a son of a bitch that you ask so much. (Epsilon) |
| Performance of entrepreneur in negotiations | 4(17) | Use my performance during the negotiations to assess the fairness of the transaction with the university. | We got a really good deal. It was good that TU/e got the impression that they shouldn't push us too hard, as they expected we otherwise would withdraw. [laughing] In that respect, we played it very well. (Omega) |
| Negotiator support | 7(33) | Use the level of support by the (TTO) negotiator during negotiations to assess the fairness of the transaction with the university. | I expected that a TTO would provide support to start a new venture. But they didn't do that at all. They only positioned themselves as a negotiator on behalf of the university. (Gimel) |
| Easiness and length of negotiation | 13(54) | Use the length and easiness of negotiations to assess the fairness of the transaction with the university. | This 10% equity participation was settled quickly. We can negotiate very long to make it 9 or 11 percent, but that does not matter eventually. (...) We actually did not mess around too much about one or two percent. I think that that was good, because both parties now feel very good and this also influences [the cooperation]. (Xi) |
| Cooperation and support by university | 17(71) | Use the degree of support of and cooperation with the university in general to assess the fairness of the transaction with the university. | You better have a good basis, that TU/e is supporting you, and that the researchers cooperate. This maybe results in a different distribution, in which there is less left for yourself. But it gives a broader base to continue [with the venture]. (Omega) |
| Venture governance | 10(38) | Use the degree of venture governance by the university to assess the fairness of the transaction with the university. | Even if TU/e has minority participation, they can make it immensely hard if they want, with the entire bunch of lawyers they have. I just don't want this within my company. (Phi) |
| Future value | 11(46) | Use potential future value or revenues of the venture to assess the fairness of the transaction with the university. | We pay something like 5% of royalties over the profit, with a maximum of 200K Euro. But if we start paying this, we talk about such huge amounts of money [that we are gaining]... At that moment, I couldn't care less. They may get their 2000K. Very easy. (...) At the moment that we make these large profits, it is fair to bring something back in this way. (Delta) |
| Entitlement university | 6(25) | Use my normative position regarding university commercialization practices to assess the fairness of the transaction with the university. | I think it is stupid that I had to negotiate with the university. I think that the principle is wrong. (...) The university should have said: 'You know what? We will just give you the technology for a symbolic fee.' The university does not need to make profit, do they? (Epsilon) |

practices at other universities are inferred from previous experiences by the academic entrepreneurs, but in other cases market norms are based on public information or information they received from others. For example, the founder of Alpha reported:

> I have talked with other entrepreneurs, who negotiated with other universities. What I learned is that it is really unfair and impossible at other universities. I'm very happy that I have started from TU/e. (...) And I think TU/e is constructive, more than other universities.

Other specific heuristics refer more to the negotiations and their object: 'performance of the entrepreneur in the negotiations', 'easiness and length of the negotiation', 'venture governance', and 'future value of the venture'. Here, in particular 'easiness and length of negotiation' surfaces as a heuristic that is used by more than half of the entrepreneurs. The length and easiness of the negotiations are important because long negotiations can delay other venture-related activities; moreover, long and difficult negotiations tend to bring about many frustrations along the way. For example, the founder of Gimel reported:

> Actually, I thought we had an agreement in June. We also had a letter of intent from the venture capitalist. The TTO [Technology Transfer Office, also referred to as spin-off support unit] wanted to invest as well. We also had an agreement over the patents. But, subsequently it still lasted half a year before the deal was actually finalized with the TTO. In the meantime, I already started with Gimel, on my own expenses. So, we were almost down and out when I finally could sign the contract. So, that was thrilling. (...) It finally turned out to be fine, but it was really not a nice experience. I certainly blame the TTO staff for this.

Furthermore, 'negotiator support', 'cooperation and support by university', and 'entitlement of the university' refer to the entity with whom the entrepreneurs negotiate. 'Negotiator support' refers to the support by the negotiator(s) to the academic entrepreneur, while the heuristic about 'cooperation and support by the university' refers to the cooperation with faculty, staff and

## Table 3.3: Existing rules used by academic entrepreneurs to form fairness perceptions

| Existing fairness dimension | Number (percentage) of respondents reporting rules of this dimension | Existing rules underlying the fairness dimension (adapted from Colquit, 2001) | Sample quotes |
|---|---|---|---|
| Distributive | 17(71) | Determine the balance between my (venture's) contributions and benefits (in terms of effort, equity, royalties, access to facilities, direct payments, etc) to assess the fairness of the transaction with the university. | Then I started to make an inventory of what it all would cost [that I was using from the university]. We attached a sum to that. When Phi starts to really run, I will pay it back. At this moment, it is a subordinated loan. I can live with that, that's fair: I use something, so I pay this back. (Phi) |
| Procedural | 19(79) | The following rules refer to the procedures used to arrive at the contract. Evaluate the extent to which:<br>- I have been able to express views and feelings during the procedures;<br>- I had influence over the contract arrived at by the procedures;<br>- the procedures have been applied consistently;<br>- the procedures have been free of bias;<br>- the procedures have been based on accurate information;<br>- I have been able to appeal the contract arrived at by the procedures;<br>- the procedures upheld ethical and moral standards;<br>to assess the fairness of the transaction with the university. | *Free of bias:* I feel it is double; I don't want to ask TU/e for advice, because they give the kind of advice and support that is good for them. I don't think that's a good thing. (Sigma)<br><br>*Consistent application of procedures:* Other entrepreneurs, who add less value themselves, get better deals. Very honestly speaking. (Tau) |
| Interpersonal | 12(50) | The following rules refer to the university representative responsible for the negotiations. Evaluate the extent to which:<br>- he/she has treated one in a polite manner;<br>- he/she has treated one with dignity;<br>- he/she has treated one with respect;<br>- he/she has refrained from improper remarks or comments;<br>to assess the fairness of the transaction with the university. | *Respect:* Finally, it was hard bargaining. When I would have known that from the start, I would have started negotiating differently. (....) And I would like to question if the university really needs to negotiate that hard with her start-ups. (...) The way they did it could have been more respectful. (Rho) |
| Informational | 7(29) | The following rules refer to the to the university representative responsible for the negotiations. Evaluate the extent to which:<br>- he/she has been candid in his/her communications;<br>- he/she explained the procedures thoroughly;<br>- his/her explanations regarding the procedures were reasonable;<br>- he/she communicated details in a timely manner;<br>- he/she seemed to tailor his/her communications to individuals' specific needs;<br>to assess the fairness of the transaction with the university. | *Timely communication:* It is very unclear, I don't see a standardized process, I should say. Everything should come from our side. We now started to negotiate with TU/e about the license. And we also got the feeling that we should start negotiating about equity participation. But again, they don't inform us: let's start talking about that. We should apparently initiate that ourselves. (Rho) |

university employees in general. In particular cooperation and support by the university are important in constructing the perceived fairness. Both support heuristics are largely influenced by the expectations of the academic entrepreneurs. For example, the founder of Rho reported:

> In the back of your mind you know it is a negotiation. (...) But I didn't expect it to be so hard. The TTO director is very commercial. That is good for the TTO. But on the other hand, I think he is too commercially oriented (...) to deal extensively with start-ups. (...) Especially with boffins, they raise their hackles in this case.

In addition to the specific heuristics identified, Table 3.3 shows examples of the use of the existing rules. In particular, the rules underlying the procedural fairness dimension are frequently reported, whereas the rules underlying the distributive and interpersonal fairness dimensions are also observed regularly. Distributive fairness refers in these cases to the assessment of the fairness of the transaction based on what the entrepreneurs receive from the university versus what they pay for it. These payments are made as in-kind efforts beneficial for the university, venture equity, patent royalties, or direct payments. In turn, the entrepreneurs receive support and are able to use university equipment, lab facilities and office space. Most importantly, they acquire the right to exploit intellectual property that is typically protected by a university-owned patent. Entrepreneurs who reported the distribution as fair evaluated the deal as acceptable because they get large returns on their 'payment'. Entrepreneurs that perceived the distribution as unfair reported they could not find sufficient justification for the particular equity position or royalty payments.

Procedural fairness here particularly refers to the consistency in applying procedures over time and across cases and the degree to which these procedures and negotiations are free of bias. Entrepreneurs evaluated procedural fairness positively when they experienced that university representatives acted according to the procedures and that the university did not exploit its powerful position; in other words, negotiators acted free of bias. The founder of Omega argued:

> You easily get screwed. The university has the most powerful position. (...) It was a good thing they did not try to maximize their side of the deal, but considered the question: can we justify this deal to all stakeholders?

Entrepreneurs who evaluated procedural fairness negatively, perceived procedures to be unclear or not applied. Furthermore, technology transfer officers are responsible for both the support and the contractual agreements. In some cases, entrepreneurs experienced this as problematic because they felt the support activities may also be targeted at the creation of a better deal for the university.

Informational and interpersonal fairness rules were less frequently reported. Informational fairness referred mainly to timely and tailored communication (cf. Table 3.3). Interpersonal fairness is especially evident in case of mistrust of university officials' behavior in the negotiations, given their dual role with regard to support and agreements. For some entrepreneurs, this was the reason they mistrusted their counterpart in the negotiations. The founder of Epsilon reported:

> They [the university spin-off advisors] do not step into the shoes of the entrepreneur. They just try to get a good deal for the university. I doubt their honesty in the negotiations. (...) That is a hard judgment, indeed.

A comparison of Table 3.2 and Table 3.3 indicates that existing distributive and procedural rules are used more frequently than specific heuristics. Table 3.4 shows this probably is an artifact of the 'scattered' image created by the specific heuristics: each of these heuristics is in fact a single item construct, while the existing four dimensions are multiple item constructs consisting of multiple rules

**Table 3.4: Specific fairness heuristics versus existing fairness rules**

| Fairness rule | Number (percentage) of respondents reporting rule at TU/e | Number (percentage) of respondents reporting rule at WUR |
|---|---|---|
| Specific heuristics | 19 (100) | 7 (100) |
| Existing rules | 18 (95) | 5 (71) |

(cf. Table 3.3). As such, the use of specific heuristics is distributed across all nine heuristics, while for the existing rules the usage is concentrated in four fairness dimensions. When all the heuristics and rules are clustered as in Table 3.4, specific heuristics are slightly more frequently reported than existing rules. Table 3.4 also demonstrates that most academic entrepreneurs use both specific heuristics and existing rules. Moreover, Table 3.4 shows the usage of specific heuristics and existing rules hardly depends on a specific university context, given the similar pattern in the TU/e and WUR data.

*3.4.2 Specific heuristics versus existing rules associated with fair and unfair perceptions*
Table 3.5 reports the use of specific heuristics and existing rules associated with 'fair' or 'unfair' perceptions of the transaction with the university. This analysis suggests that entrepreneurs draw on specific heuristics as well as existing rules to form both fair and unfair perceptions. Table 3.5 also confirms the finding from Table 3.2 and Table 3.3 that the specific heuristics show a more 'scattered' pattern.

The results show small differences in heuristics and rule usage between respondents who perceived the negotiations as fair and those perceiving these as unfair. The most important differences with regard to specific heuristics are as follows: 'other universities', 'venture governance' and 'entitlement university' are more frequently associated with unfair perceptions, whereas 'performance of entrepreneur in negotiations', 'negotiator support' and 'cooperation and support by the university' tend to be connected with fair perceptions.

With regard to existing rules, Table 3.5 suggests that distributive rules are more frequently associated with perceived unfairness. In general, all heuristics and rules are used to form both fair and unfair perceptions. This overall consistency of heuristic and rule usage, regardless of fair or unfair evaluations, increases the likelihood that many entrepreneurs apply the specific heuristics we have identified.

To check the robustness of the findings, we controlled for the influence of equity and royalty percentages in the contract between university and entrepreneur as a predictor for perceived fairness. Table 3.1 shows that high royalty percentages, and in particular high university equity stakes, are unrelated to perceptions of unfairness (e.g., Beta, Gamma, Delta, Zeta). Moreover, even an entrepreneur ending up with a deal without any university equity perceived the

university as unfair (consider Epsilon). Calculations of the average percentages for the group with fair perceptions and the one with unfair perceptions imply that ventures in both groups have comparable quantities of equity shares owned by the university (fair: 21% on average; unfair: 17% on average). So, the actual equity and royalty percentages are not an efficient predictor of fairness perceptions. Rather, the *perceived* governance is likely to be a more important predictor.

**Table 3.5: Heuristic and rule usage associated with fair and unfair perceptions**

|  | Number (percentage) of respondents reporting rule | |
| --- | --- | --- |
| Fairness rule | Fair | Unfair |
| *Specific heuristics* | 14(100) | 12(100) |
| Other universities | 4(29) | 4(33) |
| Market norms | 7(50) | 6(50) |
| Performance of entrepreneur in negotiations | 3(21) | 1(8) |
| Negotiator support | 5(36) | 3(25) |
| Easiness and length of negotiation | 7(50) | 6(50) |
| Cooperation and support by university | 11(79) | 7(58) |
| Venture governance | 4(29) | 7(58) |
| Future value | 6(43) | 5(42) |
| Entitlement university | 2(14) | 4(33) |
| *Existing rules* | 10(71) | 11(92) |
| Distributive | 7(50) | 9(75) |
| Procedural | 11(79) | 9(75) |
| Interpersonal | 7(50) | 5(42) |
| Informational | 3(21) | 4(30) |

*3.4.3 Fairness heuristic and rule usage over time*

To explore consistency in using specific heuristics and existing fairness rules, Table 3.6 reports the rule usage for those cases in which we performed at least two interviews over time. The first interview was held during the negotiations and the second interview after the negotiations were finished. The time between both interviews was approximately 12 months. Table 3.6 points out that the usage of the fairness heuristics and rules is quite consistent over time.

**Table 3.6: Heuristic and rule usage over time (in 3 cases)**

| Fairness rule | Time 1 | Time 2 |
|---|---|---|
| *Specific heuristics* | 4 | 4 |
| Other universities | 1 | 1 |
| Market norms | 3 | 3 |
| Performance of entrepreneur in negotiations | 1 | 2 |
| Negotiator support | 0 | 0 |
| Easiness and length of negotiation | 1 | 3 |
| Cooperation and support by university | 2 | 3 |
| Venture governance | 1 | 1 |
| Future value | 3 | 2 |
| Entitlement university | 2 | 0 |
| | | |
| *Existing rules* | 4 | 3 |
| Distributive | 2 | 3 |
| Procedural | 4 | 3 |
| Interpersonal | 2 | 2 |
| Informational | 3 | 1 |

*3.4.4 Fairness heuristics and rules associated with entrepreneur characteristics*

Table 3.7 reports the frequency with which specific groups of respondents employed specific heuristics and existing rules. These results point at the significance of different categories of academic entrepreneurs (in terms of

**Table 3.7: Heuristic and rule usage associated with entrepreneur characteristics**

| | Number (percentage) of respondents reporting rule | | | | |
| | Experience | | Formal position | | |
| Fairness rule | High | Low | High | Middle | Low |
|---|---|---|---|---|---|
| *Specific heuristics* | | | | | |
| Other universities | 4(33) | 4(29) | 2(29) | 4(50) | 2(18) |
| Market norms | 6(50) | 6(43) | 1(14) | 4(50) | 7(64) |
| Performance of entrepreneur in negotiations | 1(8) | 3(21) | 0(0) | 1(13) | 3(27) |
| Negotiator support | 4(33) | 4(29) | 4(57) | 1(13) | 3(27) |
| Easiness and length of negotiation | 4(33) | 9(64) | 2(29) | 5(63) | 6(55) |
| Cooperation and support by university | 8(67) | 9(64) | 2(29) | 5(63) | 11(100) |
| Venture governance | 5(42) | 5(36) | 4(57) | 3(38) | 3(27) |
| Future value | 5(42) | 6(43) | 1(14) | 5(63) | 5(45) |
| Entitlement university | 3(25) | 3(21) | 1(14) | 3(38) | 2(18) |
| | | | | | |
| *Existing rules* | | | | | |
| Distributive | 7(58) | 10(71) | 4(57) | 7(88) | 6(55) |
| Procedural | 7(58) | 11(79) | 4(57) | 6(75) | 9(82) |
| Interpersonal | 5(42) | 7(50) | 2(29) | 5(63) | 5(45) |
| Informational | 0(0) | 7(50) | 1(14) | 3(38) | 3(27) |

experience and formal position), suggesting that specific characteristics are associated with the application of certain fairness heuristics and rules.

With regard to specific heuristics, inexperienced entrepreneurs tended to refer more often to their own performance in the negotiations as well as to the easiness and length of the negotiation. Interestingly, the use of market norms is quite similar among experienced and inexperienced entrepreneurs. However, the precise content of the interview data coded into this category suggests that experienced entrepreneurs actually draw more on market norms from previous transactions they were involved in, whereas inexperienced entrepreneurs are more likely to use market norms based on social or public information.

Moreover, the heuristic 'cooperation and support by university' is almost as frequently reported by experienced as by inexperienced entrepreneurs. However, in-depth examination points out that experienced entrepreneurs used this heuristic more frequently to form a fair evaluation, whereas inexperienced entrepreneurs connected this heuristic more frequently to unfairness. Experienced entrepreneurs were prone to evaluate the university's wish for a certain equity position in terms of aligning different interests. For them, it also expressed commitment from the university. For example, the founder of Lambda argued:

> It is also an important means to continue the cooperation with TU/e. If it turns out that we have something that generates a lot of profit, the university will also get a piece of the pie. That's very fair. Besides that, it's a lot more transparent this way. We also show that we are closely cooperating with the university.

In contrast, the inexperienced entrepreneurs in our sample often complained that the university was not cooperative and committed.

With regard to existing rules, the results show that inexperienced entrepreneurs in particular referred more frequently to existing rules, especially distributive, procedural and informational justice. Within the items coded for procedural fairness, the data suggest that inexperienced entrepreneurs did refer more frequently to other cases (consistency among cases) than experienced entrepreneurs.

Differences in formal position are also associated with differences in heuristic and rule usage. The most important differences are observed between academic entrepreneurs with a high formal position on the one hand and entrepreneurs with middle and low positions on the other hand. In this respect, 'market norms', 'easiness and length of negotiation' and 'cooperation and support by university' were used less frequently by entrepreneurs with high formal positions, whereas they more frequently drew on heuristics regarding 'negotiator support' and 'venture governance'. For example, the founder of Theta reflected as follows on the negotiations:

> I would never accept the university as a majority equity-owner again. (…) They could, maybe, have like 40% of the shares but would never be majority owner again.

## 3.5 Discussion

The purpose of this chapter is to identify fairness heuristics driving the formation of fairness perceptions by academic entrepreneurs as well as to assess how the use of entrepreneurship-specific fairness heuristics complements the use of more traditional fairness rules described in the literature. In this section we summarize our key findings and discuss the results regarding the entrepreneurship-specific heuristics and their relationship with established fairness rules. Moreover, propositions dealing with the influence of individual entrepreneur characteristics are developed for those heuristics and rules where an association was found with either fair or unfair characteristics as we expect that these heuristics are particularly important. In addition, we discuss theoretical and practical implications.

### 3.5.1 Complementary heuristics

Our empirical findings suggest that existing fairness rules perform well in view of the conceptualization of fairness perceptions. Especially the procedural fairness rules are employed frequently, which confirms that earlier studies chose the right dimension to study (Busenitz et al., 1997; Busenitz et al., 2004; De Clercq et al., 2010; Sapienza and Korsgaard, 1996). Studying the effect of fairness on

entrepreneurs' behavior by means of the procedural fairness construct covers a substantial part of the fairness perceptions. However, our results also demonstrate that established fairness rules do certainly not cover all specific aspects of the formation of fairness perceptions by entrepreneurs. Some heuristics specific to the entrepreneurship setting appear to be missing in current operationalization of justice dimensions and thus form complements to the established fairness rules which could be added to one of the four fairness dimensions.

The specific fairness heuristics 'other universities' and 'market norms' are fairness heuristics that show that the academic entrepreneurs in the sample not only use the rule of distributive fairness and the rule of consistency across similar cases (which belongs to the dimension of procedural fairness), but that they also compare with more distant reference transactions. As such, these two heuristics surface as complementary procedural fairness rules by which the entrepreneurs evaluate their case. In general, this implies that future research assessing fairness perceptions of entrepreneurs should include heuristics regarding the consistency with reference transactions in the market or transactions with similar organizations as complementary rules, to enhance and extend existing measurements and theoretical frameworks regarding the formation of procedural fairness.

A number of the specific heuristics consider the university as the 'larger entity' that entrepreneurs are dealing with: 'negotiator support', 'cooperation and support by university' and 'entitlement university'. The identification of these heuristics confirms the findings of Hollensbe et al. (2008), who found that rules regarding the entity are important. Moreover, these heuristics are in line with other studies on academic entrepreneurs, which observed that new venturing processes are influenced by the entrepreneurs' evaluation of the university and in particular by the actions of the university to enhance clarity in procedures (Ambos et al., 2008; Vohora et al., 2004). Some of these identified rules are probably related to the relational fairness dimension, namely 'negotiator support' and 'cooperation and support by university' (cf. Colquitt, 2001). However, 'entitlement university' is difficult to connect with any of the established fairness dimensions. There is no category dealing with expectations or entitlement as such, while the distributive fairness construct only evaluates the ratio of outputs

versus inputs. Further investigation is needed to entangle whether this heuristic can be considered as part of one of the established dimensions. Our results show that in particular 'negotiator support' and 'cooperation and support by university' are important contextualizations of the relational fairness dimension in this specific entrepreneurial context, as they are associated with differences in fairness evaluations. This leads to the following proposition:

*Proposition 1. The degree of cooperation and support that the entrepreneur receives from the university is positively associated with perceived fairness of the transaction with the university.*

The specific heuristic of 'easiness and length of negotiation' is a process-related or procedural heuristic that Colquitt et al. (2001) did not include in their conceptualization of procedural fairness. The frequent usage of this rule and its association with both fair and unfair perceptions suggests, however, that duration effects are important. This is in line with earlier research on academic entrepreneurs (Steffensen et al., 2000). Such a duration effect of the negotiation process uncovers a previously unidentified aspect of fairness evaluations. Existing studies have observed some effects of negotiation duration, such as the effect of deadlines on the number of offers (Lim and Murnighan, 1994), but effects of negotiation duration on fairness perceptions have not been observed before. This finding suggests that, in addition to the consistency in procedures, the duration of these procedures matters. This heuristic can also enhance understanding and measuring the formation of fairness perceptions of negotiations. As such, this heuristic forms an important complement to other rules in the procedural justice dimension.

### 3.5.2 Unique heuristics
The results also show a number of heuristics which are difficult to connect to the established fairness dimensions . These specific heuristics are probably unique to the entrepreneurship setting and seem to transcend the 'academic' entrepreneurship context. The first unique heuristic is the 'performance of the entrepreneur in negotiations'. Although this heuristic is only used by a minority in our sample, in particular inexperienced entrepreneurs, some entrepreneurs

appear to use their own performance as an evaluation reference. Such a fairness rule is not covered by any of the established dimensions, but could probably be connected with literature on the 'locus of control' and 'overconfidence' of entrepreneurs (Busenitz and Barney, 1997; Mueller and Thomas, 2001). As such, this heuristic may be specific to the entrepreneurship setting.

Uncertainty and the importance of venture governance and venture control are specific characteristics of the entrepreneurship setting (cf. Baron, 1998; Busenitz et al., 1997; Busenitz and Barney, 1997; Shane and Venkataraman, 2000). These characteristics also surface in the specific fairness heuristics, which are difficult to connect to the existing organizational justice dimensions. Uncertainty is reflected in the fairness heuristic 'future value'. As 'future value' is intrinsically a heuristic related to the uncertainty of the new venturing process (i.e., the future value is uncertain), the frequent use of this heuristic shows that uncertainty is associated with fairness perceptions, although this heuristic does not have a differential relation to fair and unfair perceptions (cf. George et al., 2006; Mahnke et al., 2007).

The importance of the fairness heuristic of perceived venture governance is demonstrated by the finding that this heuristic is particularly associated with unfair perceptions. This shows that the general importance of venture control for entrepreneurs also impacts fairness assessments (cf. Alvarez and Parker, 2009; Busenitz et al., 1997; Chesbrough, 2003; Jensen and Thursby, 2001). The following proposition acknowledges the influence of this fairness heuristic as such, and contributes to the fairness literature by showing that perceived governance rather than actual governance is associated with fairness perceptions:

*Proposition 2. A high degree of perceived venture governance by the entrepreneur is positively associated with perceived fairness of the transaction with the university.*

Thus, the fairness heuristics of 'venture governance' and 'future value' imply that the perceived degree of governance and the valuation of the venture under uncertainty are important heuristics underlying the formation of fairness perceptions by entrepreneurs. Here, future research can consider whether these heuristics form an entrepreneurship-specific fairness dimension.

### 3.5.3 Individual entrepreneur characteristics

One of the important individual characteristics influencing heuristic and rule usage is the experience of the entrepreneur. This result extends earlier findings regarding the effect of entrepreneurial experience and the resulting cooperative behavior (cf. Busenitz et al., 1997; Dew et al., 2009; Lee and Tsang, 2001) by specifying how these fairness perceptions are constructed differently by experienced and inexperienced entrepreneurs. In particular, studies of academic entrepreneurship concluded that experience of founders is an important predictor of performance (Franklin et al., 2001; Grandi and Grimaldi, 2005). Our study explains, on the micro-level, how experience may influence performance through the formation of fair perceptions. Inexperienced entrepreneurs refer more often to their own performance than experienced entrepreneurs (cf. Table 3.7), resulting more frequently in fair assessments (cf. Table 3.5). Although the reference to their own performance during the negotiations is a self-efficacy effect, consistent with attribution theory (Gilliland, 1993; Ployhart and Ryan, 1997), this effect is not systematically included in previous fairness studies. In addition, our results suggest that this attribution effect is especially important for inexperienced entrepreneurs, possibly because their perceptions are more easily influenced by new experiences. Moreover, inexperienced entrepreneurs seem to search for more information to gain control over the situation, especially reflected in using heuristics that refer to easiness and length of the negotiation (as long as the negotiation is not finalized, the situation is not settled) and informational fairness (cf. Table 3.7). For inexperienced entrepreneurs, the perceived lack of (timely) information is particularly associated with unfair perceptions (cf. Table 3.5). Hence, our findings suggest the following proposition regarding entrepreneurial experience:

*Proposition 3a. Inexperienced entrepreneurs are more likely than experienced entrepreneurs to evaluate the transaction with the university with reference to their own performance; in turn, the latter is associated with fair evaluations.*

*Proposition 3b. Inexperienced entrepreneurs are more likely than experienced entrepreneurs to evaluate the transaction with the university with reference to the easiness and length of the negotiation.*

*Proposition 3c. Inexperienced entrepreneurs are more likely than experienced entrepreneurs to evaluate the transaction with the university with reference to the degree of informational fairness; in turn, the latter is associated with unfair evaluations.*

Another important individual characteristic is the formal position of the entrepreneur in the host organization. The results confirm and extend earlier findings that entrepreneurs who have more relational capital in the organization, such as professors, are more inclined to accept the procedures of the incumbent organization (Bercovitz and Feldman, 2008; George et al., 2006; Powell and Colyvas, 2008). Our results show precisely how formal positions impact the formation of fairness perceptions by academic entrepreneurs. Entrepreneurs with higher formal positions do not refer to other universities or market transactions, nor use interpersonal and information fairness rules as frequent as entrepreneurs with lower formal positions such as PhD or graduate students (cf. Table 3.7). However, as these entrepreneurs with high formal positions have an established relationship with the university, they are also likely to have high expectations regarding the TTO's support as expressed in the 'negotiator support' heuristic, which is associated with fair evaluations (cf. Table 3.5 and Table 3.7).

Moreover, our results suggest entrepreneurs with high formal positions expect that they will get a substantial say in the venture, in particular in terms of control and ownership (cf. the 'venture governance' heuristic in Table 3.7). This finding extends earlier studies on governance of new ventures (Alvarez and Parker, 2009; Alvarez and Barney, 2005), by identifying differences in the amount of relational capital of entrepreneurs. This appears to be a kind of endowment effect (cf. Thaler, 1980): the research efforts they have engaged in over a longer period of time may lead to a rise of their expectations of ownership and control of the invention. On the other hand, entrepreneurs with lower formal positions tend to search for external reference points to assess the fairness of the university, such as practices at other universities and market norms. Furthermore, they employ more additional fairness heuristics, implying they are trying to underpin their assessment of the transaction with the university more frequently and exhaustively. Especially perceived cooperation with the university appears to be critical in this case. Some of these additional fairness heuristics are more

associated with fair perceptions, such as 'cooperation and support by university', while other rules are associated with unfair evaluations, such as distributive and informational fairness rules (cf. Table 3.5). This exploration suggests that relational capital impacts the formation of fairness perceptions. This adds an important new insight to the existing knowledge regarding university or corporate spin-offs, as most studies do not take relational capital effects into account. Probably, corporate entrepreneurs and other entrepreneurs acting in a dense interpersonal network and institutional environment are also affected by such relational capital effects. This leads to the following two propositions:

*Proposition 4a. The higher the formal position of the entrepreneur in the host organization, the more likely (s)he will evaluate the transaction with this organization in terms of the degree of negotiator support and venture governance; in turn, the latter is associated with fair evaluations.*

*Proposition 4b. The lower the formal position of the entrepreneur in the host organization, the more likely (s)he will evaluate the transaction with this organization in terms of: the consistency with market norms; the easiness and length of the negotiation; the degree of cooperation and support by the university; and distributive, procedural and interpersonal fairness.*

### 3.5.4 Theoretical and practical implications

The results of this study specifically apply to the context of academic entrepreneurship, characterized by the importance of the relationship with the host university (for support and IP) and unequal power distribution (Feldman et al., 2002; Jensen and Thursby, 2001). Our findings may also apply to other entrepreneurial situations with these characteristics. A very similar situation is the relationship between entrepreneurs and large corporations that spin out new ventures led by these entrepreneurs. In this setting our findings regarding experience and formal position may also be applicable. Other settings where our findings may be relevant are, for example, the relationships between (technology) entrepreneurs and large investors such as venture capitalists, and between entrepreneurs and large partners, such as between biotech start-ups and large pharmaceutical firms. In these settings, however, the relational capital

characteristic (formal position) may operate differently, because the incumbent entrepreneurs are not (initially) embedded in the host organization, which is the case in academic and corporate entrepreneurship settings.

### 3.5.5 Limitations and future research directions

This study comes with a number of limitations. First, the inductive nature of this research limits its external validity. Strictly speaking, the findings only carry validity for fairness perceptions of academic entrepreneurs with regard to their host university. Moreover, fairness perceptions can be different in other cultures (Brockner et al., 2000; Li and Cropanzano, 2009). Therefore, it is important to explore whether the fairness conceptualizations described in this chapter also hold in different cultural settings. This implies that future work needs to assess the employment of the identified fairness heuristics in other settings and on a larger scale. Second, due to the largely ex-post nature of the interviews, we were not able to analyze in detail the dynamics of the fairness heuristics, rules and fairness perceptions during the negotiations as well as over a longer period (cf. Curhan et al., 2004; Lehner, 2000). Future studies need to adopt an extensive longitudinal research design to answer these questions. Third, in this chapter we dealt with the formation of fairness perceptions as an individual-level construct. In that sense, we did not assess the social influence within the venturing team and the social interaction with others as such (cf. Kray and Lind, 2002). Fourth, some heuristics need further refinement. For instance, the 'venture governance' heuristic could be treated with more nuance, by paying attention to different aspects of governance, such as control, shareholders interests, dilution provisions, and so forth. Finally, the design of our study is not instrumental in drawing normative implications with regard to venture performance. Future research might be able to connect our findings regarding fairness formation to entrepreneurial performance.

## 3.6 Conclusions

Studies on the fairness perceptions of entrepreneurs have demonstrated that (un)fairness perceptions by entrepreneurs have a meaningful impact on a venture's performance as they affect the degree of learning from and quality of knowledge exchange with strategic partners (Busenitz et al., 1997; De Clercq et al.,

2010; Kumar et al., 1995). Current knowledge about entrepreneurs' fairness perceptions and their effect draws on established organizational justice theory, which describes a number of fairness rules underlying the formation of fairness perceptions in regular workplace settings. However, these fairness rules may not necessarily be applicable within an entrepreneurial context characterized by higher uncertainty and the importance of venture governance issues (cf. Baron, 1998; Busenitz and Barney, 1997; Shane and Venkataraman, 2000). Our findings indeed confirm this (ex ante) conjecture, as we found that nine entrepreneurship-specific fairness heuristics are used to form fairness perceptions, in addition and complementary to the established organizational justice rules. This study shows that two specific characteristics of an entrepreneurial setting influence the formation of fairness perceptions, namely the high degree of uncertainty and the importance of venture governance issues. Furthermore, we found that fairness formation is influenced by entrepreneurial experience and the formal position of entrepreneurs in the host organization. The results of this study serve to understand the formation of fairness perception by different entrepreneurs, thus uncovering a key mechanism leading to (un)cooperative behavior of entrepreneurs. This explains why entrepreneurs' cooperative behavior may differ from what is expected from a 'rational economic' point of view, even if this behavior may carry detrimental consequences for the venturing process (Kim and Mauborgne, 1998; Pillutla and Murnighan, 1996). In this respect, the identified heuristics and rules present clues for effective cooperation by and with entrepreneurs, which is in turn related to venture performance.

The results of this study also enhance measuring fairness perceptions in the entrepreneurship setting, thus contributing to the organizational justice literature. A joint consideration of the newly identified heuristics and existing fairness rules may serve to reduce some of the unshared variance found in meta-syntheses of fairness measurement (Colquitt et al., 2001; Colquitt and Shaw, 2005), because measuring fairness formation by both traditional rules and identified specific heuristics constitutes a more comprehensive approach. As such, our study contributes to an emerging theory of the formation of fairness perceptions by entrepreneurs.

# CHAPTER 4

# EFFECTS OF FAIRNESS PERCEPTIONS ON NEW-VENTURE DEVELOPMENT[6]

## 4.1 Introduction

Academic entrepreneurs tend to perceive that they own their invention and the related entrepreneurial opportunity, although for example IP laws say otherwise (Rappert et al., 1999). This could easily lead to perceived unfairness when the university asks for a part of the venture revenues. Indeed, a limited number of earlier studies on fairness perceptions by entrepreneurs (i.e., Busenitz et al., 1997; Busenitz et al., 2004; Sapienza and Korsgaard, 1996) have demonstrated that perceptions of fairness affect cooperative behavior and performance of the new venture. This research has studied the effect of fairness perceptions of entrepreneurs on the cooperation with venture capitalists (Busenitz et al., 1997; Busenitz et al., 2004; Sapienza and Korsgaard, 1996) or on the transfer of business ownership (Howorth et al., 2004). These studies observed effects of fairness perceptions on the degree of cooperation and also found an effect on the performance of ventures. Furthermore, in particular governance mechanisms and entrepreneurs' experience were found to influence fairness perceptions. In sum, the findings of existing studies imply significant effects of fairness perceptions on new venture development.

However, little research has been done on the precise role and effects of fairness perceptions in the entrepreneurial process. Most studies assume that contractual arrangements explain the dynamics of entrepreneurial cooperation, although it has been demonstrated that the micro-dynamics of cooperation are much more influenced by perceptions of this cooperation than by the factual term sheets (cf. Ariño et al., 2008; Das and Teng, 2000; Kahneman, 1992; Ness, 2009). In

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[6] This chapter is based on E. van Burg, I.M.M.J. Reymen, A.G.L. Romme, & V.A. Gilsing (2009), How fairness perceptions affect new-venture development, paper presented at the 2009 European Group of Organization Studies Colloquium (Barcelona, Spain) and the Academy of Management 2009 annual meeting (Chicago, IL).

fact, a number of studies have demonstrated that perceptions of fairness affect cooperative behavior and also observed an effect on the performance of new ventures (i.e., Busenitz et al., 1997; Busenitz et al., 2004; Sapienza and Korsgaard, 1996). Yet, because of the questionnaire-based data of these studies, insight in the micro-dynamics of the effects of fairness perceptions on the entrepreneurial process is still largely lacking. As entrepreneurship is a process, the question remains how fairness perceptions that evolve along the venturing process (cf. Ambrose and Cropanzano, 2003; Truxillo et al., 2002) affect the venture's development. For that reason, this chapter aims to answer the following question (subquestion 3):

*How does the perceived fairness of the relationship with the university influence the development of the spin-off?*

In this chapter, we employ a process study design drawing on event data (Van de Ven and Engleman, 2004), to explore how academic entrepreneurs perceive (un)fairness in their relation with the university and how this perception affects the development of their venture. More specifically, we demonstrate that different fairness perceptions of individual entrepreneurs, partly due to experience, lead to different types of cooperative behavior, which in turn influences the development of the spin-off company on the short term. This chapter shows that perceptions of unfairness (especially held by inexperienced entrepreneurs) lead to longer negotiation processes resulting in longer start-up processes, less cooperation with the university and delayed strategic cooperation and acquisition of funding.

This chapter contributes to the entrepreneurship literature by demonstrating the effect of fairness perceptions in entrepreneurial behavior. In particular, we identify and analyze the specific influences of fairness perceptions on the venturing process, thus opening the 'black box' of the role of these perceptions in venturing processes. Furthermore, this process study extends organizational justice theory by empirically demonstrating that fairness perceptions change over time and co-evolve with the accumulation of experience. Finally, the study contributes to the practice of university spin-off support by demonstrating the

importance of developing and maintaining effective cooperative ties between the academic entrepreneur and the university.

The chapter proceeds as follows. First, we introduce the process of new venture creation, with a focus on the creation of university spin-off firms. Moreover, we discuss existing fairness research. Second, the methods are described. Subsequently, the results of this empirical study of entrepreneurs' fairness perceptions are examined using event analysis. Three patterns of new venturing processes linked to fairness perceptions are identified: *steady development*, *increasing cooperation* and *decreasing cooperation*. Finally, we discuss the contribution of this chapter to entrepreneurship and organizational justice theory as well as to the practice of entrepreneurship and spin-off support at universities.

## 4.2 Theoretical background

Both entrepreneurship and organizational justice theory provide preliminary insights in the effects of fairness perceptions on the development of new ventures. These theories do not provide any ultimate answers to the two research questions raised earlier, but provide the theoretical background of our empirical work.

### 4.2.1 Development of new ventures

Researchers in the area of entrepreneurship agree that no single universal process model applies to new venture development (Brush et al., 2008; Carter et al., 1996; Haber and Reichel, 2007). The sequence of start-up events – such as writing a business plan, acquiring resources, forming a team and finding the first client – varies enormously and does not appear to be attributable to specific conditions (Lichtenstein et al., 2007). Each venture has its own sequence of start-up events, which is largely a result of the interdependent nature of the events. One start-up event leads to the next event or impacts its effectiveness. Whereas the sequence of start-up events differs, patterns can be observed in the timing and concentration of events. In general, faster execution of start-up activities with less activities at the same time tends to lead to higher performance of the new venture in terms of continuation and cash flow (Lichtenstein et al., 2007).

Although a fixed sequence does not exist, certain essential properties of emergent organizations have been identified. Katz and Gartner (1988) identified four properties of emergent organizations: intention to create an organization,

gathering of resources, development of boundaries of the organization, and exchange of resources crossing the boundaries (e.g., sales). Empirical validation of this framework shows that these properties and activities are essential for continuing a new venture (Brush et al., 2008).

For university spin-offs, the relationship with the university is important regarding all four properties of the emergent venture. The inventor's intention to create an organization is related to the discovery and disclosure of the invention and the discovery and evaluation of its business opportunity (Nicolaou and Birley, 2003a; Roberts and Malone, 1996). In this process, entrepreneurs will start exploring and negotiating the possibility to start the venture. In the process of resource gathering, the academic entrepreneurs negotiate with the university about revenue splitting schemes (Stevens and Bagby, 2001), which often is a stressful bargaining process (Nicolaou and Birley, 2003a; Rappert et al., 1999). Moreover, in developing the product or service, close cooperation with university researchers supports the process of sharing tacit knowledge regarding the invention (Jensen and Thursby, 2001), although this also tends to increase the development time of the venture (Rothaermel and Thursby, 2005). Furthermore, to establish organizational boundaries in market exchanges, the formal relationship with the university is important for IP protection (i.e., an exclusive license) and credibility of the venture and does reduce the chance of early discontinuation of the venture (Rothaermel and Thursby, 2005; Vohora et al., 2004). Thus, developing and maintaining a (good) working relationship with the university is contributing to the development and short-term performance of the university spin-off.

### 4.2.2 The role of fairness perceptions

Organizational justice research on fairness perceptions distinguishes different dimensions, of which distributive and procedural fairness are most frequently studied (Colquitt, 2001).[7] Distributive fairness refers to the perceived fairness of the allocation of outcomes in an exchange; it is enhanced when implicit norms of

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[7] In this chapter, we use only the established framework of distributive and procedural justice and do not employ the particular findings of Chapter 3 because the conceptualization of fairness itself is not the main argument of this chapter. As a result, Chapter 4 can make a convincing contribution even if the explorative concepts of Chapter 3 are not accepted by the reader.

equity are met. Procedural fairness refers to the perceived fairness of the process and is, for example, fostered by applying (agreed upon) procedures consistently during the decision making process. Regarding the cooperation with external parties, research has demonstrated that positive procedural fairness perceptions influence the quality of this cooperation, resulting in higher performance (Busenitz et al., 2004; Kumar et al., 1995; Luo, 2005; 2008). In addition, detailed analysis of business ownership negotiations shows that procedural fairness perceptions influence sustained cooperation and affect satisfaction (Howorth et al., 2004). Here, perceptions of procedural unfairness can cause entrepreneurs to reduce cooperation, even if this harms the venturing process (Kim and Mauborgne, 1998; Pillutla and Murnighan, 1996). The effect of fairness perceptions on cooperation and performance in particular relates to the mode of interaction with the partner (procedural fairness), rather than just the content of the contract (distributive fairness) (Sapienza and Korsgaard, 1996).

Central drivers of procedural fairness perceptions regarding relationships are status recognition or dignity and respect and neutrality or bias suppression (Busenitz et al., 2004; Colquitt, 2001). Influential stakeholders in a venture – for example, venture capitalists and university incubators – are often able to impose their views on the entrepreneurs, because they have more power and resources (Cable and Shane, 1997). This may result in violating the fairness rule of respectful treatment and could reduce the entrepreneur's perceived fairness. Furthermore, the neutrality of for example the incubator implies impartial treatment of the ventures (cf. Busenitz et al., 2004). Violating this fairness rule can reduce commitment of the entrepreneurs to cooperate voluntarily and creatively and can cause the relationship to fail (Husted and Folger, 2004; Kim and Mauborgne, 1998; Sapienza and Korsgaard, 1996). On the other hand, enhancement of procedural justice increases cooperation, trust and commitment of the entrepreneurs with their stakeholders, which increases the quality of the entrepreneurial process and thus the performance of the venture (Busenitz et al., 2004; Kim and Mauborgne, 1998). Hence, procedural justice perceptions provide a convincing explanation of the effect of clear procedures of how clear procedures affect the creation and performance of new ventures. This especially applies to contexts where entrepreneurs have to deal with powerful stakeholders, as university spin-offs do (Debackere and Veugelers, 2005; Vohora et al., 2004).

Organizational justice theory is based on laboratory experiments and field studies investigating fairness formation in the context of employer-employee relationships. Some studies have extended this setting to different areas, such as the relationship between corporate headquarters and subsidiaries (Kim and Mauborgne, 1993) or between alliance partners (Luo, 2005), and also to the entrepreneurship context (Busenitz et al., 1997; Busenitz et al., 2004; Sapienza and Korsgaard, 1996). However, to increase understanding of the actual effect of fairness perceptions on new venture development, *process* studies are needed that address the questions how and when fairness perceptions influence the development of new ventures. Moreover, these studies should pay attention to the actual construction of fairness perceptions by entrepreneurs, as this is influenced by the venturing process as well. Research has established that the degree and kind of experience are important factors. Experience determines the frame of reference against which the transaction is evaluated (Burmeister and Schade, 2007; Kahneman, 1992; Shepherd et al., 2003). In general, Busenitz et al. (1997) found that both industry and firm experience – including prior experience in different firms and industries – positively influences fairness perceptions.

In sum, previous research demonstrated the importance of fairness perceptions in the context of new venture development. As such, the significance of (effects of) fairness perceptions has mainly been established on the basis of cross-sectional data, which fail to provide an understanding of the generative mechanisms and effects of changes in fairness perceptions (Ambrose and Cropanzano, 2003; Busenitz et al., 2004; Hollensbe et al., 2008; Truxillo et al., 2002). Understanding these mechanisms is important because experimental studies have concluded that fairness perceptions are not static but tend to change over time, particularly when experience accumulates and reference frames change (Kahneman et al., 1986; Lehner, 2000).

## 4.3 Methods

This study aims to extend existing theory (Eisenhardt, 1989; Lee et al., 1999) on the cooperative behavior of entrepreneurs. Here, a comparative case study approach serves to conduct an in-depth process analysis of individual perceptions (Eisenhardt and Graebner, 2007; Van de Ven and Engleman, 2004). The effect of fairness evaluations has been studied primarily by experimental

designs and surveys. To explore how and when these perceptions influence the entrepreneurial cooperative process, more inductive accounts are needed to analyze these issues (cf. Busenitz et al., 2004). Furthermore, qualitative procedures serve to combine different types of data. Thus we can combine with interviews with archival documents and performance data covering diverse venturing events (cf. Gartner and Birley, 2002). In addition, qualitative procedures are instrumental to study micro interactions between people (Lee, 1999) in the process of launching such a venture from the university setting.

*4.3.1 Sample selection and study context*

The sample consists of 17 new ventures commercializing technology from TU/e. This academic entrepreneurship setting is very appropriate to study fairness issues, as fairness perceptions tend to influence in particular the behavior of economic agents in situations of unequal power distribution and high dependency (Husted and Folger, 2004; Sapienza and Korsgaard, 1996). For these spin-off companies, the technology obtained from the university is the basis for the first product or service they bring to market. In this respect, the relationship with the university is essential to accomplish starting the venture effectively, both in the conception phase of their venture – to receive support to start the venture, to acquire and develop the technology, and to obtain access to and use facilities – and in the subsequent development phase, as well as exploring new opportunities in the future. Earlier studies have found that fairness perceptions play an important role in this context (Ambos et al., 2008; Colyvas, 2007; Rappert et al., 1999; Welsh et al., 2008). Furthermore, this study of ventures from one single university provides a great setting because it controls for variability at the institutional, regional and national level. In the meantime, this setting enables investigating in-depth the effect of fairness perceptions on the start-up process.

As already introduced in Section 1.3.4, TU/e has a long history of cooperative ties with industry. To regulate university spin-off creation, a number of rules are established, which are discussed in more detail in Section 3.3.1. The university has established also has established a heuristic rule for the value distribution of both royalties and revenues from the exploitation of a patent in a start-up: one third for the research group, one-third for the inventor(s), and one third for the

university. These rules are intended to prevent long negotiations and guide expectations of inventors as well as (future) entrepreneurs.

Theoretical sampling served to select 17 different ventures started by academic entrepreneurs from TU/e. Such a small sample is needed in an in-depth longitudinal study, as it allows detailed comparison of poorly understood phenomena. As such, we aim at understanding generative mechanisms in the venturing process which apply to similar cases, rather than gathering a widely representative sample (Eisenhardt, 1989; Lichtenstein et al., 2006; Van de Ven and Engleman, 2004). The companies were selected from the database of spin-off support and technology transfer unit (TTO) at the university. In total 71 spin-offs are in this database (between 1993 and 2008), of which 43 fit our definition of university spin-offs as a new company established to exploit university intellectual property (Pirnay et al., 2003). In consultation with one of the spin-off advisors from the university, cases were selected according to the following criteria which are theoretically relevant for the research question. First, we wanted to include different types of entrepreneurs with different backgrounds (faculty, students or entrepreneurs from outside the university, cf. Bercovitz and Feldman, 2008; Busenitz et al., 1997; Hackett and Dilts, 2004); exploiting technologies from different departments and disciplines (cf. Shane, 2001a; 2001b) and with variety regarding survival and failure of the ventures (i.e., ceased ventures are included to avoid a success bias, cf. Davidsson, 2004). Furthermore, to be able to compare the different ventures, we selected spin-off companies for which data covering at least two years of the start-up process was available. As we were not completely informed about the situation of the venture and the background of the academic entrepreneur, the final case selection we was iteratively composed during the process of interviewing and analyzing. This resulted in the selection of 17 ventures, which provides a sample that incorporates the variation and which is adequate to generate reasonably textured theory (Eisenhardt, 1989).

### 4.3.2 Data collection
Data were collected from two main sources: 1) open-ended interviews with entrepreneurs and university officials and 2) archival data. In addition, we collected data by direct observations during frequent one-to-one interactions and

by attending meetings with academic entrepreneurs and university officials between August 2006 and December 2008. Face-to-face interviews (in total 28 interviews) with the lead founders were performed in a semi-structured way, using a topically structured interview guide. The interview protocol followed the start-up process with general open-ended questions about motivation, networks, first client contacts and contracts, technology development into prototypes, training and education, support and coaching, acquiring capital, intellectual property and the university context in general. These questions were rather open with regard to experiences and perceptions, but the interviewers did made sure to cover all relevant aspects of the relationship with the university. In four cases, post-interview telephone or personal conversations served to clarify ambiguities. In three cases, the entrepreneurs were at the very beginning of the start-up process in August 2006, so we conducted multiple interviews to cover the subsequent two years as well. In these second and third interviews, the interview protocol started with a general question about how things had gone since the last interview, followed by specific questions about the aspects of the entrepreneurial process that were also discussed in the first interview. These repeated interviews, together with frequent interactions with academic entrepreneurs and support staff, mitigated the bias of retrospection by combining older with current data (Leonard-Barton, 1990).

Interviews with different people within the university were conducted to observe the institutional environment of the university and to triangulate the stories of the academic entrepreneurs (Jick, 1979). Using a similar protocol as for the academic entrepreneurs, we interviewed 9 people in 13 interviews, including the director and several other staff members of the technology transfer and spin-off support unit (abbreviated as TTO), the director of one of the main academic departments, and entrepreneurship trainers and advisors. These interviews served to collect data on general policies and practices of the university with regard to spin-off advice, facilities, funding, and networking, IP policies, negotiations about IP and costs of the facilities, and the procedures and regulations. Moreover, these respondents were questioned about the negotiations and their thoughts about the fairness perceptions of the academic entrepreneurs in our sample. These interviewees also included the officers representing the university in negotiations with the entrepreneurs.

All interviews were recorded and fully transcribed. In total, we collected 40 hours of interview data, which equaled 512 pages of text. Data collection and analysis occurred concurrently: we analyzed the data after the interviews and used this preliminary analysis to identify additional questions and probes to refine the codes, and to iteratively test the emerging patterns and relationships.

Three categories of archival data were collected and analyzed. First, for each of the companies in the sample we collected company related documents and performance data, such as business plans, funding proposals, and annual reports. Second, the university technology transfer office gave access to all textual correspondence (such as emails and proposals) and the contracts with the companies. Furthermore, we collected documentation describing university policies, plans and protocols. These documents included annual reports and descriptions of the university's history. Third, newspaper articles, interviews, brochures and website information regarding the specific companies were consulted. Table 4.1 summarizes the main data sources and introduces some characteristics of the entrepreneurs.

*4.3.3 Data analysis*

The first step in the analysis was to build a description of the university's practices and procedures with regard to commercializing technology, including any recent developments. This description was built on the documents outlining the strategy and procedures in combination with the interviews with university representatives. In this stage, interviews with academic entrepreneurs were only used to check for the consistency of the procedures as written in documents. Subsequently, this description was discussed with two officers of the technology transfer unit to correct any misunderstandings.

The second step in the analysis was to analyze the interviews with the academic entrepreneurs to identify the key events in the start-up (and in two cases the early decline) of the venture. Here, we employed the coding technique developed by Van de Ven and Poole (1990), to code the key start-up events as identified in the accounts of the entrepreneurs. The author and one of the supervisors double coded key passages in the data to refine the coding procedures. A limited number of minor differences in interpretation were found, which were subsequently discussed to improve the reliability of the coding. In

# Table 4.1: Data collection

| Name of new venture | Interviews with founders and inventors | Documents | Experienced founders | Venture continuation | University equity shares | Interviews with university representatives |
|---|---|---|---|---|---|---|
| *Alpha* | 1 | | Yes | Continued | ‹10% + royalties | |
| *Beta* | 2 | | Yes | Continued | 20%-30% | |
| *Gamma* | 1 | | Yes | Continued | 50-60% | |
| *Delta* | 1 | | Yes | Continued | 30%-40% + royalties | |
| *Epsilon* | 2 | | Yes | Continued | 10-20% | |
| Zeta | 2 | | No | Ceased | 90-100% | |
| *Eta* | 1 | Business plan Contracts | Yes | Taken over after suspension of payment | 10-20% | |
| *Theta* | 1 | Patents | Yes | Ceased | 90-100% | |
| *Iota* | 1 | Press publications Annual reports | Yes | Continued | none | |
| *Kappa* | 1 | Archived e-mail | Yes | Continued | none | |
| *Lambda* | 1 | discussions | Yes | Continued | ‹10% | |
| *Rho* | 3 | | No | Continued | ‹10% | |
| *Sigma* | 3 | | No | Continued | ‹10% + royalties | |
| *Tau* | 4 | | No | Continued | ‹10% + royalties | |
| *Upsilon* | 1 | | No | Continued | none | |
| *Phi* | 1 | | No | Continued | none | |
| Omega | 2 | | No | Ceased | 10%-20% | |
| *Total interviews* | 28 | | | | | 13 |

addition, we coded events related to the relationship with the university and to the perceptions about the negotiation process, drawing on the procedures described by Strauss and Corbin (1998). These codes were iteratively refined, discussed with the thesis supervisors, and aggregated into higher level categories. Fair and unfair perceptions were coded, as well as different dimensions of fairness perceptions (e.g., distributive and procedural fairness) following the operationalization by Colquitt (2001). An example of a perception coded as fair is: "Yes, I think we got a fantastic deal" (Tau). On the other hand, the following quote was coded as unfair: "How easy they stole one-seventh of my company!" (Eta). The QSR NVivo software served to build a code database.

To test the reliability of the final coding, the codes for fairness dimensions and fairness perceptions were coded by two coders unfamiliar with the study (two graduate students), following a secondary coding procedure as advocated by Butterfield et al. (1996) and Hollensbe et al. (2008). These coders received the final codes and their definitions together with a representative selection of the passages from the transcripts. The coders were instructed to select the most appropriate code for each of the quotes. We calculated the $P$-statistic of overall agreement, which was .83 for the fairness rules and 1.0 for the fairness perceptions. These $P$-statistics where well above the suggested threshold (.70; Cohen, 1960), implying consistency in the fit between the codes and the data.

Subsequently, we triangulated the identified 232 key events and the coded perceptions with other data sources, such as interviews with the university representatives, email conversations and press releases. Table 4.2 illustrates the coding procedures and the triangulation process.

The third step in the analysis was to analyze the event series of each of the cases. We started with graphical representations of the events to discern different patterns of venture start-up processes (Langley, 1999). One graph depicted differences in the sequence of events (e.g., ABC or BCA), another graph depicted the time between events for each of the cases (e.g., is there a smooth succession or are there interruptions?). These graphical representations for all individual cases served to observe three different pattern types. These three patterns were observed by visually inspecting all the graphs and grouping visually similar graphs together. Subsequently, we refined the sequence analysis by performing a gamma analysis for the sequence of the events (Pelz, 1985; Poole et al., 2000). This

**Table 4.2: Examples of coding and triangulation**

| Code | Quote example | Examples of other data sources |
|---|---|---|
| *Unfair negotiation procedure* | I doubt their honesty in the negotiations. (...) That is indeed a hard judgment. (Epsilon) | E-mail conversation in the archive. |
| *Fair negotiation procedure* | The negotiations went really well, because the administrative director of my department understood my position. (Alpha) | TTO representative: In my opinion, we never had something where we said: It looks as if we cannot reach an agreement. Actually, we always started negotiations with the idea that this and that has to be done and we need to have an agreement to proceed. According to me, that was our shared departure point. |
| *Unfair agreement* | There seems to be a certain arbitrariness. (...) Other entrepreneurs, who add less value themselves, get better deals. Honestly speaking. (Tau) | TTO representative: We have been struggling quite a lot about the participation and the license. |
| *Fair agreement* | For me the long term cooperation is very important. And it is logical that the university will get a certain return. (Lambda) | TTO representative: He also experienced it as very fair. He proposed this 10% of shares and I had the same proposal in my mind. So, we came to an agreement very rapidly. |
| *Acquiring large grants* | Last year, we got a grant of 200K euro, which is for about two years. So, we still have half a year. I don't count this grant as turnover, but it reduces our costs. Wages and costs for developing new products. (Rho) | Press release of the grant organization. Article in the university newspaper. |
| *First client* | Half way in my term as doctoral candidate, I was approached by the CEO of this company. He was looking for somebody who could help him a step further. (...) That has been the onset. Next, we have searched if we could set up something together, which has been the start of my company. (Lambda) | Website of the company Proposals for grant applications |

analysis draws on the Goodman-Kruskal gamma that measures the proportion of A events that precede or follow B events. The pairwise gamma is calculated by (P-Q)/(P+Q), where P is the number of A events preceding B events and Q refers to the number of B events preceding A events. After having calculated the matrix with all possible pairs, precedence scores are calculated. The precedence score for an event is the average of its gamma scores, ranging from -1 to +1, indicating the location of the event in the total ordering. The separation score of an event is the mean of the absolute value of its gamma scores, which indicates the distinctness of the events. Events with separation scores above 0.5 are separate; values between 0.25 and 0.5 imply that the event is not clearly separated; and values below 0.25 imply that the event is not separable (Poole et al., 2000). The case analysis especially draws on the combined precedence scores per pattern. To control the validity of distinguishing the different events, separation scores of the events were checked per case. Results showed that all the different events were separate (indicated by separation scores larger than 0.5).

The fourth step in the analysis was to relate the identified patterns and the underlying events to fairness perceptions. We analyzed around which events these perceptions play a role and how this relates to the development of the ventures. Furthermore, we analyzed the experience of the founders as a condition for the venturing process and fairness perceptions. Subsequently, for each of the ventures, and the patterns they belong to, we analyzed the data to identify certain characteristics of the venture development process and we combined these patterns with the performance data. This analysis of the performance data, in combination with interview data and other sources, served to build theory on how and when fairness perceptions affect the venturing process.

## 4.4 Results

### 4.4.1 Three new venture development patterns

To establish the relationship between fairness perceptions and venturing development, we first identified and described three new venture development patterns (displayed in Figure 4.1). At the heart of each of the patterns is the perceived fairness of the relationship with the university and the three patterns correspond with differences in fairness perceptions. This relationship consists of multiple ties. Academic entrepreneurs usually have a relationship with a

researcher or research group, with a university department and with the university's technology transfer office (TTO, also referred to as spin-off support unit). They form fairness perceptions about each of these connections, but the interview data imply that relationship with the TTO and to a lesser extent the relationship with the departmental director are the most significant ones. So, in the remainder of this chapter 'fairness perceptions' refer to the sum of these relationships in which the relationship with the TTO is most important. Where relevant, we distinguish between distributive and procedural fairness. In general, procedural fairness is more frequently reported and identified in our data. Figure 4.2 depicts the relative importance of the distributive and procedural fairness for each of the three patterns.

The three observed patterns are: steady development, increasing cooperation and decreasing cooperation. In the *steady development* pattern, the relationship with the university is perceived as rather fair during the entire period studied. In the *increasing cooperation* pattern, the entrepreneurs perceive an unfair relationship with the university during the first period of the venturing process,
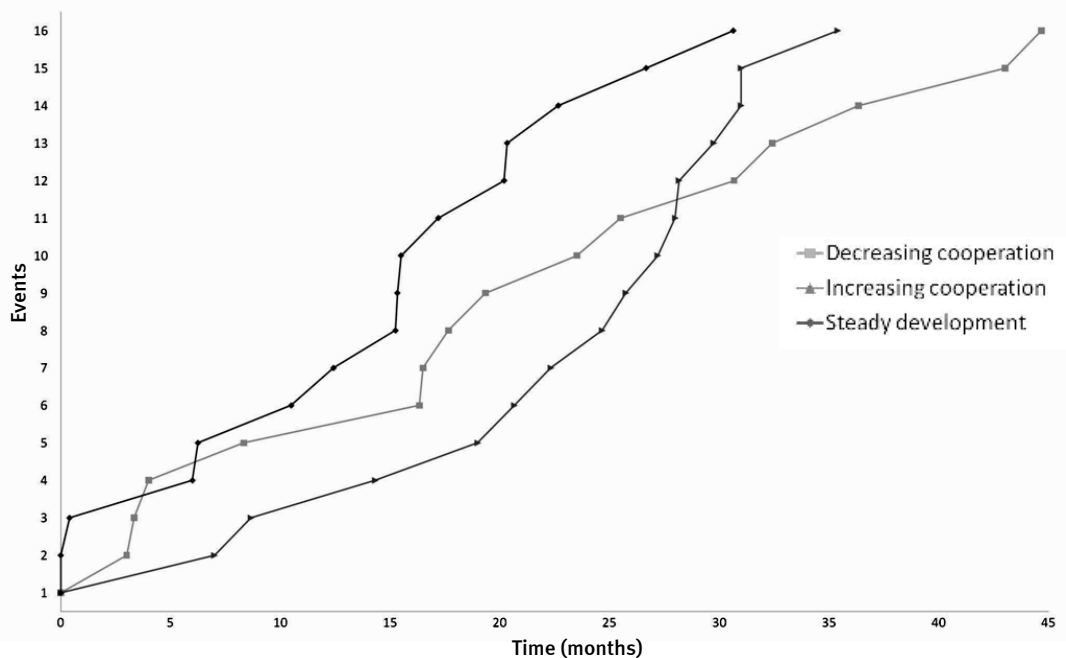


**Figure 4.1: Average timing of 16 most frequent events per pattern**

but subsequently learn to perceive this relationship as rather fair and as such also increase their cooperation with the university. In the *decreasing development* pattern, the entrepreneurs initially perceive the relationship with the university as fair, but later this changes to perceived unfairness and the cooperation with the university is reduced or discontinued. A summary of the analysis of each pattern is presented in Table 4.3. Table 4.4 illustrates exemplary observations of the patterns and lists the cases in which each pattern was observed. In the remainder of this section, each pattern is characterized and illustrated by a typical case. In addition, the distinctive effects of experience are discussed. The major differences between the patterns are tested by a t-test. This test confirms that a number of events occur at different moments (see Table 4.6). Moreover, the essential differences between 'steady development' and 'increasing cooperation' are confirmed. The slopes of the first five events of 'steady development' and 'increasing cooperation' are significantly different (.046), demonstrating that in the 'increasing cooperation' pattern proceeding events takes more time. The slopes of the next events of these two patterns are not significantly different, thus confirming that the entrepreneurial behavior in the second part these patterns are similar, involving effective cooperation. The differences between the 'decreasing cooperation' and the other patterns are not confirmed, due to the limited amount of observations in this pattern.
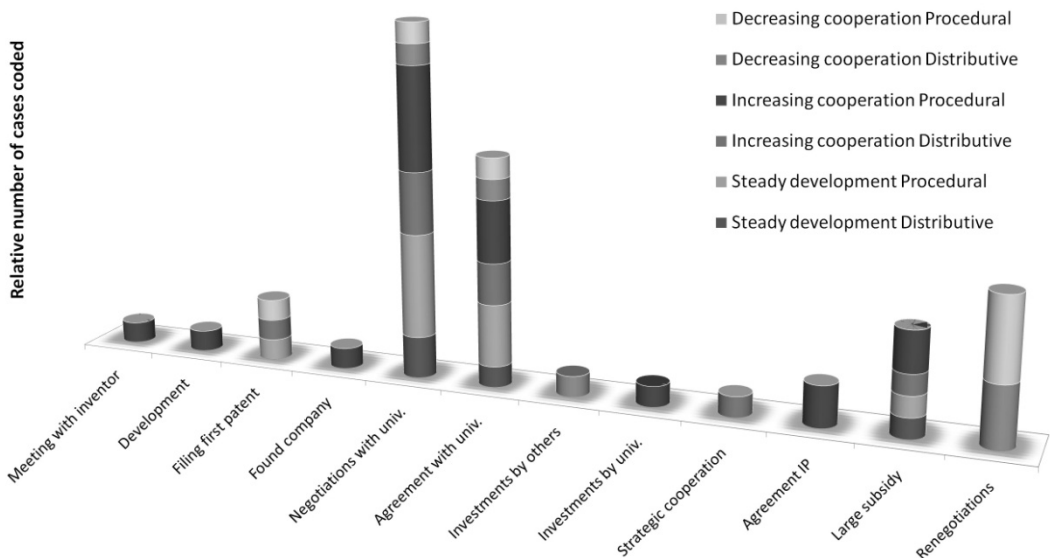


**Figure 4.2: Importance of procedural and distributive fairness evaluations per pattern**

*4.4.2 Pattern 1: Steady development (fair-fair)*

This pattern is characterized by a relatively early establishment of the company and early strategic cooperation, as Table 4.5 shows. In this respect, business organizing activities precede an agreement with the university. With regard to fairness perceptions, these entrepreneurs perceive the procedures and policy of the university and the (negotiation) behavior of its representatives as rather fair, especially in terms of procedural fairness (see Figure 4.2). The ventures following this pattern show steady development and continuous turnover growth, while critical events in the development curve are the filing of the first patent and the start of production (events 4 and 8 in Figure 4.1).

*Delta.* A professor in computer science developed a tool based on her work and that of her colleagues over the past few years. This tool was used for solving practical problems in teaching and research. She also made the tool

**Table 4.3: Characteristics and consequences of the patterns**

|  | Steady development | Increasing cooperation | Decreasing cooperation |
| --- | --- | --- | --- |
| Experience | Experienced entrepreneurs | Inexperienced entrepreneurs | Entrepreneurs with experience accumulated in this venture Renegotiations under difficult circumstances |
| Characteristics | Early founding of company and strategic cooperation Negotiations and agreement perceived as fair | Before agreement: Long negotiations with university Negotiations perceived as unfair.<br><br>After agreement: Deal perceived as fair Increasing cooperation Acquiring pre-seed funding | Quick start and early agreement In renegotiation phase, previous agreement difficult Renegotiations perceived unfair |
| Consequences | Early acquisition of pre-seed funding Early and tight cooperation | Late (pre-seed) funding Delay by long negotiations | Decreasing cooperation Delay in renegotiations |

available for others through the internet. An entrepreneur with a PhD in computer sciences, who just sold his company, discovered the tool and anticipated attractive commercialization opportunities. This entrepreneur used the tool to approach a potential client and found that this tool was very helpful to deal with business information problems. Subsequently, he approached the professor and they agreed to set up a development project to explore the commercialization of the tool. Here, they engaged a MSc student, who later also became one of the founders. The development of the tool looked promising, so some months after the first meeting they approached the representatives of the department and the TTO to reach an agreement on the conditions under which commercialization in a new start-up could be done. Because the technology was the result of years of research, the agreement obtained after two months was that the university got about 35% of Delta's equity and Delta would pay royalties over the commercialization (if successful). At the same time, this start-up acquired the right to consider the commercialization of future research outcomes in this particular area. The research group profited from the deal, because it would receive one-third of the revenues and in addition the inventor's budget would be increased by another one-third share of the revenues. The entrepreneurs, the professor as well as the university officials perceived it was a fair deal in terms of distributive fairness. As the entrepreneur stated:

> It is especially important that we found something that was satisfactory to everybody. (...) They may get their 200K [for the royalties]. Very easy, also because it is favorable for both parties. When the university sees something coming back, we will probably get more from them as well. (...) When we make so much profit, it is fair to give something back, as we agreed.

Also the university official reported that this was a very smooth process:

> In my opinion, this has been a very easy story. We agreed very quickly how we were going to do this, because the entrepreneur felt that it was very important that the university got a participation in his company.

Several months later this deal was formally signed. In the meantime, the external entrepreneur and the student founded Delta, and they invested their own capital in the company. They continued cooperating with the university, to develop the first product, but also in view of future releases of software.

**Table 4.4: Exemplary observations of the patterns**

|  | Steady development | Increasing cooperation | Decreasing cooperation |
|---|---|---|---|
| *Cases* | Alpha, Gamma, Delta, Iota, Kappa, Lambda, Upsilon | Beta, Sigma, Tau, Rho, Phi, Omega | Epsilon, Zeta, Eta, Theta |
| *Characteristic quotes of fairness perceptions of negotiations in relation with the venturing process* | We always had a good relationship with the professor. And we were always very open about what we could and what we couldn't do. The cooperation has brought benefit for both parties. (Iota) | We would like to finalize this, so that we have clearness and we could proceed with our venture. (…) In that sense, it was really nice to wind up the negotiations, for then we could make headway and both parties have got to know where they stand. (Rho) | Looking back, I would never accept the university as a majority shareowner again. (…) They could maybe have like 40% of the shares, but would never be majority owner again. (Theta) |
|  | It is goodwill to do something back. We agreed that with the professor. We didn't want to have the appearance that we stole the knowledge or that we had privileges. (Iota) | It is the question: how do you get a fair deal? Do you as a start-up not always get the worst? (…) Is that fair? They say the current procedure [and business valuation] is standard. We are negotiating about something we don't know anything about. (…) This makes it really difficult and creates a very long trajectory. And that is not positive, because you get friction everywhere. (Tau) | These have been difficult negotiations, really horrible. This was unnecessarily complicated. The university thought in fact that at that moment the big money was streaming in and they would like to have their share of it. This is absolutely not the case, it is exceptionally risky business. (…) After much fiddling around we agreed on a compromise in which they got a piece of the shares.(Eta) |

### Table 4.5: Average time of the occurrence of events (months)

| Event | Steady development | Increasing cooperation | Decreasing cooperation |
|---|---|---|---|
| Invention | 0.0 | 0.0 | 0.0 |
| Push | 6.0 | 0.0 | 4.0 |
| Search for ideas | | 2.0 | |
| Meeting with inventor | 0.0** | 7.0** | 3.3 |
| Development | 0.4** | 10.0** | 3.0 |
| Filing first patent | 6.3 | 14.0 | 25.5 |
| Found company | 12.4 | 22.3 | 8.3 |
| Agreement department | 10.5 | 20.7 | |
| Negotiations with univ. | 20.2 | 19.0 | 16.5 |
| Agreement with univ. | 26.7 | 28.2 | 16.3 |
| Team formation | 15.5 | 8.7 | 26.0 |
| Investments by others | | 24.7 | 19.3 |
| Winning prizes | 66.0 | 27.2 | |
| Investments by univ. | | 14.0 | 6.0 |
| Strategic cooperation | 20.3 | 28.0 | 30.7 |
| First client | 15.3** | 31.0** | 23.5 |
| Agreement IP | 22.7 | 25.8 | |
| Hiring personnel | 17.2* | 35.4* | 17.7 |
| Large grants | 32.1 | 31.0 | 32.4 |
| Survival problems | | | 49.0 |
| Renegotiations | | 23.0 | 44.7 |
| Production | 15.3** | 29.8** | 36.3 |
| Stop cooperation univ. | | | 43.0 |
| Attempt to buy-out | | | 60.5 |
| Stop company | | 55.0 | |

Differences between patterns: *Significant at 10%; **significant at 5%; ***significant at 1%.

**Table 4.6: Gamma analysis of event sequences**

| Event | Steady development | | Increasing cooperation | | Decreasing cooperation | |
|---|---|---|---|---|---|---|
| | Precedence | Frequency | Precedence | Frequency | Precedence | Frequency |
| Invention | 0.63 | 7 | 0.81 | 6 | 0.81 | 4 |
| Push | 0.26 | 1 | 0.68 | 3 | 0.52 | 2 |
| Search for ideas | 0.41 | 1 | 0.48 | 1 | 0.52 | 1 |
| Meeting with inventor | 0.44 | 2 | 0.34 | 4 | 0.48 | 3 |
| Development | 0.24 | 5 | 0.42 | 3 | 0.59 | 2 |
| Filing first patent | 0.20 | 6 | 0.33 | 6 | 0.11 | 2 |
| Found company | -0.03 | 7 | 0.17 | 6 | 0.34 | 3 |
| Agreement department | 0.01 | 3 | 0.24 | 4 | | 0 |
| Negotiations with univ. | -0.02 | 5 | 0.12 | 6 | -0.03 | 4 |
| Agreement with univ. | -0.19 | 7 | -0.18 | 5 | 0.30 | 3 |
| Team formation | 0.01 | 2 | -0.05 | 5 | -0.07 | 1 |
| Investments by others | | 0 | -0.24 | 3 | 0.22 | 3 |
| Winning prizes | -0.48 | 1 | 0.00 | 4 | | 0 |
| Investments by univ. | | 0 | -0.19 | 2 | 0.07 | 1 |
| Strategic cooperation | -0.26 | 5 | -0.11 | 4 | -0.24 | 3 |
| First client | -0.26 | 6 | -0.37 | 4 | -0.25 | 2 |
| Agreement IP | -0.17 | 3 | -0.23 | 5 | | 0 |
| Hiring personnel | -0.14 | 5 | -0.62 | 5 | -0.02 | 3 |
| Large grants | -0.29 | 11 | -0.34 | 10 | -0.26 | 5 |
| Survival problems | | 0 | | 0 | -0.30 | 2 |
| Renegotiations | | 0 | -0.48 | 1 | -0.28 | 3 |
| Production | -0.35 | 4 | -0.54 | 4 | -0.28 | 3 |
| Stop cooperation univ. | | 0 | -0.16 | 1 | -0.41 | 2 |
| Attempt to buy-out | | 0 | | 0 | -0.64 | 2 |
| Stop company | | 0 | | 0 | -0.81 | 3 |

As one of the founders observed:

> Nobody is able to really protect the property of software, but we
> preferred to have a clean relationship with the university. We had the
> idea to maintain the triangle between the external experienced
> entrepreneur, the professor and me. We liked to involve the university.
> And indeed, we had to negotiate that, and we were somewhat skeptical
> about it, (...) but it wasn't a big deal. We arrived at the TTO and they were
> very supportive.

Delta hired its first personnel, and shortly after that, the first contract with a
client was signed. In order to protect their software design, they subsequently
filed a design registration. In subsequent years, Delta grew steadily in
turnover and number of employees.

In the steady development pattern, the cooperation and the interaction
between the new venture and the university is never at serious risk and the new
venture progresses steadily – but more rapidly than in the other two patterns, as
Figure 4. shows. Essential for many of the analyzed new ventures is the
development of the invented technology. In most of the cases, developing this
technology towards a marketable product or service consumes ample time and
money. Therefore, research cooperation and pre-seed funding are important. This
necessitates a formal relationship with the university, as investors and grant
providers ask for a solid IP position and for a guaranteed research backup from
the inventor(s). Table 4.5 shows the average time of the observed events per
pattern (the ordering of events is according to the overall average). This shows
that in the steady development pattern especially the agreement with the
department is reached earlier than in the increasing cooperation pattern (see also
Table 4.5). Table 4.6 reports the results of the Gamma analysis of the event
sequences. The precedence scores indicate the average order of the events in each
of the patterns. The frequencies of the events show that some events occur often,
thus indicating iterations in the startup process. In this respect, the analysis
reported in Table 4.6 shows that the negotiation and agreement events are
adjacent to the acquisition of large grants for the steady development pattern.

More importantly, Table 4.4 and Table 4.5 show that the time between the start of the negotiations and the agreement is relatively short and that these negotiations are evaluated as fair, in particular with respect to procedural fairness (see Figure 4.2); the final terms of the agreement do not differ significantly from the other patterns (see Table 4.1). Furthermore, the agreement is often reached while the company is already up-and-running, such as in the *Delta* case.

The analysis of the cases reveals that in three of the seven ventures with this pattern, the entrepreneurs had extensive business experience and in most of the other cases the founders had prior experience with large projects (see Table 4.1). This experience apparently serves to provide important reference transactions that operate as fairness heuristics in assessing the interactions with the university, which in these cases results in evaluating the transactions with the university as fair. For example, the founder of Lambda compared his deal with market transactions:

> Usual royalty percentages are between eight and ten percent. In my case these percentages are similar. We just make agreements in conformance with market standards. That is the most effective deal.

### 4.4.3 Pattern 2: Increasing cooperation (unfair-fair)

This pattern is characterized by a relatively long period of negotiations with the university, with much iteration (see Table 4.5 and the frequencies in Table 4.6). Finalizing these negotiations is essential to be able to attract pre-seed funding. As a result of the long negotiations, these events occur in a relatively late phase. In the first phase of the start-up activities, the entrepreneurs perceive the university's rules and the behavior of its representatives as unfair (procedural fairness). Moreover, they feel that the balance between their effort and what they can acquire from the university is unfair in terms of distributive fairness (cf. Figure 4.2). However, around or after finalizing the negotiations, this perception changes and these entrepreneurs believe that they (in retrospect) finally got a good agreement which is beneficial for the development of the company. After this hiccup of the negotiations, the development of the company progresses in a moderately paced manner, as the decreasing slope in Figure 4.1 suggests.

*Sigma.* A PhD student invented an interesting engineering principle and was stimulated by his supervisor to develop it into a machine prototype. He developed this machine during his employment as doctoral candidate and discovered that the industry was interested. He filed the principle in a patent with help of the university patent office. Around his dissertation defense, he started talking with the department and the TTO about the possibilities to use the generated IP and the facilities at the university to create a new venture that exploits this invention. Because he and his supervisor perceived it as their personal invention, he felt unfairly treated when university officials proposed a deal about IP and facilities in which the university would get a 10% share in the company and royalties over the patent. He believed other universities provided better deals:

> At university X they say: 'If there is a patent and you can reach a good agreement between the spin-off and the university, like royalties as a percentage of the revenue generated by the patent, that's okay. Then, we don't need to have a share in the spin-off.' But here they want both a royalty-agreement, in which they claim a part of the turnover, and they also want to have a share in the company. For me, that's out of the question.

In the meantime, he was able to get an agreement with his department that he could stay in his office and use the facilities, while also engaging in some educational work in the department. Besides developing his machine, he also started approaching the market and started doing engineering consultancy work for a company. After the first meeting with the TTO officers, he involved a number of senior advisors in the negotiations with the university. But after three meetings over one year, he decided that the opinions did not converge. So, he decided to explore a work-around strategy in which he planned not to cooperate with the university and not to use the patent:

> So, we wanted to say to the university: now, we have a better idea. We will build a new machine, we have a client, production facilities, et cetera. We proceed with this and then we don't need the old patent anymore.

Half a year later, however, he acknowledged that he actually needed a deal with the university to be able to apply for a number of sizeable grants. Thus, he proposed that the university obtained 5% of the shares in Sigma and that he in turn got an exclusive license of the patent. This deal was finally signed, some 20 months after the first negotiations. Subsequently, he applied for the grant thereby cooperating with the university spin-off advisors. The slow process of negotiations due to, among others, his negative fairness perception of the process, had delayed the acquisition of this grant. As he reported:

> This is still the first phase of this grant [which is 25K euro's and not the second, which is 200.000 euro's], because I should have finished everything with the university first. (...) When you want to acquire this grant, you need to have an agreement with the university because you need to cooperate with a university to acquire this specific grant. So, I just could apply for this grant for the first time last week, because I eventually have finished the negotiations and completed the agreement.

He also evaluated the relationship with the university now much more positive, reflecting a shift in his fairness evaluation:

> Now, we have reached a good deal. When I chat with people around me, who are also involved in these activities, than I hear every time that I have been able to reach a very good deal.

The *Sigma* case shows that the perception of both distributive and procedural unfairness of the entrepreneur in the first phases of the venturing process causes a delay in the venture development with respect to the acquisition of funding. This is also reflected by the finding that the negotiations in the increasing cooperation pattern on average last longer than in the two other patterns: the time between the start of the negotiations with the university and reaching an agreement is 9.2 months versus respectively 6.5 and -0.2[8] months (Table 4.5: 'Agreement with univ.'-'Negotiations with univ.'). Table 4.5 and Table 4.6 also

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[8] The duration can be negative, because it reflects just the difference between averages of all cases.

show that other important venturing activities, such as finding the first client (precedence score -0.37) and hiring personnel (-0.62) take place later than in the other two patterns. This is partly influenced by the unfair perception of the entrepreneur(s), as the *Sigma* case demonstrates (see also Table 4.4). However, when the deal is finally finished and they start to perform these subsequent venturing activities, all of the entrepreneurs experience the university as helpful and relatively fair (procedural fairness), and they would like to cooperate on the long term with this university and evaluate the contract also in more positive terms.

An important condition affecting this pattern is that most of the entrepreneurs are relatively inexperienced. These entrepreneurs were still doctoral or graduate students at the university or recently completed their studies when they started their company. So, they did not have any substantial business experience or experience with large, externally funded, projects. This lack of experience influences the speed in which venturing processes proceed, because the entrepreneurs engage much more in exploration and search (e.g., for the right direction of their venture) than, for example, most of the entrepreneurs in the steady development pattern. Furthermore, this lack of business experience influences their fairness perception, as their evaluation of the university's rules and the behavior of its representatives as unfair is based on a comparison with other academic entrepreneurs at the university or other universities. In contrast, after having finalized negotiations, the entrepreneurs refer more to market transactions to argue that the university was a reasonable cooperation partner.

*4.4.4 Pattern 3: Decreasing cooperation (fair-unfair)*
This pattern is characterized by a relatively straightforward and quick start of the venture after a short period of negotiations with the university, as Table 4.5, Table 4.6 and Figure 4.1 demonstrate. In the first phase of the start-up, the entrepreneurs perceive the university's rules and behavior as fair and they are happy with the agreement obtained. However, around the first or second investment round, this perception changes and they experience their previous agreement with the university as a heavy burden, in particular in terms of procedural fairness (see Figure 4.2). Moreover, they experience the course of the renegotiations as unfair and decrease their cooperative efforts with the university.

This combination of events – financing round, renegotiations, and decreasing cooperation – is in two of the four cases related to a downturn in the venture's performance as well.

*Eta.* A research group at the university developed a high-end solution for the communications market. After extensive research, conducted over a period of more than 17 years, the research leader saw commercial opportunities. Because he did not want to become an entrepreneur himself, he contacted a venture capitalist. This venture capitalist (VC) knew a serial entrepreneur with experience in this industry. Together, they explored the commercial viability of this invention and agreed that it had large opportunities. Other VC's were also very interested. After these explorations, the VC decided to invest heavily in this start-up, in order to enable a rapid start. Subsequently, the company was founded and two former PD's in the research group joined the founding entrepreneur. While starting Eta, the also began negotiating with the university, which resulted into a deal after five months. These negotiations proved to be difficult, because the company was already being established so that the deal had to be finalized quickly. At this stage, however, the entrepreneurs still perceived the ongoing process as fair, and they continued cooperating with the research group, which formed a very important prerequisite to make the invention a commercial success. Because they had to invest heavily in equipment and testing, two months later, they had to attract new funding and therefore acquired a second round of investments from the first VC and another VC. This resulted in dilution of the stock shares of the university, which was not easily accepted by the university's representatives. As a result, the relationship between the university and the entrepreneurs deteriorated. Because Eta needed high quality lab space, it started cooperating with another university, where the entrepreneurs expected to get much more support and experienced more smooth negotiations. This university also cooperated in the acquisition of large scale (2 million) government grants. In the next two years, the company made much progress and its product was approaching the point of market introduction. However, because of the capital intensity of the development process, the cash flow was drying up and a third investment round was needed after two years. The VC's which already had

invested wanted to have another investor on board, and a number of VC's appeared to be interested. In addition, the VC's wanted to see the commitment of a big customer. Thus, Eta obtained a letter of intent from one of the potential customers. However, the VC's perceived it still as too risky to further invest because of difficult market circumstances and the capital intensity of the product development. Subsequently, the entrepreneurs tried to sell Eta and found a party that was interested. To sell Eta, commitment was needed from all the shareholders. The VC's agreed as well as the founders. However, the difficult relationship with the university turned out to be more problematic, as the university did not want to dilute any further. After relatively long negotiations during this phase – while Eta in the meantime asked for suspension of payments – the university finally agreed on a reduction of its equity position. Overall, the cooperative ties with the university largely broke down, as the entrepreneurs and the inventor experienced the university as unfair and uncooperative. As the founder reported:

> The cooperation with the university was very difficult, but we needed lab space. Then, we discovered that a different university also had reactors where we could produce our products. (...) Because the relationship with our university was so bad, we moved to this university, talked with the professor and they were very interested. (...) So, we ended up with ceasing the cooperation with our university and cooperating with a different one.

However, this process was time-consuming, while Eta was still in stormy weather. Over the next months, the venture was reorganized and the founders left the company, which was subsequently sold again and finally went bankrupt. Just before the founders left, they tried a management buy-out, which was not successful. As a result, the university ended up with a very small amount of shares in the mother company, the founders were not involved any longer and the invention was not exploited any further.

The *Eta* case illustrates that in the first phase of the decreasing cooperation pattern the process and cooperation go rather smooth, and Figure 4.1 shows that funding is acquired relatively early. But around the second and third round of

investments, the negotiations with the university – which are perceived as unfair – are delaying the investments in these crucial phases. In all three the cases that exhibit this pattern, this perception of procedural unfairness results in decreased or ceased cooperation with the university. These companies then have to find other – 'better' – partners, which also delays the commercialization process.

This pattern is associated with founders with substantial entrepreneurial and business experience who experience specific situational conditions and/or extreme uncertainty combined with time pressure at a critical stage of their venture's development. The three companies (*Eta, Epsilon, Theta*) show a venturing process in which large investments are done at an early stage, and for one company (*Zeta*) funding is needed in an early phase. This creates rather independent and viable companies and also reinforces the founder's initial experience. The early success in attracting funding influences the attitude of the founders in relation to the university, which is evaluated regarding its contribution to the venture, in comparison with VC's and market parties. For example, as the founder of Epsilon reported:

> The average VC does not ask so many clauses as the university. (...) The approach is: as the university gets such a percentage for actually nothing, what should I tell this VC three months later? That the company's value has increased twenty times? That doesn't work. It is just not correct.

However, these entrepreneurs have to (re)negotiate with the university in circumstances characterized by high uncertainty and pressure. Eta and Theta were in serious problems because their cash flow was running dry and they needed to attract new funding. For Epsilon, there was the proposal of an investor, which was hard to combine with the interests of the university as a shareholder and strategic partner. In this situation, the university was perceived as not dealing flexibly and quickly with these negotiation processes under high pressure. The university procedures have to be dealt with, and it is in the interest of the university to assure its integrity and exposure, which in these cases was not easy to combine with the explorative nature of the venturing processes. These cases illustrate the downside of equity ownership by the university, as it can also lead to conflicts of interests.

*4.4.5 A model of fairness effects on new venture development*

To help making sense of the different patterns and observations, Figure 4.3 summarizes and connects a number of key findings. This figure shows the central role of previous experience and experience accumulation during the venturing process as important generative mechanisms of the effects of (changes in) fairness perceptions. In addition the negotiation length itself, that depends on the degree of relevant experience and the fairness perceptions, influences the development pace of the new venture.

One of the key findings of this study involves the role of experience. In this respect, our analysis implies that experienced entrepreneurs use different fairness rules to evaluate the transaction, which increases the likelihood of evaluating the procedure and agreement as fair (cf. Hollensbe et al., 2008). Furthermore, experienced entrepreneurs tend to value cooperation with the university as more important than relatively inexperienced entrepreneurs, and they are prepared to pay for it. For example, the founder of Lambda reported: "For me, the long term cooperation is very important. And it is logical that the university will get a certain return." As a result, experienced entrepreneurs evaluate the relationship with the university more often as fair and tend to more easily and quickly accept the terms under which the university would allow them to exploit the technology.
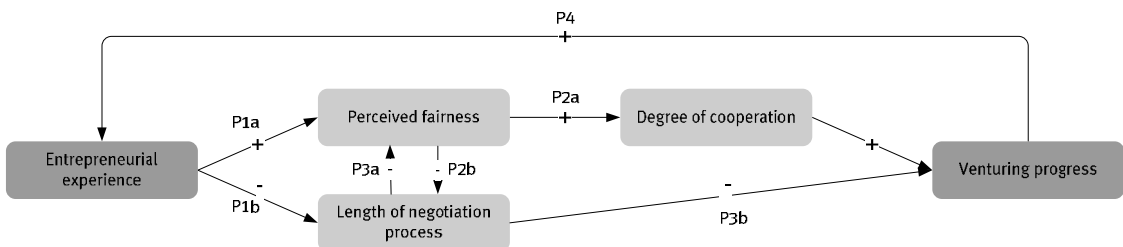


**Figure 4.3: A process model of fairness effects on new venture development**

This leads to the following propositions:

*Proposition 1a. Relevant previous business or startup experiences increase the likelihood that the entrepreneur evaluates cooperative relationships as fair.*

*Proposition 1b. Relevant previous business or startup experiences of the entrepreneur decrease the length of the negotiation process.*

Fairness evaluations appear to influence cooperation. For example, the Sigma and the Eta case illustrate clearly that evaluating the relationship as fair is an important generative mechanism for constructive cooperation. In addition, unfair evaluations apparently delayed the negotiation process. These observations lead to the following propositions:

*Proposition 2a. The more a relationship is perceived as fair, the more cooperative the entrepreneur will be in this relationship.*

*Proposition 2b. The more the relationship is perceived as fair, the faster the negotiation process will proceed and an agreement will be reached.*

Moreover, the negotiation process plays a central role in delays in the venturing progress. The negotiation process also affects fairness perceptions. Longer negotiation processes lead to evaluating the relationship as more unfair. In this respect, entrepreneurs use the length and easiness of the negotiation process to assess the fairness of the transaction with the university. For example, the founder of Sigma told in the second interview: "In the second negotiation discussing they [the TTO director] said: we will make a small adjustment to our claims. But, this way, the process keeps going on. I get very tired of it. (...) I feel they make many claims, but they give little in return."

In addition, the length of the negotiation process has a direct influence on the venture development pace. As negotiations with a key partner, such as the university for an academic entrepreneur, last longer, the venturing progress will be delayed. Hence, we propose:

*Proposition 3a. As the negotiation process proceeds faster, the relationship will be perceived as more fair.*

*Proposition 3b. As the negotiation process lasts longer, the venture's development (in terms of events that need to be accomplished to start the venture) will proceed slower.*

Finally, experience is not a static element of our model. The venturing process and the development of the negotiations lead to new experiences, resulting in learning by the entrepreneur. Especially the increasing cooperation pattern shows a learning pattern which parallels the accumulation of experience, subsequently leading to changing fairness perceptions and resulting in increasing cooperation. This leads to the following proposition:

*Proposition 4. As the venture develops further, the founders learn and their experience increases, thus influencing or changing the fairness evaluations and the length of the negotiation process.*

## 4.5 Discussion

Although previous research has established that fairness perceptions have significant development and performance effects, these studies have not provided insight in the precise role and effects of fairness perceptions in the entrepreneurial process. In particular, knowledge on how and when fairness perceptions affect the early stages of new ventures is not available. Therefore, we have assessed the effect of fairness perceptions on the development of the early startup events of a number of comparable venture processes. Our study reveals the precise role and generative mechanisms of fairness perceptions. The data analysis points at the relationship between the perception of unfairness and delays in the venturing process, whereas fair perceptions appear to be linked to a more rapid pattern of development. This development pattern is, of course, not only determined by fairness perceptions. Nevertheless, our study implies that especially procedural fairness perceptions affect the willingness to cooperate with an important partner, thus confirming earlier studies (Busenitz et al., 1997; Busenitz et al., 2004; Kumar et al., 1995; Sapienza and Korsgaard, 1996). In this respect, this study provides the

following new insights regarding how and when fairness perceptions influence the development of new ventures.

This study shows *how* fairness perceptions influence the development of new ventures and how these fairness perceptions are subsequently also affected by the new venturing process. The findings imply that if the early relationship with the university is experienced as fair, the entrepreneurs are more likely to cooperate with the university. This positively influences the ability to acquire funding and engage in strategic cooperation, resulting in faster development of the venture. Moreover, if the relationship with the university is perceived as fair, the agreement will be reached earlier and negotiations will be less intensive. Conversely, unfair perceptions delay productive cooperation with the university, resulting in delayed business start-up activities and acquisition of funding, and postponed building of external relationships. In addition, unfair perceptions are associated with long negotiations, causing similar delays in the venturing process.

One of the important generative mechanisms is formed by previous or accumulated experience. In this respect, our study makes an important contribution to both entrepreneurship and organizational justice literature. Research on the role of entrepreneurial experience has, for instance, found that experienced entrepreneurs are more effective in developing and sustaining relationships (Mosey and Wright, 2007). Our study shows that an explanation might be that experienced entrepreneurs are less influenced by potentially 'unfair' aspects of the relationship (e.g., the specific distribution of revenues), and are able to see the relationship in the broader perspective of valuable cooperative ties (cf. Westhead et al., 2005). The organizational justice theory has paid little attention to relevant experience as an individual-level generative mechanism of fairness evaluations. Our study shows that in some situations accumulation of experience can be one of the important generative mechanisms of fair and unfair evaluations.

In addition, experience is not a static but dynamic condition that evolves over time and during the entrepreneurial process. Thus, experience cannot be measured at one single moment, but should be treated as a process element, probably following a learning curve. Moreover, the experience condition evolves over time, implying that fairness perceptions cannot be exclusively studied cross-sectionally (cf. Ambrose and Cropanzano, 2003; Truxillo et al., 2002). This implies

also for other (inter)organizational relationships that fairness perceptions should be studied from a dynamic perspective and connected to the development of the relationship over time (Ariño et al., 2008; Reuer et al., 2006), thus extending the results of previous fairness studies (Luo, 2008).

    This chapter also shows *when* fairness perceptions influence the development of new ventures. Fairness perceptions especially play a role during (re)negotiations with the university. After these negotiations the agreement and the perceptions are rationalized and the terms of the relationship and agreement are accepted. These negotiations are observed especially during the beginning of the start-up process and when the company is facing survival problems or needs more financing. As such, this study highlights the importance of negotiation processes for new venture development, confirming results from previous studies (Ariño and de la Torre, 1998; Doz, 1996; Reuer and Ariño, 2002). Most of these studies tend to focus on contractual dimensions. However, our study shows that process characteristics such as the length of the negotiations and perceptions, rather than explicit contracts, affect venturing progress. Ariño et al. (2008) found small firms' alliance dynamics in terms of contractual renegotiations parallel those of larger firms, but one important difference is that small firms are less likely to adapt their contracts when collaborative interactions result in governance misalignment. Here, our study shows that in these cases the cooperation is likely to deteriorate, even if the contracts do not change.

### 4.5.1 Practical implications

This study has a number of important practical implications. Most studies of the university spin-off process and infrastructure focus on the support structures and less on the perceptions of the entrepreneur. In this respect, this study shows that it is worthwhile for university and TTO representatives to try to maintain a positive relationship with academic entrepreneurs. This is beneficial for the development of the venture, which in turn also is likely to result in more (future) benefits from successful spin-offs for the universities. As perceived unfairness is linked to the procedure of the negotiations rather than related with the agreement as such, it is important that rules and policies are transparent to all stakeholders. This adds to the importance of Design principle 4 as specified in Section 2.6. Moreover, this chapter shows in detail in which phases of the spin-off process

these rules are particularly important. Furthermore, the decreasing cooperation pattern shows that the university should also explain up front when it wants to divest its interests in the spin-offs. Over the course of time, ventures can run into difficult circumstances in which the university is not the right partner to have on ones side. Thus, formulating an exit or divestment strategy with regard to spin-off companies must be part of university policy. On the other hand, entrepreneurs should be aware that their perceptions can guide them toward behavior that may not be beneficial for the venture. In this respect, acknowledging fairness perceptions and its potential influence may serve to identify the development path that best fits the incumbent venture.

### 4.5.2 Limitations and future research directions

This study of fairness perceptions of entrepreneurs in relation to the venturing process has a number of limitations which can be addressed by future research. First, this study involved a small sample of high-tech companies in a university setting. The external validity of its findings applies particularly well to this domain but not necessarily beyond it. Moreover, fairness perceptions can be different in other cultures (Brockner et al., 2000; Leung, 2005). Thus, similar studies in other settings would probably reveal different or additional patterns and may further enrich the understanding of the role of fairness perceptions in the entrepreneurial process. Second, the data collected in this study includes a combination of repeated interviews and observations over a period of two years, together with retrospective accounts complemented by archival data. To entangle the very details of the process, however, real-time or close to real-time observations are likely to reveal important fine-grained dynamics and may result in more sophisticated patterns (e.g., a fair-unfair-fair pattern), which help to analyze the micro-foundations of the dynamics observed in this study. Third, although the qualitative interview data indicate a causal relationship between fairness perceptions and new venture development, the data did not allow an unambiguous rejection of the opposite direction of the relationship. Therefore, we are merely able to conclude that fairness perceptions and new venture development are correlated. Fourth, this study did not explore constructs mediating the relationship between fairness perceptions and cooperative behavior. For example, researchers have contended that perceived fairness

influences emotions (del Río-Lanza et al., 2009) and that fairness perceptions are a driver of trust and commitment (Kim and Mauborgne, 1993; Robson et al., 2008), which act subsequently as mediator for cooperation and performance (Baron, 2008; Luo, 2008). In this respect, future studies can add to the understanding of the causal chain between fairness and cooperation and performance.

## 4.6 Conclusions

Although many studies have demonstrated the effects of fairness perceptions on human behavior, prior research has not explored how the fairness perceptions by entrepreneurs affect new venture development. One of the reasons of this lack of understanding is that many studies have used cross-sectional data instead of data that provides insight in the venturing process. By adopting a process perspective on the venturing process and on fairness perceptions, we explored how and when fairness perceptions influence the development of new ventures. This study shows that fair evaluations lead to more cooperation, which positively influences the ability to acquire funding and engage in strategic cooperation, resulting in faster development of the venture. Moreover, if the relationship is perceived as fair, negotiations will be less time-intensive. Fairness perceptions especially play a role during (re)negotiations with the university. As such, this study highlights the importance of negotiation processes for new venture development. This chapter contributes to the entrepreneurship literature by demonstrating the effect of fairness perceptions on entrepreneurial behavior. In particular, the accumulation of experience appears to be an important generative mechanism behind fairness evaluations. This insight also extends organizational justice theory by demonstrating that fairness perceptions change over time and co-evolve with the accumulation of experience.

# CHAPTER 5

# DESIGN STRATEGIES FOR SPIN-OFF CREATION[9]

## 5.1 Introduction

Large, mature organizations are often capable of exploiting existing products efficiently, but are typically less effective in being innovative. Financial systems and bureaucratic procedures adopted to control processes in large organizations tend to be hostile toward innovative ideas, proposals and initiatives (Dess et al., 2003). One of the solutions to this problem is to structurally separate exploitation tasks and innovative exploration activities (Ambos et al., 2008; Tushman and O'Reilly, 1996), the latter for example in a new venture unit. On the other hand, such a structurally separate unit still needs to have some degree of integration with the parent organization, which forms the lifeline for the new ventures in terms of resources and reputation (Burgelman and Sayles, 1986). As such, the new venture unit acts as an 'incubation' semi-structure that mediates organizational rigidities and supports organizational renewal by means of corporate entrepreneurship (Brown and Eisenhardt, 1997; Dess et al., 2003). Previous studies have provided detailed assessments of the layout of such a new venture unit and its simultaneous integration with and separation of the host organization (e.g., Gilbert, 2006; Jansen et al., 2009; Tushman and O'Reilly, 1996). However, *how* these units got established in the first place has largely remained unaddressed.

In this respect, our understanding of the process of designing such units – with university spin-off support units as one particular instance – is still in its infancy. Studies considering how designers use knowledge to deal with the complex contexts of this design process are rare (Hill and Birkinshaw, 2008). Here, this study contributes to the corporate and academic entrepreneurship

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[9] This chapter is based on E. van Burg, I.M.M.J. Reymen, A.G.L. Romme, & V.A. Gilsing (2008), Organizational complexity and designing in context, paper presented at the 2008 European Group of Organization Studies Colloquium (Amsterdam, The Netherlands) and the 2008 Organization Studies Summer Workshop on Embracing Complexity (Pissouri, Cyprus).

literature by studying the interaction between design processes of new venture units and diverse complex design contexts. The way designers use and process knowledge can be conceptualized in terms of three design strategies (Gavetti et al., 2008): off-line reasoning and planning, feedback-driven learning, and associative reasoning. Research on designing new venture units implies that in many organizations this design process is in particular driven by experimentation (i.e. feedback-driven learning) or by copying designs (i.e., associative reasoning) from other organizations (Hill and Birkinshaw, 2008). An important question then is how specific contexts enable or hamper particular design strategies. As such, Birkinshaw and Hill (2003) for example question the appropriateness of the context to which designs are 'copied'. In this respect, this chapter aims to answer the following question (subquestion 4):

> *What are the cognitive design strategies that can be followed to design effectively and efficiently a support unit that stimulates the creation and development of university spin-offs?*

In the organization design literature, the interaction between context and designing is little understood (Farjoun, 2008; Gavetti et al., 2005; Gavetti et al., 2008). Organization design research has mainly been concerned with designing solution components as well as with evaluations of the performance of different designs (e.g., Dunbar and Starbuck, 2006; Gresov and Drazin, 1997; Sinha and Van de Ven, 2005). In spite of the fact that organization design research has become somewhat more focused on the design *process* (e.g., Dunbar and Starbuck, 2006; Romme, 2003; Van Aken, 2004), we still lack insight in how agent-designers interact with specific design contexts (Gavetti et al., 2008). More insight in this interaction is needed to better understand the contribution of the different design strategies to the performance of the design process in specific contexts (cf. Gavetti et al., 2005; Gavetti et al., 2008), which in turn serves to better advise design practitioners. Here, this chapter makes a second contribution – now to the organization design literature – by describing and explaining how designers employ particular strategies in specific contexts as well as by exploring the interaction between complex organizational contexts (characterized in terms of

near-decomposability and hierarchy) and the contribution of the adopted design strategies to design process performance.

This chapter focuses on the processes of designing spin-off support units in complex contexts (which can be considered as a Technology Transfer Office (TTO) with spin-off support tasks). The empirical part of the study draws on three case studies of the creation of three spin-off support units at universities. In these three cases, we study the design strategies adopted to construct such a unit in a university setting.

This chapter is structured as follows. First, we explore how designers use design strategies to deal with specific contexts. Next, we discuss important challenges and contextual factors related to organizing new venture units. The Method section discusses the case selection, data collection, and data analysis. We then describe and interpret the design processes of spin-off support units at the three universities. Finally, our main findings are discussed.

## 5.2 Theory development

### 5.2.1 Organization design and design strategies

For several decades, research on organization design has primarily studied the question how an organization with certain goals can fit its structure to its context (Barley and Gideon, 1992; Dunbar and Starbuck, 2006; Sinha and Van de Ven, 2005). In this respect, the focus was on researching the components of good designs and on evaluating the performance of these designs. This line of research accumulated in contingency theory and configurational approaches, which served to explore design strategies dealing with (mis)fit to contextual contingencies and conflicts between contingencies (Gresov, 1989; 1997). However, results of this type of research have had little practical relevance (Dunbar and Starbuck, 2006), particularly in view of the complexity of the interaction between designing and context (Hill and Birkinshaw, 2008; Sinha and Van de Ven, 2005).

Recently, a more deliberate focus on design *processes* resulted in methodologies that serve to develop design principles from practitioners' knowledge (e.g., Plsek et al., 2007; Van Burg et al., 2008) or from research synthesis (e.g., Denyer et al., 2008). This line of research recognizes contextual factors as being critical for design processes and the performance of designers in terms of efficiency and effectiveness (Denyer et al., 2008; Jelinek et al., 2008).

Although several authors emphasize the contextuality of organizational knowledge (e.g., Tsoukas, 2005; Tsoukas and Vladimirou, 2001), research on organization design (processes) has not yet addressed how knowledge acquired in situation A can be used and contextualized by designers in context B.

The design context involves a variety of factors that (may) influence the design actions, but that are not included in the design activity as such. However, some contextual factors may change as an indirect result of the design process (i.e., second order change). The design context can be characterized as a complex organizational system, which according to Ethiraj and Levinthal (2004: 407) consists of "a large number of elements that interact in a non-simple way". For Herbert Simon (1962), the designability of these systems is primarily influenced by their degree of hierarchy and near-decomposability (or loose coupling). *Hierarchy* implies that the system is composed of subsystems and also involves "subordination to an authority relationship" (Sanchez and Mahoney, 1996: 64). Therefore, in organizations with high degree of hierarchy, design decisions at higher hierarchical levels can be enforced at lower levels. Conversely, conflicts between subsystems can be resolved by decisions at higher hierarchical levels. Moreover, hierarchy also involves the notion of nested hierarchies (Ethiraj and Levinthal, 2004). These nested hierarchies enable local search and trial-and-error designing while the total system remains stable (Perrow, 1972).

*Near-decomposability*, also known as loose coupling, refers to the clustering of interactions between agents within each of these subsystems instead of dispersed interactions between all agents in the system.[10] In other words, in a nearly completely decomposable system, the rates of interaction within each subsystem are much higher than the rates of interaction between the subsystems (Simon, 2002). This bundling of interactions in subsystems reduces the cognitive demands on the designer (Ethiraj and Levinthal, 2004). Another advantage of near-decomposability is that it enables localized adaptation within each of the subsystems (Weick, 1976). The degree of near-decomposability of organizations is

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[10] Simon (1962) illustrates near-decomposability with the example of two watchmakers, Tempus and Hora, making watches with the same number of elements. However, Tempus has to assemble the whole watch at once, whereas Hora has designed his watches so that he could put together subassemblies. In the case that the work is frequently interrupted, Hora performs better because only one subassembly falls to pieces, whereas Tempus has to start over completely.

thus influencing their designability and adaptability. Ethiraj and Levinthal (2004) compare Simon's emphasis on the (perceived) hierarchy of complex systems to more recent perspectives on complexity that emphasize the decentralized nature of change, which is only partly knowable in a complex system. They simulated the net-effects of designing such a complex system and found that hierarchy is a necessary and sufficient condition to be able to design and create this system and that a higher degree of near-decomposability facilitates these design efforts.

In sum, hierarchy and near-decomposability are two important characteristics of the organizational context to be considered in design processes. These characteristics are, however, not identical with the designer's representation of them. "How complex or simple a structure is depends critically upon the way in which we describe it" (Simon, 1962: 481). The design efforts to deal with this complex context are guided by three 'modes of cognition', or design strategies, employed by the designers (Gavetti et al., 2008): off-line reasoning and planning, feedback-driven learning, and associative reasoning (cf. Broadbent, 1973; Tsoukas, 2005).[11]

First, *off-line reasoning and planning* is the cognitive assessment of the design problem by the designer and the search for potential alternatives for design actions in a specific context without engaging in interactions with this and other situations (Gavetti et al., 2008; Gavetti and Levinthal, 2000). This assessment can be supported by computational approaches and systems. As a design activity, off-line reasoning and planning is fairly straightforward, does not engage in actual interaction with the context and involves reasoning based on existing knowledge available to the designer (cf. Pahl et al., 2007). In this design strategy, the consistency and the processual logic of designing is especially emphasized (Broadbent, 1973; Pahl et al., 2007). In this respect, Simon (1996) outlined how data, planning and forecasting may enable high performing designs, adapted to the specificity of the design situation (cf. Miller, 2008). But he also identified the main limitation of this computational approach, namely that rationality is bounded. This limitation in particular applies to social systems (e.g.,

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[11] Gavetti et al. (2008) propose this three-fold distinction as a basic set of cognitive modes, which we adopt in this paper as a useful typology. This typology is also congruent with the four modes presented by Tsoukas (2005: 267) and Broadbent (1973: 25).

organizations), for which "the complexity of the environment is immensely greater than the computational powers" (Simon, 1996: 166).

Second, by *feedback-driven learning* the designer generates design knowledge by actually engaging in design actions and by processing positive or negative outcomes of these actions, leading to adapted or reinforced strategies (Argyris and Schön, 1978; Gavetti et al., 2008; Levitt and March, 1988). By actually creating the design artifact in interaction with the context, the designer tests whether understanding of the context is correct and to what extent the design should be adapted to fit in the context to achieve a desired situation (Boland, 2004; Romme and Endenburg, 2006). In this respect, Donald Schön's influential work on 'reflective practice' argues that the context (e.g., infrastructure, clients, users) 'talks' to the designer, who subsequently has to reflect on it and use these reflections in order to create a good design (Schön, 1984; 1987: 44). By means of this conversation the designer creates understanding of and gives meaning to the context (Weick, 1995).

Third, *associative reasoning* is the process in which the designer generates knowledge by comparing the situation at hand with other situations, in terms of analogy (Gavetti et al., 2005; Gentner and Holyoak, 1997; Holyoak and Thagard, 1995; Tsoukas, 1993), case-based reasoning (Gilboa and Schmeidler, 2000), or imitation (Haunschild and Miner, 1997; Rivkin, 2000). According to many scholars, the implicit or explicit use of analogies is central to human thinking and is typical for designers (e.g., Dorst, 2008; Holyoak and Thagard, 1995; Lawson, 2006; Schön, 1984; 1987; Yoo et al., 2006). Schön (1987: 66-67) argues as follows: "When a practitioner makes sense of a situation he perceives to be unique, he sees it as something already present in his repertoire. (...) The familiar situation functions as a precedent, or a metaphor, or (...) an exemplar for the unfamiliar one. Seeing *this* situation as *that* one, a practitioner may also *do* in this situation *as* in that one." Thus, by framing the context, the designer can imagine meaningful design actions and understand some of the essential characteristics of the situation (Winograd and Flores, 1986). Gavetti, Levinthal and Rivkin (2005) model the situation in which a designer draws on analogies to make design decisions. Whereas there are major difficulties in making the correct analogies – in terms of getting the right source and getting the transfer context right – Gavetti et al. (2005) find that any analogy, even irrelevant ones, provides better results than

making only local decisions without analogies outside the existing framework. The story recounted and interpreted by Weick (1990) about the troops that found their way out of the Alps with a map of the Pyrenees illustrates this (Gavetti et al., 2005). Moreover, good analogies produce better results than bad ones. Here, the designer's experience moderates the transformation of design knowledge of context A into design knowledge that is valid in context B. In this respect, the designer's experience can be imagined as a repertoire of analogies (s)he can draw on (cf. Gobet and Simon, 1996). The larger this repertoire is, the more likely the designer will select an appropriate analogy for transforming knowledge from one context into another (cf. Carlile, 2004; Lawson, 2006; Yoo et al., 2006).

Designing organizations embedded in complex contexts can thus be guided by three different design strategies. This conceptualization of three design strategies, based on three modes of cognition, is instrumental in studying designing as a process rather than considering design as implementing a fixed blueprint (e.g., the classic contingency approach), while making conceptual distinctions between different approaches. In the remainder of this chapter we assess how designers use these design strategies to create spin-off support units, and we explore the relation between these strategies and design process performance in different contexts. Thus, this chapter treats designing as a process, while providing conceptual clarity with respect to the interaction of the design process with its context and the contribution of the design strategies to the performance of the design process (cf. Farjoun, 2008; Gavetti et al., 2005; Gavetti et al., 2008).

*5.2.2 Organization design for new venture creation*

This study explores design activities and interactions in different contexts to examine how designers deal with designing spin-off support units in large, complex organizations. In this chapter we focus on the design of such a unit for new venture creation at three different universities. To introduce this particular type of design, we briefly review the literature on new venture creation in complex contexts. We focus on new venture creation from universities and discuss relevant contextual factors.

A large number of studies in the innovation literature recommend designing separate divisions or units to support the creation of new businesses alongside mainstream operations and as an extension of R&D activities (e.g., Ambos et al.,

2008; Burgelman, 1983; Galbraith, 1982; Tushman and O'Reilly, 1996). Such a structurally autonomous unit helps decoupling rigidities in the parent organization from the actions and perceptions in the new venture (Gilbert, 2006). To integrate this unit with the parent organization, different integration mechanisms are identified such as senior team integration (Tushman and O'Reilly, 1996) and formal organizational integration mechanisms by means of cross-functional interfaces (Jansen et al., 2009). As such, these new venture units are 'semistructures' in the middle between very structured and very unstructured organization (Brown and Eisenhardt, 1997). Previous research identified the fit of these semistructures with the parent organization and focused on the new ventures as the level of analysis. Researchers have been less concerned with design processes at the level of the new venture units (Hill and Birkinshaw, 2008). In this respect, Hill and Birkinshaw (2008) observe that in many organizations this design process is driven by experimentation or by copying designs rather unreflectively from other organizations, even to rather inappropriate corporate settings (Birkinshaw and Hill, 2003). Moreover, Burgelman (1983) finds that because of their hybrid and semistructured nature, these units are likely to encounter serious tensions in the corporate environment. In a corporate context, these tensions include for instance differences in speed of development of new businesses and mainstream business projects, differences in risk propensity, different decision-making processes, the ownership of intellectual property, and the allocation of people working for the venture (cf. Birkinshaw and Hill, 2005). The question how such a new venture unit can be designed – while dealing with these tensions – is addressed to a lesser extent. In sum, important questions can be raised with regard to the use of different design strategies in diverse contexts as well as the contributions of these strategies to the performance of the design process (Hill and Birkinshaw, 2008).

Similarly, designing new venture support units and policies at universities creates tensions with existing practices. These tensions include commercial goals versus research goals, the ownership of intellectual property and the allocation of revenues (Ambos et al., 2008; Rappert et al., 1999; Stevens and Bagby, 2001). The design of these units and the performance of design processes in terms of efficiency (i.e., effort and time needed) and effectiveness (i.e., arriving at the intended results as well as the viability of these results) is influenced at multiple

contextual levels (Bekkers et al., 2006; Hill and Birkinshaw, 2008; Mowery et al., 2004; Rothaermel et al., 2007; Shane, 2004). In the empirical study in this chapter, we focus on two levels: the national and regional level reflecting the policy context and the university level reflecting the organizational context.

At the national level, spin-off creation from universities is in particular influenced by intellectual property (IP) laws, such as the Bayh-Dole Act in the USA (e.g., Mowery et al., 2004). At both national and regional levels, several public policies influence spin-off creation from universities, such as governmental subsidies, the business and entrepreneurial climate, educational policies, and access to the capital market (Baum and Silverman, 2004; Bekkers et al., 2006; Lockett and Wright, 2005; Shane, 2004).

At the university level, the size of the organization increases the complexity and thus tends to decrease the ability to design the whole organization (Ethiraj and Levinthal, 2004). However, size may also invoke more change and reorganization (Baker and Cullen, 1993). Older universities are also likely to reorganize more frequently (Baker and Cullen, 1993), but history can also reinforce routines that operate as a frame of reference for design actions (Daft and Weick, 1984; Hardy, 1990). The formal organization of a university can be considered as a professional bureaucracy in which the hierarchy is anchored in the consultation processes and procedures with a high degree of decentralization and loose coupling (Hardy, 1990; 1991; Weick, 1976). Besides that, a high degree of politics complicates decision making, whereas organizational hierarchy may serve to reduce politics (Hardy 1990). Furthermore, the focus, eminence and culture of the incumbent university influence new venture creation. This contextual factor, however, is very hard to influence and design in the short term (Debackere and Veugelers, 2005; Di Gregorio and Shane, 2003; Djokovic and Souitaris, 2008). More instrumental in this respect are the policies and procedures, including incentives, and the spin-off support infrastructure (e.g., advisors, incubators) that a university has (Debackere and Veugelers, 2005; Jensen and Thursby, 2001; Vohora et al., 2004). With regard to policies and infrastructure directly targeted at spin-off creation, the experience in spin-off creation and the organization of the support process affect the quantity and quality of the new ventures created (Powers and McDougall, 2005b).

Although several studies have been conducted regarding the establishment of support structures (cf. Debackere, 2000; Jacob et al., 2003; Kirby, 2006; Roberts, 1991), the context-specificity of designing new venture units has not been explicitly addressed (Birkinshaw and Hill, 2003). Our study therefore theorizes about the use of different design strategies in specific contexts as well as how these strategies relate to the performance of the design process.

## 5.3 Methods

To examine how complex contexts interact with the use and performance of design strategies, we performed a descriptive study of the (re)design of three European universities of technology with regard to facilitating and stimulating the creation of university spin-offs. As such, we do not aim at describing the entire process of designing spin-off support units, but focus on the different design strategies that designers employ in these contexts. The design actions are performed by 'agent-designers', people with the responsibility to act on behalf of (parts of) the university organization.

For the purpose of our study, the setting of university new venture creation is appropriate for three reasons. First, universities are comparable across different cultural and national contexts, as they have similar goals, structures and populations (e.g., Hardy, 1990; 1991). Second, universities provide a moderately complex context to explore our research question (cf. Farjoun, 2008). Third, a careful research setup and data analysis is possible in this empirical domain, by drawing on previous studies that considered specific aspects of universities and spin-off support (e.g., Rothaermel et al., 2007; Shane, 2004).

### 5.3.1 Data collection

A comparison of several cases, selected with regard to variation and constants, can inform theory development about the interaction between design strategies and contextual characteristics (cf. Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2003). The three cases selected for this study are three technology universities: UPC in Spain, and TU/e and WUR in The Netherlands. We refer to Section 1.3 for an elementary introduction to these cases and their context.

At all three universities, data were collected from multiple sources and backgrounds to get a rich understanding of the design processes. In-depth, face-

to-face interviews were performed in a semi-structured way (between September 2006 and October 2008), using a topically structured interview guide. Interviews were conducted with the initiators of the programs, different support professionals, university professors, and deans. Moreover, policy makers and support professionals from organizations and government bodies outside the university were interviewed. Furthermore, at each university, academic entrepreneurs were interviewed. These entrepreneurs were chosen so that they represented the main characteristics of the local population of academic entrepreneurs, with regard to experience, age, disciplines and departments, period of starting the company, as well as successes and failures. In total, 64 hours of interviews with 66 people were recorded and fully transcribed. In addition, different types of documentation were collected, including annual reports, strategy documents of new venturing support units, business plans of the new ventures, and other studies of the universities. Table 5.1 summarizes the main data sources for the three case studies.

**Table 5.1: Data collection**

| Case | Interviewed staff-members | Interviewed entrepreneurs | Main documents and reports |
|------|---------------------------|---------------------------|----------------------------|
| UPC | 6 | 7 | List with all the new ventures<br>Business plans<br>Reports and plans from the regional government and the university<br>Two journal publications |
| TU/e | 14 | 23 | List with all the new ventures<br>(Annual) reports from the university<br>Business plans<br>One history book and one journal publication |
| WUR | 6 | 8 | List with all the new ventures<br>(Annual) reports from the university<br>Business plans<br>Two history books |

*5.3.2 Data analysis*

In the analysis of the cases, the first step was to write a comprehensive case narrative of the design and development of the university and the new venture support organizations within the university (cf. Eisenhardt, 1989). These descriptions also contained a brief analysis of the design components of the university, together with a number of context characteristics, which were mentioned by the interviewees or recognized by the interviewers. All these topics were coded and the QSR NVivo software served to build a code database and maintain the chain of evidence (Yin, 2003). We subsequently discussed these case descriptions with support professionals at each of the universities, to get feedback and check for accuracy.

The second step was to code, within each of the cases, the main characteristics and the main design actions. Characteristics were coded by quotes that expressed the degree of autonomy of the different university departments (near-decomposability), quotes expressing the extent to which interviewees perceived the formal authority within the university to be important (hierarchy) and quotes indicating frequency of interactions with policy makers. This resulted in a design narrative for each case. To identify the relevant design actions, we coded the change events in the development of the units for supporting new ventures. Here, we employed the coding technique developed by Van de Ven and Poole (1990), to code the key events as identified in the accounts of the university representatives and entrepreneurs. This resulted in a list of events, including the dates, actors and actions.

Third, design actions were related to the three design strategies proposed by Gavetti et al. (2008). This served to inductively 'measure' the 'amount' of employment of each strategy: the more design actions in a case were associated with one of the strategies, the more important that strategy was in that specific context (cf. Table 5.3). Subsequently, for each of the design strategies, we searched for case-evidence indicating the relationship between the employment of these strategies and the performance of the design processes. The performance of the design process is operationalized as 1) efficiency of the design process in terms of the efforts and time needed and 2) effectiveness of the design process in terms of arriving at the intended results (i.e., a unit supporting new venture creation) and the viability of the design results (i.e., survival of the unit).

Fourth, the three cases were compared along the different identified context characteristics and design strategies, using tabular representations (Miles and Huberman, 1994). Here, the case characteristics were assessed both qualitatively (e.g., individual interviewees expressing that one characteristic is very important) and quantitatively (e.g., the number of interviewees expressing that a certain characteristic is important). With regard to the classification of the design actions, the data underlying each change event was assessed and coded within one of the three design strategies. This resulted in preliminary statements that were iteratively tested with the data in order to craft grounded theory about how design strategies interact with the complexity of the design context.

## 5.4 Results

This section describes the results of the case studies. First, the design and development of policies and activities with regard to new venturing in the three universities are narrated to provide a better understanding of the cases. We then outline the main context characteristics of the universities. Third, the main components of the design of a spin-off support unit at the three universities are discussed in terms of the three design strategies. Finally, the contribution of the design strategies employed to the performance of the design process is discussed.

### 5.4.1 Case descriptions

The following case descriptions give a brief overview of the context in which the three design efforts are embedded. We refer to Table 1.1 in Chapter 1 for a summary of the main characteristics of the three universities.

### Technical University of Catalonia (UPC)

Located in an autonomous region in Spain, UPC is a public university founded in the 1970s. It specializes in the fields of architecture, engineering, merchant seamanship, economics, health sciences and applied mathematics. UPC engages in a large number of educational activities, but also undertakes a significant effort in research. The current UPC is a merger of different institutions and universities, now encompassing seven campuses. In 1998, a specific program was initiated to stimulate the creation of university spin-offs, modeled after the Stanford Ventures program. Funded by a private enterprise, the vice-president of the university

founded a program targeted at promoting academic entrepreneurship, called
Programa Innova. Over the years, this program has evolved into an organization
with nine professionals involved in support, IP advice, entrepreneurship training,
and the management of European programs.

Initially, Programa Innova focused only on how to change the culture of the
university toward a culture that is more supportive to entrepreneurship. This was
initiated by the current director of the program, who also was a vice-president of
the university at that time (cf. del Palacio Aguirre et al., 2006). With a small
budget, two people were hired to support and stimulate entrepreneurship by
giving training and advice. After two years, the program was extended because
structural funding from the regional government became available. At that time,
the training and education for undergraduates, PhD students and faculty was set
up in a more structured way. Programa Innova also implemented a coaching
program, with experienced entrepreneurs hired to support a selected group of
companies. Furthermore, Programa Innova created a business plan competition
to stimulate researchers and students to write a business plan. Moreover, the
university board allocated part of the funding obtained from government to
found an investment company, targeted at investing in the new ventures. This
investment company is completely separated from the Programa Innova new
venture support program. In 2007, Programa Innova launched a new program
pilot targeted at involving more students and more departments in the actual
creation of new ventures.

The place of the university in the innovation and entrepreneurship system is
reinforced by the regional government that positioned UPC as the only gate to a
financing program for seed capital. The government agency for business
development within the autonomous regional government initiated this seed
capital program in 2001. Since then, the seed capital scheme has substantially
changed three times, causing reorganizations in how universities supported new
ventures.

In 2004, the regional government set up a funding structure to support the
creation of business angel networks by different universities. As such, universities
set up their networks with informal investors. Because the network itself was
funded, it was beneficial for every university in the region to set up its own
network, as UPC also did. However, these separate networks did not work as

expected and policy was redesigned to facilitate only combined networks involving multiple universities.

Over the last few years, the different programs around UPC are converging as new venture support professionals increasingly get to know and trust each other. Furthermore, the regional government also pushes toward convergence. For example, each new venture support program is expected to have training, provide access to funding, help with IP support, and initiate or cooperate in a business angel network. Moreover, some policies have been adapted because of the feedback from Programa Innova. The fact that a number of the support professionals and policy makers were involved in multiple roles and functions (e.g., in the government agency and later in Programa Innova) also helped to increase the convergence.

*Eindhoven University of Technology (TU/e)*

TU/e is founded in the 1950s in the Netherlands, as a public university with the primary goal of providing education in the fields of engineering and electronics; research was deliberately aimed at supporting the education of students. In the 1970s, the goal shifted toward societal relevance. Moreover, contract research for industry became increasingly important and a technology transfer office was established. In the 1980s, however, the cooperation with industrial partners became more difficult, because university research groups were increasingly pressed to enhance academic quality and output. So, the focus shifted toward doing more academically respectable, rather than practically relevant, research. In the early 1990s, this resulted in closing the technology transfer office, although contract research activities continued. Since then, two tendencies dominate the strategy of TU/e: a focus on research and a restructuration of the societal service (Lintsen and Schipper, 2006). The initiatives of TU/e to support entrepreneurship gained again more weight in the late 1990s, among others due to stimuli of the national government and the European Commission. Therefore, new experiments with novel forms of contract research and renewed cooperation with industry were set up. TU/e thus established an incubation centre and founded a university holding company for investments in new ventures. This development was reinforced with the arrival of a new president of the university board. This president, who formerly worked in industry, was appointed in 2002. He again

placed technology transfer as well as technology entrepreneurship prominently on the strategic agenda of the university. This combination of factors resulted in a redesign of the university's strategy. In the new strategy, one of the main goals was to promote the application of knowledge developed within the university by established or newly created ventures.

To facilitate this new strategy, TU/e redesigned its entrepreneurship support and technology transfer organization in 2004. Until then, TU/e had merely been providing office space for entrepreneurs without much support. The redesigned organization, called TU/e Innovation Lab, became the orchestrator of all entrepreneurial and technology transfer activities within the university. To build this organization, a managing director, with experience in new venture creation, was enlisted to design and lead a state-of-the-art organization. This unit searches for research findings with commercial potential, provides office space, facilitates investments in the start-ups, provides skilled support for IP and other critical aspects of new ventures, and offers coaching. Recently, part of the support activities for entrepreneurship was embedded in educational programs to involve more students and enhance awareness of the opportunity to create a spin-off.

In 2005, the support organization within TU/e, TU/e Innovation Lab, set up a collaborative network with eight other regional organizations, including a regional development agency, the corporate incubator of a large multinational, the technology transfer office of an undergraduate college in the same city, and a bank. This network has attracted funding from the national government, to run the network and provide seed capital to start-ups.

*Wageningen University and Research Center (WUR)*
The origins of WUR go back to the 19th century, when the Gemeentelijke landbouwschool (municipal agricultural school) was taken over by the government. Over a period of more than 100 years, this school developed into WUR. In 1997, this university merged with the Dienst Landbouwkundig Onderzoek (Agency for Agricultural Research, abbreviated as DLO), founded in the 1880s, into WUR. Furthermore, in 2004, the independent Hogeschool (University of Applied Sciences) Van Hall Larenstein became part of WUR. As a result, WUR currently is an institute with a broad range of educational and

research activities focused on life sciences and natural resources, organized in five departments – each with a large autonomy and its own (financial) responsibility.

The origins of collaboration with industry and efforts to commercialize research findings go back to the early years of WUR. Until 1981 these efforts were primarily made by individual researchers, staff and students. In view of the reduced funding by the Dutch government, WUR appointed an official in 1981 to coordinate the contacts with industry in order to transfer knowledge and generate income. Within the university, this also marked a trend toward more cooperation with industry and a more business-like attitude with regard to research (Faber and de Ruiter, 1993: 236-238). At that time, however, there hardly was any attention for creating spin-offs. At the DLO side, there has always been a strong focus on cooperation with industry, set up at the level of semi-autonomous 'business' units, which later became departments.

In the late 1990s, spin-off support started receiving more attention as a particular instrument for transferring technology, also as a result of the merger with the more industry and business oriented DLO. A business support office was founded on instigation of the vice-chancellor and president of the university. The goal of this business support office was to commercialize university inventions by means of selling patents and licenses and supporting (new) companies to commercialize these inventions. In 2004, the Wageningen Business Generator (WBG) was founded to increase these activities and to enable investments in university spin-offs. In this respect, WBG engages in technology transfer activities on behalf of the semi-autonomous departments within WUR, whereas the patents remain the property of the departments. WBG also employs business developers who scout for inventions (that can possibly be commercialized) in each of the departments, and they help to develop these business opportunities.

In addition to the technology commercialization activities within the WUR organization, in 2001 WUR created an incubator with financial support from the national government. This incubator is partly owned by WUR, but is a separate organization with its own funding. This incubator provides facilities and support to new ventures in the life sciences, with a focus on the spin-offs from WUR. In 2005 a larger network consortium was created – again with support from

governmental funds – to promote entrepreneurship in the field of food production.

Whereas at UPC and TU/e different programs and tensions co-existed and often converged, at WUR we observed mainly divergence over time. For example, one of the interviewees from WUR said:

> In fact, competition is currently arising between on the one hand WBG and on the other hand the scouting by a consortium around WUR [targeted at new venture support]. So, the scout of the consortium is busy with the ideas, but WBG tries to prevent that good ideas are developed without their involvement. That is not an ideal situation. (...) I would prefer to have an organization in which the scouting and screening program would have been fully adjusted to both WBG and the consortium.

Thus, competition existed as a result of the multiple organizations around WUR engaging in new venture support. This competition in particular concerned the question who would invest in particular ventures and what kind of support would be favorable for this venture. These tensions in WUR's new venturing system arose from the presence of designing different interrelated new venturing support 'tracks', each with its own history: the WUR/WBG track, an entrepreneurship supporting consortium around WUR in which the incubator was involved, and the history of investments by an investor, who was closely connected to the university and participated in that consortium. Within WUR, increasing divergence was evident from the recent restructuring of WBG in the summer of 2008. The relatively independent and central position of this support organization was reorganized toward a situation in which the directors of very large departments have the authority to execute these tasks unilaterally, under their own budgets. The university vice-chancellor reflected on this as follows:

> Who decides about it [what we do with IP]? That was one of the main reasons for saying: we will organize it differently. Recently, we started delegating this kind of decisions and matters (...) to the level of the departments. These are large departments, with a turnover of 125 million

(...), they have to make their own decisions, and they need to have that ownership. We had WBG, but that was a commercial organization, owned by us, but outside of the departments, governed directly by the board, with a significant budget to stimulate the generation of extra revenues.

*5.4.2 Context characteristics*

In each of the three cases, the design process involved founding an organizational unit within a particular university. In the analysis, we consider the units for supporting new ventures – Programa Innova (UPC), TU/e Innovation Lab (TU/e) and WBG (WUR) – as the focal object of the design efforts. Each university, with its different faculties and general departments as well as links to external organizations, was also subject to design activities, but in a more indirect way. To a large extent, the university is therefore treated as part of the context. Overall, a university can be characterized as a design context that is moderately novel as well as moderately complex (cf. Farjoun, 2008; Gavetti et al., 2008). A number of characteristics of the organization of the universities and their environment contribute to the complexity of the design situation. In this respect, our analysis of the cases implied that in particular the degree of near-decomposability, the hierarchical nature, and the interactions with policy makers influence the design activities. Table 5.2 summarizes these characteristics for each of the cases.

The degree of near-decomposability pertains to the existence of multiple semi-autonomous departments within the university, which creates differences in goals and perspectives. At each of the three universities, new venture support professionals framed the difficulty of their tasks in terms of the substantial autonomy of the different non-academic and academic departments of their university. Each department can be considered semi-autonomous in terms of its budget, education and research. The new venture support processes, however, were created to serve all these departments, and thus formed part of the central organization. Thus, the degree of autonomy of the different departments increased the difficulty to support individual groups and researchers by means of a single policy and infrastructure. For example, at TU/e both support staff and entrepreneurs observed that all academic departments are different and have their own interpretations. One of the entrepreneurs interviewed at TU/e said:

> Although TU/e Innovation Lab is backing us, we still have to convince
> everybody [at the department] that we should have our own space here,
> really. The department should realize that this company is good for the
> department and for the university. At the university, there are islands
> everywhere: in addition to the departments, there are also the sub-
> departments, et cetera. And everyone is taking care of their own things.
> As a starting entrepreneur, I've experienced that this makes it difficult to
> deal with them.

At WUR, the degree of near-decomposability of the departments was
relatively high compared to UPC and TU/e. This is partly because each
department had a largely independent history, often outside WUR. Later, each
department had full financial autonomy and the management team of the
university included the directors of these departments. WUR's departments
enjoyed a higher degree of autonomy, in particular with regard to the revenue
streams from commercialization that are significantly higher than at TU/e or UPC
(see Table 1.1). The existence of these different departments and their relative
autonomy contributed to the complexity of the design situation.

Furthermore, the hierarchical nature of a university affected the ability to
design new venture support policies and activities and the embeddedness of new
venture support within the university organization. Each of the universities has a

**Table 5.2: Context characteristics of the cases**

| Context characteristics | UPC | TU/e | WUR |
|---|---|---|---|
| *Near-decomposability* | Moderate | Moderate | High |
| *Hierarchy* | High | Moderate | High |
| *Interactions with regional and national policy makers* | Very high | High | Low |

different degree of hierarchy, which is observed in the importance of consultation of lower levels and the extent to which decisions can be taken unilaterally. WUR appears to have the highest degree of organizational hierarchy, as it is organized around a small and powerful board of three people, among them the vice-chancellor who managed education, research and commercial activities. Below this board, the directors of the five different departments together formed the management team. If the board and management team operated together, they had an enormous leverage and authority over the entire organization.

At TU/e, the situation is somewhat similar, but the departments depended much more on the board for their funding. As such, there was more of a consensual culture sustained by consulting with and obtaining commitment from departments, research groups and faculty. Besides commitment from these lower levels, for many decision topics the board of TU/e needed the approval of the university council, consisting of students and faculty members. To convince these different groups, the informal role of opinion leaders – for example, several professors with elite academic status – was also critical.

At UPC, hierarchy is also very important, next to informal leadership. This may be an effect of a Spanish cultural context in which status is important as well as a political university system in which individual personalities play key roles. The founder of the Programa Innova program was such an opinion leader, and had a high management position within the university. In all three universities, the support of the board of the university was a critical factor in initiating the spin-off support unit and getting the program up and running. Thus, organizational hierarchy played an important role.

Interactions with external stakeholders provide another instance of the complex context. In this case, these external stakeholders are represented by policy makers. Each university is part of a regional innovation system, and hence university representatives engaged with regional policy makers. For all three universities, this interaction was intensive and reciprocal, involving a larger group of people within the university as well as many different regional bodies. Furthermore, representatives of the universities frequently interacted with national policy makers. Since these universities are part of the public educational system in their country, they are subject to policies of the national (Dutch or Spanish) ministry of education. Moreover, the ministries of economic affairs also

became involved in policies affecting universities, particularly in view of the increased interest in technology transfer. In all three cases, this resulted in frequent interaction with policy bodies. Relative to TU/e, WUR was less intensively engaging in interaction with (national) policy makers, because WUR focused on their university support activities and policies. At UPC, on the other hand, the designers interacted with regional policy makers extensively and frequently. The situation here is somewhat different because UPC is located in a region with an autonomous governmental status; this means that the region rather than Madrid crafts a substantial part of the relevant policies with regard to new venture creation. The connections between UPC and the regional policy makers were therefore very tight, also as a result of frequent staff transfers in both directions. One of the representatives from the regional government said:

> In the beginning, the regional government wanted them [the support offices at universities] to produce lots of companies. And later, I think also as a result of the influence of [the initiator and the current director of the program], the regional government has been going more for the soft aspects. We asked them to work more with undergraduates, so that they develop more entrepreneurial qualities. Therefore, it has evolved over time.

### 5.4.3 Using three design strategies

We now turn to the three design strategies, by considering how their usage varies over the three context characteristics. Table 5.3 provides an overview of important design actions in the three cases and the related design strategies.

*Off-line reasoning and planning* by means of careful analysis of available data was observed in all cases, in particular related to funding processes. Government agencies, university boards, development programs and other financers requested extensive documents to assess the plans (e.g., for funding new units). These plans typically included descriptions of the goals, anticipated support activities, the relationship with other initiatives, existing support and expertise, and most importantly: a budget proposal. These documents represented the design as a planned exercise set up to produce the results expected by the funding

### Table 5.3: Design actions and associated strategies

| Case | Year | Important design actions | Off-line reasoning and planning | Feedback-driven learning | Associative reasoning |
|------|------|--------------------------|----------------------------------|--------------------------|-----------------------|
| *UPC* | 1998 | Creating Programa Innova | x | | x |
| | 1999 | Adapting Programa Innova | | x | |
| | 2000 | Expanding, more structural support | | x | |
| | 2001 | Access to seed capital | | | x |
| | 2002 | Adapting seed capital program | | x | |
| | 2004 | Network development | | | x |
| | 2004 | Adapting seed capital program | | x | |
| | 2005 | Hiring IP advisor | | x | x |
| | 2006 | Restructuring support around ventures | | x | |
| | 2007 | Structuring into one network | | x | |
| | 2007 | Creating program targeted at students | | | x |
| | 2007 | Adapting seed capital program | | x | |
| | 2007 | Converging programs | | x | |
| *WUR* | 1998 | Developing business support office | x | | x |
| | 2001 | Founding (external) incubator | x | | x |
| | 2002 | Redesigning strategic and financial aspects | | x | x |
| | 2004 | Founding WBG | x | | x |
| | 2005 | Creating network organization | | | x |
| | 2008 | Restructuring WBG | | x | x |
| *TU/e* | 1998 | Founding incubation centre | x | | x |
| | 1998 | Founding university holding structure | | | x |
| | 2002 | Developing new strategy, focused on spin-offs (more support and services) | x | x | x |
| | 2004 | Redesign of support organization, with one orchestrating unit (TU/e Innovation Lab) | x | x | x |
| | 2005 | Creating network organization | x | x | x |
| | 2005 | Creating Technology Entrepreneurship Program | | x | x |
| | 2006 | Adjusting policies: e.g., equity as payments | | x | x |
| | 2008 | Embedding support in faculties | x | x | |

agencies. As a result, such plans often represented a 'political' reality in which numbers, reasoning and action sequences were primarily a means to get the funding, only to a lesser extent reflecting the real activities. An entrepreneurship professor at TU/e reflected on this 'reported' reality:

> In the past the support was just 'window-dressing'. (...) The government
> says: universities have their societal responsibility, and we will provide
> the money. Then, as a university, we started to make a lot of smoke, but
> the fire was hardly visible, at least not within the university.

Regarding the context, the degree to which agent-designers adopted off-line reasoning and planning depended primarily upon the history and phase of the support, the hierarchy, and the interaction with especially national or regional policy makers. The history of new venture support at the incumbent university determines what is already known and accepted within the organization. This acceptance influences the degree to which redesign efforts have to be presented as careful reasoning and planning in order to convince organization members. Within UPC these off-line reasoning and planning activities were rare and limited at the start of the program in 1998. At TU/e and WUR, more recent explicit redesigns implied that funding agencies required extensive motivation and planning, presented as careful planned redesign. The degree of formal hierarchy and the place of the designers in this hierarchy affected the extent to which the (re)design was justified by documents, careful analyses, planning, and the presentation of results. Whereas the primary knowledge sources for the redesign plans were largely provided by associative reasoning or the emergent results of feedback-driven learning (for instance the delivery of successful ventures), the plans were ultimately written and presented as carefully planned designs created by off-line reasoning. These documents also served to shape design efforts and increase commitment at various levels within the university. The same occurred at the national level. As such, off-line reasoning and planning provided an important strategy to guide the interaction with policy makers. The director of TU/e Innovation Lab:

> In about 5 years the University of Twente produced about 480 new ventures. Rotterdam: 11, Leiden: 2. The rest of the universities was not on that list. The Secretary of State concluded they did not produce new ventures. (...) I said: well, I believe we at least have a professor of entrepreneurship over here. (...) But, we simply did not fill out these charts.

So, in the interaction with policy makers and decision makers, official planning documents and preliminary results were important to convince them and gain their approval. To achieve this approval, the director of TU/e Innovation Lab subsequently made sure he presented numbers and detailed plans of the redesign activities, although they were often primarily written to convince policy and decision makers rather than to shape the actual design activities.

*Feedback-driven learning* by frequent interactions with faculty and academic entrepreneurs appeared to facilitate learning with regard to what does (not) work within a certain setting. At UPC, for example, the spin-off support unit discovered through interactions that it was not feasible to change the mindset and priorities of faculty or to let all of them engage in entrepreneurial activities. The entrepreneurship support programs were therefore made available from a certain distance, to make sure that they did not interfere with education and research processes and did not need the commitment of all faculty. At TU/e, an important adaptation was to bring technology transfer, contracting with industry, intellectual property support and entrepreneurship support under one umbrella to align policies and create an integrated approach. Previously, these activities were distributed across different departments, which was widely perceived as problematic and confusing. Combining these activities under one aegis made them easier to access and integrate. Another example from the TU/e case involves equity participation. TU/e's initial demand for 100% equity in new ventures resulted in some major failures – the CEOs of these companies had no exposure to ownership incentives or risks. Over the years, TU/e therefore moved to minority equity participations. Furthermore, TU/e also began to treat equity as a form of payment by the entrepreneur for the invention and support. A start-up support officer explained:

> At the department of chemistry, we had this situation where we said: if you want to stay here, these are the costs. But the venture could not afford that. So we [the spin-off support unit] said: we will pay the bills to the department, if we get a little tuft of your equity in return.

Thus, this instance illustrates how active learning occurs in response to feedback, adapting practice as insight emerges.

In all three cases feedback-driven learning appears to be important, but the specific organizational context affects the frequency of feedback-driven learning and the organizational level (e.g., board, department, and faculty) at which useful feedback can be obtained. First, the degree of near-decomposability apparently affects the opportunities for frequent interactions. For example, at WUR the departments are rather autonomous and the directors of these departments control the implementation of the support of WBG. Some departments did not commit to the new venture support activities and policies, and therefore, interaction with these departments was limited. Because the interests diverged too much, these interactions did not result in many adaptations at the central spin-off support unit WBG. Instead, these interactions resulted in new strategies developed at the departmental level, thus causing divergent interactions. Actually, directors and faculty of the departments learned how to evade the consequences of the central organizational support policies. The director of WBG:

> This [the structure of WUR] creates an enormous complexity! Because people have many escape routes. (...) The director of department X, who also is responsible for the portfolio of commercialization, used local approaches and tried everything to obstruct [WBG'] corporate activities. We always ran into troubles. If we had a difference of opinion with an inventor and we said: 'We are not going to invest, because this case is not good enough', then the inventor would go public with this and get lots of media attention. (...) Spin-offs were founded outside WBG and the university board accepted that.

At both TU/e and UPC, however, the new venture support unit became more embedded in the departments and less perceived as just a part of the central

organization. Thus, frequent interactions with the individual groups and researchers within departments served to develop tailor-made programs. One academic entrepreneur of TU/e illustrated this interaction and the flexibility: "No question is too crazy, and often the answer is: okay."

Second, organizational hierarchy influences in particular the level (board, department directors, research groups, or individual faculty) at which feedback-driven learning occurs. At both WUR and UPC, formal hierarchy was quite important; at UPC the formal hierarchy was reinforced by political power. In both cases, decisions were therefore typically taken top-down. As a result, learning occurred at positions higher in the hierarchy, in particular in interaction with external organizations and departmental directors and deans. Less interaction was observed with faculty and other workers at the operational level of the university. For instance, one of the former support officers at UPC observed:

> Any program that involved the faculty members on a regular basis in the process never appears to work. We tried this, and we tried that, and in the end, we concluded that the only asset that we had in accomplishing the things we wanted was [the initiator and the current director of the program]. Because he is an opinion leader in the university.

In this respect, Programa Innova learned about faculty disinterest in resources available to carry out support tasks, and subsequently focused on interactions at higher levels of the university organization (board, directors, and deans) and interactions with public policy makers. As a result, the design of the support program became more targeted at developing different funding models in interaction with representatives of other governmental agencies, because these relationships were close and well developed. At WUR, the situation was similar because of the little integration in the departments, so WBG focused on executing the support design without much adaptation. However, because of the lack of embeddedness at lower levels of the organization (i.e., departments, research groups and faculty), design activities appeared to be vulnerable to decreasing support of the board, which could cause rapid changes in the new venture support policies and activities. The major reorganization that took place in the

WUR case illustrates this. The director of WBG, responsible for designing and executing new venture support at WUR:

> Some [of the department directors] supported me, but others were somewhat more opportunistic. They saw a strategy emerging: 'the boss [the vice-chancellor] says something, he wants this'. That is the reality of a political situation. (…) This was basically a macho unilateral decision [by the vice-chancellor of the university].

This was confirmed by the vice-chancellor:

> This was not a decision based on consensus, but a decision just made by the board. We invest in this unit. (…) Some things just have to be decided by the board.

The third design strategy of *associative reasoning* was employed at two different stages. First, exemplars within the university and in direct proximity to the university are important sources of inspiration. For example, Programa Innova at UPC started to support the commercialization of intellectual property similar to the support already existing in the separate technology transfer unit of UPC. The same pattern is observed where policies and support methods were copied between institutions. For example, the independent Business Centre, located close to the WUR campus, was the first unit to provide intensive support to new ventures. Later, WUR decided to establish their own policies and support staff, which previously only consisted of a limited number of people involved in technology transfer. WUR also decided to invest in companies, something previously done by one of the partner organizations of WUR and the Business Centre. Conversely, the regional consortium where investors were also involved, wished to become involved in scouting ideas at WUR departments, something that is currently only done by WBG. Similar local copying movements were observed at UPC. For example, another university in the proximity of UPC had developed a successful science park. The regional government agency identified this as a good example, motivating UPC to try to establish a similar science park.

Similarly, the success of the university culture transformation at UPC apparently set an example for other universities in Spain.

Second, designers of new venture support also referred to more distant cases as sources of inspiration for designing and starting new venturing programs in universities. Widely reported new venture stories from elite U.S. universities such as MIT and Stanford (cf. Roberts, 1991; Roberts and Malone, 1996) had caused European university boards to pay more attention to university spin-off stimulation, in addition to other means of technology transfer. For example, the director of TU/e Innovation Lab visited universities in Singapore and Stockholm, among others, and learned that a good rule for the distribution of revenues was very important. Moreover, the educational Technology Entrepreneurship Program was designed after the example of Brown University (cf. section 2.7.3). Another example is UPC, which adopted the idea of a business angel network from such networks elsewhere in Europe. These analogies not only serve to design new policies and support activities, but also to justify them. Moreover, the analogies with other cases served to identify dissimilarities. The vice-chancellor of WUR:

> With the director of WBG, I made a trip to six top universities in the States. (...) We saw that it is important that the research group around the researcher profits from the commercialization. (...) We did not imitate this exactly, but we followed the same principles, in terms of distributing some of the financial benefits of a successful new venture to the research group.

In addition, such site visits facilitated developing a common mindset among decision makers on new venture strategies. However, personal biases and experience affected the associative reasoning raised by these site visits. This is evident from how the vice-chancellor of WUR and the director of WBG reflected on their visit to American universities. The director of WBG saw ...

> that, as a university, it is important to have money at your disposal to invest. Most universities completely depend on funding from third

> parties. That undermines your position in negotiations with these
> external parties.

Therefore, the director of WBG developed a fund of several millions of Euros for large investments in new ventures on behalf of the university. By contrast, the vice-chancellor of WUR inferred from the same site visits that ...

> the philosophy of generating rigid income by large investments in
> companies by ourselves (...) is a very risky business. We should be very
> careful with this! If this is a separate fund and it is directing the research
> then we are pushing the wrong buttons.

So, the use of analogies to a large extent depends upon the designer's background and experience. Furthermore, in the case of large differences between semi-autonomous departments (e.g., WUR), analogies do not only result in new shared perspectives but also in diverging interpretations. Hierarchy is in particular related to the ability to implement the observed analogies and to communicate this as an inspiring vision, although this is moderated by the local culture of cooperation. The director of TU/e Innovation Lab at TU/e:

> [In Singapore:] if the boss says: 'to the left', we go to the left. But here, we
> keep talking for 4-5-6-7 years! (...) However, here it is easier... Just walk in
> to the office.

The use of more distant exemplary cases, such as MIT and Stanford, appears to be related to the international character of the university, as it is more frequently observed at WUR and TU/e and is less prominent at UPC. Local exemplars are slightly more observed in the case of UPC, probably due to the close proximity to the regional government which enforces regional convergence and interwovenness.

### 5.4.4 Design strategies and performance of the design process

The data discussed thus far suggest that the design of the new venture support policies and activities especially draws on associative reasoning, whereas

feedback-driven learning is also important at UPC and TU/e and off-line reasoning and planning plays a significant role at WUR and TU/e. The importance of off-line reasoning and planning can be illustrated by quoting the director of WBG, who described the sources for his redesign planning process as follows:

> The board said: wouldn't you like to think about setting up an organization for 'corporate' valorization? (...) I got a room in this building and I started to analyze. (...) I started to think about how this world [of spin-off support and technology transfer] looks like: what are success and failure factors, what is the chance for success? Once I mapped this, I thought about what the factors are where a knowledge institute can contribute to make new ventures successful. To maximize the chance for success. I did this by talking to a lot of people, by reading extensively, and by looking around.

Moreover, our findings indicate that the use of the design strategies and their contribution to the performance of the design process is strongly associated with specific context characteristics. The context influences the degree to which one of the design strategies will result in the desired outcome: a successful and viable spin-off support unit. The context also affects the easiness of communicating and implementing the design efforts, in other words: the context also influences the efficiency of each of the design strategies. Our data suggest that hierarchy and near-decomposability in terms of money streams are important determinants of the contribution of design strategies to the performance of the design process. In this respect, the WUR case illustrates how some of these context characteristics surfaced in a very explicit way, related to tensions about power and ownership of revenues and success. Referring to the role of the board and management team at WUR, the director of WBG argued:

> I think that an important part of the discussions involved the question of [political] power. They were of the opinion that WBG had become too powerful. That's the reason they killed it. (...) I was the only one who had an independent budget within this organization. Everybody was jealous.

In retrospect, these tensions resulted in a major redesign, which in fact implied the end of the WBG unit in its old form. The lack of feedback-driven learning resulted in limited anchoring of the unit in the nearly decomposable semi-autonomous departments, which in turn thus lead to low effectiveness of the design process in this case in terms of survival. Table 5.4 summarizes our main findings by specifying the normative implications of the design strategies in terms of design results (in particular arriving at the intended results and the viability of the design results) and efficiency of the design process in terms of effort and time needed.

**Table 5.4: Design strategies in relation to context characteristics**

| Context characteristics | | Off-line reasoning and planning | Feedback-driven learning | Associative reasoning |
|---|---|---|---|---|
| **Organization** | | | | |
| *Near-decomposability* | High | R[12]: *medium*, not anchored E[13]: *high*, easy justification | R: *high*, anchoring the design E: *low*, potentially diverging and time consuming | R: *high*, avoiding lock-in E: *medium*, guiding but potentially diverging |
| | Low | R: *medium*, not anchored E: *high*, easy communication | R: *high*, anchoring E: *medium*, time consuming | R: *high*, avoiding lock-in E: *high*, converging |
| *Hierarchy* | High | R: *medium*, threat of resistance E: *high*, convince and justify | R: *medium*, difficult to anchor at all hierarchical levels E: *medium*, difficult to learn from all hierarchical levels | R: *high*, justified design E: *high*: easy communication |
| | Low | R: *medium*, not anchored E: *low*, difficult to communicate | R: *high*, fine-tuning design E: *medium*, dispersed interaction | R: *high*, justified design E: *low*, difficult to communicate |
| National and regional policy interactions | | R: *high*, justified design E: *high*, easy to communicate | R: *high*, foster convergence E: *low*, time consuming | R: *high*, justified design E: *medium*, dependent on relationships |

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[12] R: the importance of this design strategy for design results/effectiveness: arriving at the intended results (i.e., a new venture unit supporting new venture creation) and the viability of the design results (i.e., survival of the unit) in this particular context.

[13] E: the importance of this design strategy to efficiently perform the design process, in terms of the efforts and time needed, in this particular context.

This table is structured in terms of the context characteristics: near-decomposability, hierarchy and the interaction with regional and national policy makers. Concerning the university as a complex organization, we found that in particular the degree of loose coupling of departments and the degree of hierarchy shape the use of different design strategies and affect the associated performance of the design process. For instance, in an organization with high near-decomposability, feedback-driven learning is needed to anchor the design in the academic departments, thus increasing the survival chances of the designed unit. In terms of efficiency, however, feedback-driven learning is time consuming and can, in different parts of the organization, result in divergent feedback. For the policy context, the efficiency and results of design strategies are largely influenced by the intensity of interaction with regional and national policy makers. Here, in particular off-line reasoning and planning appear to be instrumental in justifying and anchoring the design as such as well as to communicate the design process.

## 5.5 Discussion

Our empirical study in this chapter explores how designers of organizations use different (cognitive) design strategies in different contexts. The data from three cases suggest that contextual conditions influence the use of these strategies and affect the associated performance of the design process (see Table 5.4). Our findings indicate that associative reasoning prevails in the case contexts and that feedback-driven learning is instrumental in anchoring the designs to enhance the viability of the designed units. In this respect, this study underscores earlier theoretical claims that designers in moderately complex and novel settings preferably engage in associative reasoning by way of analogies (Farjoun, 2008; Gavetti et al., 2005; Gavetti et al., 2008; Gavetti and Rivkin, 2007). Moreover, this study replicates the finding that both experimentation and analogies (or copies) are very important to design separate yet bridging new venture units in a complex organization (Birkinshaw and Hill, 2003; Hill and Birkinshaw, 2008).

### 5.5.1 Theoretical implications

Most importantly, our findings serve to specify *how* organization designers use these strategies and combinations of these strategies to design new venture units. Our findings also serve to specify the performance of the design process

associated with employing different strategies in diverse contexts (characterized by near-decomposability, hierarchy and interaction with policy makers, cf. Table 5.4). These insights in the context-specific contribution of the design strategies substantially extend previous research on the design of new venture units (cf. Hill and Birkinshaw, 2008) and on organization design (cf. Gavetti et al., 2008). In this respect, this study underlines that the design strategy of associative reasoning creates the ability to acknowledge differences between the situation at hand and the exemplar situation, which tends to result in design processes with high performance (cf. Table 5.4). As such, an analogy can function as a mental framework that incorporates (and possibly integrates) different aspects of the object being designed. In the design efforts and implementation of support activities and policies, a particular exemplar – for example the venturing system at MIT – can provide a powerful vision to avoid lock-in and to justify the design as such.

This study also provides a number of new insights by linking the associative reasoning strategy to the design context. First, the degree to which analogies can be used efficiently apparently depends on the hierarchy of the organization and the place of the designers in this hierarchy. Moreover, the viability of the design result in case of associative reasoning is subject to the complementary use of the strategy of feedback-driven learning, as the WUR case shows. Furthermore, the empirical findings suggest that associative reasoning is used at several levels in and around the organization, which then can lead to converging mindsets around a particular exemplar. However, in the case of conflicting interests of the decision makers, the exemplar situation can also create divergence (e.g., at WUR).

Another finding that extends previous theorizing (i.e., Farjoun, 2008) is that feedback-driven learning may also prevail in a moderately complex and novel context, and not merely in situations characterized by extreme novelty and high complexity (e.g., Rivkin, 2000; Sarasvathy et al., 2008; Sommer and Loch, 2004). Feedback-driven learning is in particular instrumental in adapting given (preliminary) designs to the context and anchoring them in the organization. As all three universities are to a large extent nearly-decomposable, feedback-driven learning appears to enable the designers to create a new venture support system that is tailored to the needs of particular lower hierarchical levels (departments, research groups, individual faculty) (cf. Perrow, 1972; Weick, 1976). However, the

UPC case shows that a high degree of hierarchy tends to limit feedback-driven learning to only higher levels of the hierarchy, thus highlighting a risk that is not acknowledged in previous research (cf. Ethiraj and Levinthal, 2004; Perrow, 1972). Moreover, in case of WUR's central new venture support organization that highly depends on loosely coupled departments, feedback-driven learning at the level of the support unit diverged from what was learned at the level of departments and thus tensions aroused.

This points at an important interaction between hierarchy and near-decomposability. The cases studied in this chapter involve designing a spin-off support unit as a central entity, which has to be (partly) integrated with the decentrally organized, loosely coupled departments. In such a situation, formal authority and charisma will provide the designer with the power and discretion to fully exploit the existent hierarchy in designing and implementing solutions (Hardy, 1990; Simon, 1962). The loosely coupled nature of university departments, however, limits the role of organizational hierarchy in creating and implementing policies throughout the university; as such, a convergence of bottom-up change efforts and embeddedness in combination with support from the top is necessary. Such a combination of hierarchy and loose coupling prevents an "on-going pattern of organizational restructuring" of the different organizational units (Ethiraj and Levinthal, 2004: 430), as hierarchical power serves to cut the knot.

Our findings regarding the use of off-line reasoning and planning extend previous work in this area (Gavetti et al., 2005; Gavetti et al., 2008). We observed that all design strategies are employed, but on diverse hierarchical levels, in different degrees and with diverse results. Farjoun (2008) argued that off-line reasoning and planning is most likely to be adopted in familiar, stable and less complex settings. However, our study suggests designers also use off-line reasoning and planning in moderately complex and moderately novel settings. In particular, this design strategy helps to 'sell' particular ideas to stakeholders and providers of resources, whereas the actual design process to a large extent draws on associative reasoning and feedback-driven learning. This finding may also serve to explain why some design studies emphasize feedback and association (e.g., Gavetti et al., 2005; Schön, 1984; 1987), whereas other studies focus on planning and forecasting (e.g., Gresov, 1989; Kirby, 2006; Pahl et al., 2007; Simon,

1996). As such, our study demonstrates that all three design strategies are likely to be used in one empirical setting, but in different degrees of importance, at different organizational levels, and with differential impact on the performance of the design process.

The experience of agent-designers surfaces as an important designer-specific factor in dealing with contexts in all three cases. For example at TU/e and WUR, the directors of the new venture support organizations had previously acquired experience in designing similar organizations in other settings. Experience influences what can be done, "given who s/he is, what s/he knows, and whom s/he knows" (Sarasvathy et al., 2008: 339), which is apparently different at WUR and TU/e: at WUR, the designer choose to create a separate fund, while at TU/e, the director emphasized the embeddedness in the departments. As such, experience does not provide an exclusive explanation, but does help to understand how designers interpret analogies and integrate design knowledge from different sources. This is in line with previous work by Gavetti et al. (2005), who observed that the experience of the agent applying the analogy is an important predictor of the performance of the application in practice. In this respect, experienced designers tend to pick better analogies (Gick and Holyoak, 1983; Holyoak and Thagard, 1995) and are also likely to be more capable in adapting their analogies and strategies (Dorst, 2008; Weick, 1995; Yoo et al., 2006). At UPC, the use of analogies was observed to a lesser extent and feedback-driven learning was more important than in the two other cases. This may be a result of the incumbent designer having less business and international experience (cf. Chi et al., 1981); moreover, this designer was evidently more integrated in the university's political system, as a former vice-president and dean. In this respect, experience of the designer(s) also appears to be an important moderator between the context and design process performance associated with using feedback-driven learning (Argyris and Schön, 1978; Levitt and March, 1988). Here, our case studies illustrate the pivotal role of agent-designers in crafting separate new venture units, while interacting with the complexities of the organization. Designers are agents who (can) create coherence in a design and decide which design strategies to follow. The importance of the experience of designers highlights that design theory needs to carefully balance the role of designers and

the role of specific design actions codified in principles and rules (cf. Dorst, 2008; Romme, 2003).

*5.5.2 Limitations and future research directions*

This study has the following limitations. First, the context of the cases may imply particular, possibly biased, outcomes. We studied a design process in a loosely coupled university organization. In this respect, universities are very different from many other (e.g., business) organizations. These other kinds of organizations constitute other contexts for design and designing new venture units in corporate business environments may be subject to different tensions. One important difference could be that, in general, new venture units in universities aim at enhancing exploiting inventions in contrast to the exploration focused mainstream activities of the university, whereas in business organizations new venture units aim at enhancing exploring new business opportunities in contrast to the exploitation oriented mainstream organization. Studying design processes in such different types of organizations may show different results regarding the precise details of the interaction of design strategies and context characteristics. In addition, in order to fully integrate the complexity of the design context with field work on organization design, a combined effort of computational modeling and qualitative case studies can provide a more sophisticated strategy.

## 5.6 Conclusions

This chapter contributes to the innovation management and corporate entrepreneurship literature by exploring the interaction between design processes of separate spin-off support units and complex design contexts. Moreover, this study contributes to the organization design literature by describing the use of different design strategies in these specific contexts as well as specifying the contributions of these strategies to the performance of the design process. The design of spin-off support units in universities suggests how difficult it is to deliberately change an organization with multiple linkages, a long history, and semi-autonomous departments that are loosely coupled. Our study also points to the role of organizational near-decomposability, which forms a contextual characteristic that in interaction with hierarchy severely influences the domain

available to designers and the applicability of top-down directives. In this respect, the case studies in this chapter emphasize the power of associative reasoning as well as the need for feedback-driven learning at different organizational levels in the organization, by people with certain levels of experience. Overall, our study suggests design strategies need to be understood in relation to the complexity of the context in which they are adopted.

# CHAPTER 6

# ETHICAL EVALUATION OF UNIVERSITY SPIN-OFF CREATION

## 6.1 Introduction

The engagement of universities in commercialization of research such as spin-off creation, as studied in the previous chapters, raises moral questions. If one of the main goals of universities is to produce sound knowledge, would the usage of this knowledge for economic benefits not corrupt research 'objectivity'? For example, Sheldon Krimsky (2003: 1) states that "university science becomes entangled with entrepreneurship; knowledge is pursued for its monetary value; and expertise with a point of view can be purchased". On the one hand, faculty were proud of the success of the Stanford spin-off Google and were happy with the research funding of $US336 million that equity sales delivered to Stanford University. On the other hand, people asked what these unprecedented cases will imply for renowned universities. The benefits of commercializing science create what Roger Geiger calls the 'paradox of the marketplace': "the marketplace has, on balance, brought universities greater resources (...) and a more productive role in the U.S. economy. At the same time, it has diminished the sovereignty of universities over their own activities, weakened their mission of serving the public, and created through growing commercial entanglements at least the potential for undermining their privileged role as disinterested arbiters of knowledge" (Geiger, 2004: 265). Thus, the engagement of universities in commercializing research raises the question whether this engagement is good or bad.

Universities act as players in regional and national economic systems in different ways. Universities sell their education to students at the undergraduate, graduate and MBA level. University researchers are involved in doing research and writing research reports for several institutions and companies. Moreover, universities have to acquire funding from the state, from public institutions and from private companies. Furthermore, universities sell parts of the created

knowledge by licensing or selling intellectual property rights. In addition, one of the commercialization and knowledge transfer routes that has gained much attention over the last years is the start-up of new ventures exploiting university inventions, the university spin-offs. This last route of commercializing and transferring knowledge combines a number of these economic activities, namely licensing, transferring personnel and students, and contract research. Therefore, university spin-offs are the natural focus of this chapter on the ethical evaluation of economic activities of universities.

The debate on the moral issues raised by the engagement of universities in commercializing of research has been lively, in particular since the 1980s (Feller, 1990b). In addition, systematic inquiry of the phenomenon has started. However, the empirical findings are usually not taken into account in the debate on these moral issues. Moreover, many contributions to this debate have been remarkably one-sided. Therefore, this chapter aims to bring the debate a step forward by collecting the arguments, evaluating them by means of reviewing empirical findings and taking into account different ethical perspectives. In this respect, this chapter goes beyond unproductive dichotomies between 'old-school Mertonian-style' and 'new-school profit-oriented' research (cf. Owen-Smith and Powell, 2001). As a result, this chapter provides an answer on the following question (subquestion 5):

*How can moral issues regarding spin-off creation be mitigated?*

First, a review of the literature collects the different arguments that favor or oppose the creation (and support for) university spin-offs. This inventory of arguments is, where possible, evaluated by a review of empirical studies that demonstrate the substance and power of the arguments. In this way, I extend earlier overviews that focused only on the negative effects of patenting (i.e., Baldini, 2008; Thursby and Thursby, 2005). Second, the two dominant ethical theories, deontological and teleological theory, are used to evaluate these arguments and create a synthesizing reflective equilibrium by balancing different perspectives (cf. Rawls, 1999). In the current status of the debate, many arguments are often used irrespective of their differences in assumptions and perspectives, which makes it difficult to compare arguments. By presenting different lines of

ethical reasoning, understanding of different outcomes of the evaluation is enabled. This facilitates comparing these different perspectives in order to construct a reflective equilibrium to be used in the debate. In general, this chapter contributes to the debate on the commercialization of science by reviewing the advantages and disadvantages and showing that some of them are not empirically supported, while others are substantial. Furthermore, this ethical evaluation contributes to this debate by showing distinct lines of reasoning which result in different evaluations of the university spin-off phenomenon. The integration in a reflective equilibrium provides a moral criterion which provides an instrument to evaluate university spin-off creation. In addition, the review in this chapter contributes by specifying a number of research directions.

## 6.2 Arguments in support of university spin-off creation

### 6.2.1 Knowledge utilization

One of the main reasons to foster the creation of university spin-offs is the knowledge utilization objective. Universities create new knowledge and do inventions. Much of the research underlying these inventions has been paid by taxpayers, at least in the case of public universities. The benefits of this research and these inventions therefore have to feed back to taxpayers, to the society. This is partly done by teaching students the results of the research and by publishing research findings in books and academic journals. Moreover, the value of the inventions can be further unleashed by bringing these inventions to the market, which will create better and more products, thus possibly increasing life standards of taxpayers. Thus, commercialization of science is justified by the benefit and use of the public (Powell and Colyvas, 2008).

Many inventions reach the market by large, established firms that buy the property rights of university inventions (Thursby et al., 2001). However, some inventions are not feasible for exploitation by established firms. This especially applies to inventions that are in an early stage of their development and inventions that involve much of the tacit knowledge of the university inventors (Mitchell et al., 2002; Thursby et al., 2001; Zucker et al., 2002). In these cases exploitation by the inventor him/herself in a university spin-off implies that the uncertainty can be reduced and that the involvement of the inventor is ensured (Hsu and Bernstein, 1997; Shane, 2002). As such, spin-off firms are important

catalysts in spurring technology flows (Rappert et al., 1999) and can serve to realize the commercial and social benefits of a discovery (Meyer, 2006a).

### 6.2.2 Economic growth

University spin-offs can contribute to economic growth, both locally and on a broader, national scale (Mueller, 2006; Shane, 2004). Although the relationship between university spin-off creation and economic growth is not linear (Mowery and Sampat, 2005), research results do imply that new high-tech companies such as university spin-offs contribute evidently to economic growth (Mueller, 2006; Shane, 2004; Shane, 2009). University spin-offs generate significant economic value and create more jobs than the average small businesses (Shane, 2004). As such, support from universities to found university spin-offs helps these firms to grow. For spin-off firms, maintaining the relationship with the university is important for several reasons. For example to obtain access to expertise, keep abreast of university research, get assistance and help with specific problems, and have access to public funding (Geiger, 2004; Zucker et al., 2002; Zucker and Darby, 1998). Thus, by enabling and supporting university spin-off creation universities can contribute to economic growth.

### 6.2.3 Learn from other 'culture'

A popular idea is that faculty is too isolated in their ivory tower. Their tasks of independent observation and theorizing may have made them introspective with little attention for the outside world. One of the benefits of university spin-offs, as has been argued, is that they enable learning from the different culture of business (Welsh et al., 2008). Moreover, as there is no fundamental separation between the world of science and the world of business in terms of technology and research subjects, university spin-offs provide one of the necessary bridging roles (Powell and Owen-Smith, 2002). So, engaging in university spin-off creation can result in sharper market foci of faculty and the emergence of new research ideas (Feller, 1990a).

   A number of researchers have aimed to quantify this effect by examining whether academic researchers engaging in industry relationships in general and spin-off activities in particular have more research output in terms of published papers. The number of published papers then is a proxy for research quality and

productivity of researchers. Assuming that engagement in commercial activities spurs creativity and leads to potential new and fruitful research directions, higher publication rates are hypothesized. This hypothesis is confirmed by the finding that such inventor-authors publish at or above average publishing rates of faculty (Lowe and Gonzalez, 2007; Meyer, 2006b; Zucker and Darby, 1998).

### 6.2.4 Revenue generation

The generation of university spin-offs provides income for universities (Colyvas et al., 2002; Jensen and Thursby, 2001; Leute, 2005; Slaughter and Leslie, 1997; Welsh et al., 2008). This income involves the royalties on the commercialization of the licenses sold to these companies. Furthermore, many universities have policies to take equity in spin-off companies, which gives them the benefit of goal alignment and control, but also the ability to benefit from all the business activities related to the university inventions (Bray and Lee, 2000). Moreover, by holding equity in a spin-off company, the university avoids the risk that the entrepreneurs work around the patent (Shane, 2004). Researchers report positive revenues by technology transfer and in particular from equity holdings in university spin-offs (Bray and Lee, 2000; Chapple et al., 2005). Besides the direct revenues from the commercialized invention, spin-offs bring related financial benefits because they often attract public funding which is partly spent at the university. For instance, Hsu and Bernstein (1997) found that MIT spin-offs used grants to fund research at the university.

However, some researchers indicate that it is not evident whether there is really a net benefit for universities. For example, Stevens and Bagby state that it is "unclear what benefits are distributed or what the incentives are for the instruction and service functions of universities; (...) there is no consensus regarding who benefits or should pay for knowledge creation and transfer" (Stevens and Bagby, 2001: 264, 266). One of the main questions in this respect is whether there flows more public money to private companies than vice versa. It seems that a small number of large top-universities have net income from licensing and spin-off activities, but the majority of universities is making losses on technology transfer (Geuna and Nesta, 2006). An important concern is that universities have been reluctant to ensure good formats for the licensing deals (maintenance payments, milestone payments) (; Edwards et al., 2003).

## 6.3 Arguments contra university spin-off creation

### 6.3.1 Reduced academic commitment

The main reasoning opposing the commercialization of science and the creation of university spin-offs argues that conflicts of interest will arise. On the one hand, advancing academic knowledge is the primary goal of a university researcher. On the other hand, (s)he is stimulated to engage in entrepreneurial activities that also need investments in time and effort. This could create a tension between the academic tasks versus commitment to private entrepreneurship tasks (Bird et al., 1993; Renault, 2006).

Empirical investigation of this topic, however, suggests that this tension is not very pronounced (Steffensen et al., 2000), as the portion of faculty expressing interest in licensing is remarkably low, indicating that faculty have not become too commercial (Thursby and Thursby, 2005), or because of effective 'conflict of interest' policies (Argyres and Liebeskind, 1998; Leute, 2005; Powell and Colyvas, 2008; Welsh et al., 2008). In addition, research on the relationship between patenting and entrepreneurship activities on the one hand and the publishing tasks on the other hand indicates that engagement in commercialization does not result in reduced academic research output (Baldini, 2008; Lowe and Gonzalez, 2007; Meyer, 2006b; Van Looy et al., 2006; Zucker and Darby, 1998). Moreover, results show a positive relationship between the quality of articles, measured by the number of citations, and the number of university spin-offs (Di Gregorio and Shane, 2003; Powers and McDougall, 2005b). This indicates that entrepreneurial activities do not reduce academic efforts or vice versa; they rather tend to reinforce each other.

### 6.3.2 Research direction change

Related to the potentially reduced academic commitment is the objection that engagement in university spin-off creation will change research directions(Colyvas and Powell, 2007). As Feller states (1990a: 342): "[T]he institutional incentives to foster faculty research related to reducing technical and economic uncertainty increase as well, even when these lines of research diverge from 'academic advances in knowledge'." Whereas research output in quantitative terms does not change, the content of research in qualitative terms will change. An important role of universities is to perform fundamental research.

The argument is that, instead of executing fundamental research, faculty engaging in entrepreneurial activities and industry relationships will focus on research directions that have more commercial opportunities (Feller, 1990a). As a result, research that benefits the public interest but has no opportunity to contribute to a market solution could be abandoned (Krimsky, 2003). Instead, commercial success of certain research directions can lead to strengthening those directions, resulting in overembeddedness that reduces both future academic and commercial success (Owen-Smith and Powell, 2003). Maintaining the focus on fundamental research will therefore be more beneficial on the long term, even in economic and commercial terms, because fundamental research can result in path-breaking innovations (Glenna et al., 2007; Lacetera, 2009). Moreover, as a result of growing commercial interests, the autonomy of researchers to choose their own direction could get lost (Kleinman and Vallas, 2001).

Empirically, the existence of changes in research directions is still indecisive. Azoulay et al. (2006) indeed found changes in research directions, towards more applied research. Others, however, did not find an evident shift in research directions (Thursby and Thursby, 2005; Ylijoki, 2003). In addition, Thursby et al. (2007) show in a simulation study that a research shift is likely to occur not at the expense of fundamental research, but at the expense of leisure time.

*6.3.3 Anti-commons effect*

One of the results of having private parties such as spin-off companies commercializing university research may be that this research cannot be freely communicated anymore. Because the rights on the intellectual property are sold and since commercial interests are involved, university researchers are not allowed to communicate openly about the research involved since competitors could be listening. As a result, only the research group that invented a certain technology can build on the research in follow-up research, but is not allowed to present their research results in the outside world, nor is able to invite other researchers around the world to join their research direction. This effect is called the 'anti-commons effect': commercialization of research can restrict communication and exchange amongst scientists (Vallas and Kleinman, 2007; Welsh et al., 2008). Some argue that this goes against the traditional values of universities (Argyres and Liebeskind, 1998; David, 2004b; Krimsky, 2003). For

example, Argyres and Liebeskind state that the universities' "social-contractual commitment to society [was] to create and sustain an 'intellectual commons': a knowledge archive openly accessible to all members of society" (Argyres and Liebeskind, 1998: 428).

The anti-commons effect is empirically confirmed (Murray and Stern, 2007), although its impact does not appear to be very large or significant (Chang and Yang, 2008). Some studies have found that publications of which the intellectual property is protected by a patent receive slightly less citations than their unpatented pairs (Fabrizio and Di Minin, 2008; Murray and Stern, 2007). Moreover, Mars et al. (2008) found that communication of research results among students in class rooms decreased if these students were acting as entrepreneurs commercializing these research results.

### 6.3.4 Threats to objectivity

Engagement of faculty in commercial activities such as spin-offs could result in research that becomes biased, because of the commercial interests attached to the research. An example is the systematic bias that has been found in drug-testing studies that are sponsored by pharmaceutical companies (Krimsky, 2003; Lexchin et al., 2003). The 'objectivity' norm means that university research should be free from (monetary) interest in the outcome of the research (i.e., Argyres and Liebeskind, 1998; Feller, 1990a; Slaughter and Rhoades, 2004). When commercial interests are growing, monetary interest increases, thus causing growing threats for the academic claim of objectivity (Krimsky, 2003; Vallas and Kleinman, 2007). The empirical research of Colyvas (2007) has demonstrated that institutional change resulted in acceptance of commercial and monetary interests, which means that the norm of monetarily disinterestedness is eroding (assuming that this norm was higher in the past) (Kleinman and Vallas, 2001).

### 6.3.5 Inequity among faculty

One of the potential side-effects of faculty engaging in university spin-off creation could be that some faculty acquire a higher total income than other faculty that does not have these revenues. Differences in faculty pay because of entrepreneurship profits may cause envy (Argyres and Liebeskind, 1998;

Slaughter and Leslie, 1997). Empirical research on university spin-offs appears not to find this inequity disadvantage, as it is not reported.

### 6.3.6 *Departure of faculty*

In case a university spin-off is founded by faculty, the latter will probably devote (part of) their time to this new venture and may eventually leave their academic careers. This could be a disadvantage, in case the university wants to keep this faculty on board. Slaughter and Leslie's (1997) research indicates that this issue is not perceived as problematic, nor is it reported by other researchers.

### 6.3.7 *Unfair competition by spin-offs*

Because university spin-offs typically exploit public-funded research and since they often receive support by the university, university spin-offs can be considered as 'state-sponsored' enterprises (Mars et al., 2008). This could create unfair competition relative to new ventures that have to do it on their own (Bird et al., 1993). The strength of this argument depends on the question whether industry spin-offs really do not receive support. In many countries and regions, entrepreneurship is promoted and sponsored with incubators, funds et cetera, such as the SBIC grant in the US (Lundström and Stevenson, 2005). This implies that many other new ventures also can be considered to be to some extent state-sponsored.

## 6.4 Deontological evaluation

Deontological ethics evaluates actions by assessing whether these actions conform to some specified set of rules. The foundations of this ethical philosophy are laid by Immanuel Kant (Micewski and Troy, 2007). His basic rule to decide what is just is: "Act only on that maxim whereby you can at the same time will that it become a universal law" (Kant, 2005: 81 [421]). Based on this rule, specific deontological norms can be developed. For example, John Rawls advocated a contractarian approach, in which the Kantian maxim is translated as 'inherent moral standing of persons' articulated in a social contract (Lefkowitz, 2003). In this way, also other ethical norms can be considered as 'deontological', meaning that people have to adhere to these norms rather than basing their evaluations on the consequences of their actions (Lefkowitz, 2003).

I will discuss two of such imperative approaches to evaluate university spin-off creation: the Mertonian ethos of science and the Kirznerian ethics of finders-keepers. The Mertonian ethos of science is relevant because it is the ethos most authors in the debate on commercialization of university knowledge refer to. As such, the Mertonian ethos of science represents the (idealized) deontological norms from the university side of the debate on university spin-off creation. On the other hand, the Kirznerian finders-keepers ethic is selected because in entrepreneurship theory the theorizing of Israel M. Kirzner is increasingly seen as one of the basics (Douhan et al., 2007; Foss et al., 2007; Sarasvathy et al., 2003). Moreover, Kirzner has developed a theory of distributive justice for an entrepreneurship context, which is similar to other emerging ethical evaluations of the specific distribution problems in entrepreneurial situations (cf. Dew and Sarasvathy, 2007). Thus, this Kirznerian finders-keepers ethic provides an important concept representing the entrepreneurship side of the debate on university spin-off creation. As such, these two perspectives provide extremes with regard to thinking about science and entrepreneurship, and are therefore likely to cover the continuum of perspectives on this issue.

### 6.4.1 Merton: Ethos of science

The distinguished sociologist Robert K. Merton studied scientific practice to observe the 'normative structure of science' underlying the behavior of scientists. Merton performed this research in the late 1930s and early 1940s; these studies are collected in *The Sociology of Science* (Merton, 1973). At the time of Merton's studies, the legitimacy of science was questioned because of developments in directions that were not commonly accepted, such as the German and Soviet Union ideological science and scientific discoveries to improve weapons. Merton sought answers to the question how scientific knowledge can still be a source of universal truth if so many social structures are involved. To answer this question, he tried to identify the 'ethos of science', the social contract binding the behavior of scientists. Merton identified four sets of 'institutional imperatives' (Merton, 1973: 270-278). *Universalism* means that science transcends the particularity of the investigator(s). *Communalism* (or communism) describes the common ownership of the goods produced by scientific investigation. *Disinterestedness* refers to scientific investigation without considerations of personal gain or other indivi-

dual interests. *Organized skepticism* means that a scientist employs "temporary suspension of judgment and (...) detached scrutiny of beliefs in terms of empirical and logical criteria" (Merton, 1973: 277). These norms are tacit and also idealized. The latter can be illustrated with the norm of disinterestedness: for instance, each scientist is at least interested in getting publishable results. Merton acknowledged that these idealized norms of science were not always actually followed by scientists (Merton, 1973: 383-412), which was also contended by other researchers (Mitroff, 1974; Montgomery and Oliver, 2009).

Whatever the exact descriptive value of the Mertonian norms may be, they are often used as norms characterizing "basic, fundamental or academic science and are distinguished from applied or industrial science" (Slaughter and Leslie, 1997: 178). According to these norms, how do we evaluate the identified advantages and disadvantages of university spin-offs? Table 6.1 provides an overview of the evaluation of advantages and disadvantages of university spin-off creation according to Mertonian norms. This makes clear that university spin-off creation in particular contradicts disinterestedness (Kleinman and Vallas, 2001; Krimsky, 2003; Owen-Smith and Powell, 2001; Vallas and Kleinman, 2007). When an individual researcher is involved in a university spin-off as founder or one of the employees, this implies that (s)he has an interest in the performance of this new venture. Because the venture is based on his/her research, this means that this research is no longer free from interest in the outcomes of the research.

**Table 6.1: Mertonian evaluation of university spin-off creation**

| Advantages | Evaluation | Disadvantages | Evaluation |
|---|---|---|---|
| Knowledge utilization | N/A[14] | Reduced ac. commitment | N/A |
| Economic growth | N/A | Research direction change | Contradicts disinterestedness |
| Learn from other 'culture' | N/A | Anti-commons effect | Contradicts communalism |
| Revenue generation | Contradicts disinterestedness | Threats objectivity | Contradicts universalism |
| | | Inequity among faculty | N/A |
| | | Departure of faculty | N/A |
| | | Unfair competition | N/A |

[14] The Mertonian norms are not applicable to evaluate these advantages and disadvantages.

Furthermore, the anti-commons effect that knowledge can no longer be shared openly and freely could clearly contradict the norm of communalism (Argyres and Liebeskind, 1998; Krimsky, 2003). In addition, the threat to objectivity contradicts the norm of universalism because the essence of the universalism norm is that research should be objective and transcending the particularity of the investigator (Slaughter and Rhoades, 2004). In sum, evaluating university spin-off creation by means of Mertonian scientific ethos shows that university spin-off creation to a large extent contradicts these three norms.

### 6.4.2 Kirzner: Ethics of finders–keepers

The economic theory of Israel M. Kirzner is increasingly seen as important in entrepreneurship theory (Douhan et al., 2007; Foss et al., 2007; Sarasvathy et al., 2003). For this chapter, one particular consequence of his theory is of interest, namely the implication for the division of profit in the market (Burczak, 2002; Kirzner, 1989). Kirzner's theory is based on the Austrian school of economics, which provides a different perspective on the market than mainstream neoclassical economics. Austrians consider knowledge of economic opportunity, technology, potential market demand, and resource availability as subjective. This knowledge depends on individual perception and can be wrong or can be right. Entrepreneurs use their subjective knowledge to discover economic opportunities. This discovery, thus, is dependent upon the individual; it is possible that no other person had the knowledge required to discover a particular economic opportunity. Because of this personal perception involved in the discovery of an opportunity, the opportunity can be treated as if it does not exist without that person. Stated differently, it can be said that the entrepreneur creates products "*ex nihilo*" (Kirzner, 1989: 13). As a consequence, the output created by the entrepreneur is *discovered* output. According to Kirzner, in this case a so-called 'finders-keepers ethic' "is consistent with what appear to be widely shared moral intuitions" (Kirzner, 1989: 17). Kirzner (1989: 17) sees this finders-keepers ethic as different from a first-claimant ethic:

> One who finds a beautiful, previously unowned seashell and takes possession of it is entitled to that seashell, we interpret the finders-keepers ethic to mean, not because he was the first to register a claim to it,

but because he found it. Not only was the seashell unowned and unclaimed before he found it, but it was in fact undiscovered as well. In other words the seashell had, insofar as human awareness goes, no *existence* prior to its discovery. By finding it, the seashell's discovery has, in a sense, *created* it.

The consequence is that because the finder of an entrepreneurial opportunity is more entitled to it than anybody else, (s)he also has more right on the profits of the discovery. A fundamental condition to assign the property of the entrepreneurial opportunity to the finder is that the opportunity itself is "not fabricated out of prior inputs, it was not the result of a deliberately undertaken research program" (Kirzner, 1989: 152). But even in the case where prior inputs play a role in the discovery, as in a university spin-off based on the findings of a systematic research program, still the ultimate discovery of the entrepreneurial opportunity as existing outside the immediate (results of the) research program is attributable to the discoverer (Shane, 2000). As a result, simple distributive justice rules appear not to apply because "naive applications of the contractarian framework to innovations assume novelties instantaneously reveal their full consequences to decision makers, at least probabilistically", as Dew and Sarasvathy (2007: 274) have argued.

**Table 6.2: Kirznerian evaluation of university spin-off creation**

| Advantages | Evaluation | Disadvantages | Evaluation |
|---|---|---|---|
| Knowledge utilization | Yes: Is a different discovery | Reduced ac. commitment | N/A |
| Economic growth | N/A | Research direction change | Research differs fundamentally from entrepreneurship |
| Learn from other 'culture' | N/A | Anti-commons effect | No: Knowledge is subjectively owned |
| Revenue generation | Yes: For discoverer | Threats objectivity | N/A |
| | | Inequity among faculty | No: Revenues created by entrepreneur |
| | | Departure of faculty | N/A |
| | | Unfair competition | No: Opportunity created by entrepreneur |

Employing this finders-keepers ethic enables evaluating the advantages and disadvantages of university spin-off creation from a different perspective. Table 6.2 summarizes this evaluation. Fundamental in the Kirznerian discovery justice is that discovering an opportunity is different from the inputs in the research and discovery process (cf. Dew and Sarasvathy, 2007). Thus, it can be argued that the commercialization of research results involves a different realm than the research realm. Knowledge utilization therefore is not linearly connected with the academic research underlying this commercialization. Depending upon the efforts from the university side into the commercialization (and the search for entrepreneurial opportunities), the discovery of the ultimate opportunity is at least partially owned by the entrepreneur. As a result of this distinction, there is a natural boundary between entrepreneur and inventor (in the case these two are different people) and at least between the entrepreneur and the other research group members. In this line of reasoning revenues from the university spin-off are also legitimate, and at least partially for the entrepreneur. This can create income differences among faculty, but these are legitimate because no-one else (could have) discovered this opportunity. In sum, evaluating university spin-off creation from a Kirznerian discovery ethics results in an evaluation that is supportive for such 'academic entrepreneurs'.

## 6.5 Teleological evaluation

Evaluating actions by a teleological ethical theory means that we focus on the consequences of the actions. Teleological ethics, also known as consequentialism or utilitarism, assumes that something is done for some personal or collective benefit, and not necessarily because it is the right thing to do (Frankema, 1973). In the formulation of Jeremy Bentham, teleological ethical theory argues that an action is good if it produces the greatest amount of good for the greatest number of people (DeConinck and Lewis, 1997). This evaluation depends obviously on how we define 'good'. For our purposes, let us consider the consequences for two different goods: the first is the advance of fundamental science; the second is economic growth. I discuss the consequences of university spin-off creation for these two different goods. Here, the review of the empirical results as discussed in Sections 6.2 and 6.3 provides insight in the *consequences* (whereas the deontological evaluation only focused on the *norms*). Table 6.3 presents an

overview of the evaluation, whereby 'AS' refers to the goal of 'advancing fundamental science' and 'EG' refers to the good of enhancing 'economic growth'.

With regard to the advantages of university spin-off creation, the goal of advancing fundamental science is not hindered substantially, whereas economic growth is generally fostered. The literature review showed that knowledge utilization, economic growth, and the effect of learning from the business culture is enhanced by university spin-off creation. With regard to revenue generation for the university, research results were ambiguous. Moreover, it is unclear whether revenue generation for the university would foster economic growth. From the goal of advancing fundamental science, revenue generation for the university – if any – is likely positive, because it provides funding to perform fundamental research.

The evaluation of the disadvantages of university spin-off creation shows more mixed results. First of all, a number of disadvantages were not supported by the reviewed empirical research and are therefore excluded from the evalua-

**Table 6.3: Teleological evaluation of university spin-off creation**

| Advantages | Evaluation | Disadvantages | Evaluation |
|---|---|---|---|
| Knowledge utilization | AS: neutral<br>EG: positive | Reduced ac. commitment | N/A: Not supported |
| Economic growth | AS: neutral<br>EG: positive | Research direction change | AS: Moderately negative:<br>Sometimes changes<br>EG: Moderately negative:<br>Sometimes changes |
| Learn from other 'culture' | AS: neutral<br>EG: positive | Anti-commons effect | AS: Moderately negative:<br>To some extent existing<br>EG: positive |
| Revenue generation | AS: positive if existing<br>EG: neutral: ambiguous | Threats objectivity | AS: Moderately negative:<br>To some extent existing<br>EG: neutral |
|  |  | Inequity among faculty | N/A: Not supported |
|  |  | Departure of faculty | N/A: Not supported |
|  |  | Unfair competition | AS: neutral<br>EG: potentially negative if existing |

tion (indicated by 'N/A' in Table 6.3). With regard to the potential change in research direction, research has shown that this change sometimes exists. In these cases, research has changed not in quality but the research direction has shifted from fundamental to more applied research. This shift, if existing, is obviously detrimental to advancing fundamental research. Moreover, a change towards applied research is possibly also disadvantageous to fostering long-term economic growth, as radical innovations by fundamental research results are more likely to generate sustainable competitive advantage (Glenna et al., 2007; Lacetera, 2009; Owen-Smith and Powell, 2003). Regarding the anti-commons effect, the goods of advancing fundamental science and economic growth result in different evaluations. Research findings indicate a small anti-commons effect, which could reduce the efficiency of fundamental academic research because research results are not openly shared. On the other hand, it is often argued that economic growth is enhanced by well-functioning markets and sustainable businesses. One of the means to create a sustainable business is by protecting the intellectual property, which potentially results in an anti-commons effect. With regard to the threat to objectivity, research results show that this threat exists and that objectivity of research is sometimes undermined. For advancing academic science, this is obviously negative. On the other hand, it is not clear whether this has an impact on economic growth. Finally, unfair competition created by supporting spin-off creation could have a detrimental effect on economic growth, assuming that economic growth is fostered the most by fair competition in the market. The literature review, however, showed that it is unclear whether university spin-off support really creates unfair competition. Moreover, the unfair competition does neither appear to harm nor to foster science.

In sum, the teleological ethical evaluation of university spin-off creation shows a number of elements that enhance both the goods of academic science and economic growth. On the other hand, a number of elements were identified that likely harm these goods. In general, the effect of university spin-off creation is likely advancing the greatest amount of good for most of the people (assuming that the distribution of profits in the society is reasonable equal). If the remaining disadvantages of university spin-off creation could be reduced, the advantages clearly outperform the disadvantages.

## 6.6 A reflective equilibrium

The inventory of advantages and disadvantages of university spin-off creation provides the arguments to evaluate the commercialization of university knowledge by means of university spin-offs. The deontological and teleological perspectives show different evaluations. I now will integrate these perspectives in a reflective equilibrium. Subsequently, I sketch the contours of an ethically sound university spin-off policy.

A reflective equilibrium means that we come to a judgment that is aligned with the principles we adhere to (i.e., the equilibrium), and which is at the same time taking into account the current knowledge of conditions and outcomes (i.e., reflective) (Rawls, 1999). In this chapter, I have explored two very different sets of principles under the heading of a deontological evaluation. The outcomes of university spin-off creation are reviewed under the heading of a teleological evaluation. The review of empirical results for each of the advantages and disadvantages shows that some of them are not significant, while others are actually substantial.

The arguments that are not consistent with the empirics can be taken out of the equilibrium. On the advantages side, it is unclear whether university spin-off creation creates net revenues for the majority of the universities. Much research presents gross revenues, but the question is if net benefit remains after subtracting the costs of maintaining a technology transfer office and other support services. Here, future research is needed to clarify this advantage, but at this moment the evidence does not give this advantage much weight. On the disadvantages side, many studies have shown that the potential disadvantage of reduced academic commitment is not consistent with data on publication results. This could be an effect of having the right incentives and structures in place to combine academic research with commercialization, as some authors have argued (Ambos et al., 2008; Chang et al., 2009). As a result, universities should be cautious not to neglect this disadvantage, but in the equilibrium this disadvantage is not rated as very important at this moment. Furthermore, the disadvantage of inequity among faculty because of unequal benefits appears not to exist as it is not reported frequently. This could also be the result of well-functioning incentive systems. For example, the frequently copied Stanford distribution rule prescribing that one-third of the revenues go to the university,

one-third to the research group and one-third to the inventor-entrepreneur prevents envy (Colyvas, 2007; Stevens and Bagby, 2001). So, it appears possible to dismantle this disadvantage by the right organizational design. Finally, the review results imply that the departure of faculty is not seen as a problem in most cases. As a consequence, this disadvantage appears as not substantial. In sum, the equilibrium includes on the one hand of three advantages of university spin-off creation: 1) knowledge utilization, 2) economic growth, and 3) learning from the other 'culture'. On the other hand, three disadvantages exist: 1) research direction change, 2) anti-commons effect, and 3) threat to objectivity.

An equilibrium of these advantages and disadvantages by considering the ethical evaluations from different perspectives tends towards the judgment that university spin-off creation is desirable if detrimental effects can be mitigated as much as possible. This equilibrium is constructed as follows. On the one hand, according to Mertonian norms, furthering university spin-off creation is bad policy. On the other extreme, according to Kirznerian logic, nothing is wrong with university spin-offs and private benefits from such public funded research. Furthermore, from a teleological perspective, the three supported advantages are contributing to economic growth and not reducing the advancement of science, whereas the change in research direction and the threat to objectivity are evaluated as negative for both advancing science and economic growth, and the evaluation of the anti-commons effect differs per defined good. Because economic growth is probably creating a good for more people than advancing science as such, teleological evaluation tends towards the judgment that university spin-off creation is desirable. Moreover, the objections from a Mertonian viewpoint can be mitigated to some extent, by designing the right structures governing the creation of university spin-offs, which reduces the disadvantages. Under the condition that these detrimental effects can be mitigated, the benefits of university spin-off creation (from especially a Kirznerian and teleological evaluation) appear to outweigh the disadvantages.

This reflective equilibrium is subject to mitigating the three disadvantages while conserving the already existing instruments reducing the other disadvantages. The three disadvantages that need attention of both policy makers as well as researchers are: research direction change, anti-commons effect, and threat to objectivity. For (university) policy makers, faculty and academic

entrepreneurs the awareness of these three potential disadvantages is important. Furthermore, research has demonstrated that designs exist that reduce these disadvantages. The change in research directions can probably be reduced by incentivizing not only the quality of the research but also the direction of the research (Thursby et al., 2007). The anti-commons effect is more difficult to deal with, although developments in the direction of open science appear to be driven by the intention to enhance the free sharing of academic knowledge (David, 2004b). This direction is one that provides potential (David, 2004a) and needs more attention, in particular in combination with commercialization of this knowledge (West, 2008). An effective way to reduce the threat to objectivity appears to increase the transparency of funding flows (Krimsky, 2003; Smith, 1998) as well as the enhancement of formal conflict of interest policies (Argyres and Liebeskind, 1998; Leute, 2005; Powell and Colyvas, 2008; Welsh et al., 2008). In general, one of the important design rules to enhance both fundamental science as well as to enable and stimulate university spin-off creation is the creation of a 'dual' structure. These two objectives have to be separated as much as possible, both in a managerial and a physical sense. Of course, especially in early stage of the spin-off company, the scientific endeavor and the commercial path intermingle and boundaries have to be negotiated (Rappert et al., 1999). But on the long term these two activities have to be separated to be able to enhance both directions (Ambos et al., 2008; Chang et al., 2009; Debackere and Veugelers, 2005; Van Burg et al., 2008).

## 6.7 Limitations and future research directions

This ethical review of the university spin-off phenomenon and construction of a reflective equilibrium supports a constructive debate. To advance this debate, important research questions have to be answered. First, the created equilibrium is 'reflective' in the sense that it is dependent upon the current state of knowledge regarding university spin-off creation (Rawls, 1999). Future research can discover other disadvantages or can show that disadvantages are increasing on the long term by eroding the still existing Mertonian norms (Slaughter and Rhoades, 2004). Therefore, systematic enquiry is required to update the equilibrium and enable decision making based on sound knowledge. Second, the reflective equilibrium in this chapter is based on two deontological perspectives and two teleological

evaluations. More perspectives could be added, in order to challenge or strengthen the constructed equilibrium. Third, an issue that becomes more serious when commercialization practices are more and more copied around the world is the study of the diverse national legal and social regimes regarding universities and entrepreneurship. Most literature, including this review, implicitly assumes a non-existing uniformity in practices around the world. Most research has focused on the US and to a lesser extent on Western Europe. To develop policy and make normative recommendations, understanding the national, local and regional context is needed. Fourth, the literature review showed that it is necessary to study the net revenues from university spin-offs as well as other commercialization practices such as licensing. Fifth, the issue of potential unfair competition needs further research. Many new companies are supported by government and support organizations. It is worth considering whether in open market systems such as the US or the EU this creates inequality or not.

## 6.8 Conclusions

This chapter integrates the different lines of reasoning regarding the moral issues generated by commercialization of science by means of university spin-off creation. The main contribution to this debate is the construction of a reflective equilibrium that can be used as a moral criterion. I conclude that commercializing science by means of university spin-offs is ethically desirable under the condition that disadvantages can be mitigated by designing appropriate organizational structures. Future work and debate needs to generate continuous attention for issues such as research objectivity and the contribution of science to society and to update the reflective equilibrium. In this respect, this review provides a basis for continued discussion that draws on sound arguments.

# CHAPTER 7

# GENERAL CONCLUSIONS

## 7.1 Introduction

This research was motivated by the observation that quite some knowledge has been accumulated about university spin-off creation and entrepreneurship in general, but that it is difficult to connect this wisdom with practices at universities. Therefore, a design science approach was adopted as the overarching approach of this dissertation to connect the scholarly knowledge base with these practices. In the endeavor of developing design principles to advise these practitioners and to provide scientists with a framework to assess the state-of-the-art of the scientific knowledge, a number of underresearched areas were identified. Therefore, a number of studies in this thesis focused on the formation and effect of fairness perceptions, the overarching design strategies as employed by organization designers, and the ethical evaluation of the university spin-off phenomenon. In this chapter, the main conclusions from this dissertation are presented and a final set of design principles is constructed. Moreover, the theoretical and practical implications are specified and a number of avenues for further research are identified.

## 7.2 Answering the research questions

In Chapter 1, the main research question is defined and five more detailed subquestions are introduced. First, the conclusions for each of the subquestions are recapitulated, which subsequently leads to an answer on the main question and to a number of general conclusions.

### 7.2.1 Question 1

*What principles can be established to design a university organization that stimulates (rather than discourages) the creation and development of university spin-offs?*

The conclusions from Chapter 2 provide the initial answer to question 1 by specifying five design principles. In Section 7.2.6, I will further refine this answer. These five principles especially serve to deliberately craft solutions to (re)design a support system for university spin-offs, thereby building on earlier emergent design actions at a particular university. If components of the infrastructure are already in place at a university, a more deliberate design process employing these principles serves to extend and improve the existing practices. In his respect, the case-study of Chapter 2 suggests there are two fundamentally different phases in building capacity for university spin-off creation: first, an infrastructure for spin-off creation (e.g., including a collaborative network of investors, managers and advisors) is developed, that then enables support activities to individual spin-off ventures. These phases indicate a time-dependency in the implementation of these five design principles in which design principle 1 is first and design principle 5 is something that can be achieved at a later stage. The results of this chapter show that in particular important questions around the perceived fairness of spin-off activities are under researched. The formation and influence of these fairness perceptions of the entrepreneurs are explored in subquestion 2 and 3.

*7.2.2 Question 2*

*What are the heuristics underlying the formation of fairness perceptions of academic entrepreneurs?*

Chapter 3 focused on the entrepreneur's level to investigate the fairness issue that rises when universities seek to foster the creation and development of spin-off companies. We investigated how academic entrepreneurs form fairness perceptions of their relationship with the university. We identified the heuristics and rules underlying the formation of fairness perceptions by academic entrepreneurs. The results imply that existing organizational justice rules as represented in the four dimensions of distributive, procedural, interactional and interpersonal fairness are employed by entrepreneurs. Especially procedural and distributive fairness rules are used by the academic entrepreneurs in our sample. However, Chapter 3 also shows the use of nine fairness heuristics specific to the entrepreneurship setting. These nine heuristics are in their shorthand

descriptions: other universities, market norms, performance of the entrepreneur in the negotiation(s), negotiator support, easiness and length of the negotiation(s), cooperation and support by the university, venture governance, future value, and entitlement of the university. Key entrepreneurship specific heuristics that appear to substantially affect the formation of fairness perceptions by entrepreneurs are related to perceived venture governance and the uncertain future valuation of the venture. The results of Chapter 3 imply that the use of both specific fairness heuristics and established fairness rules is consistent over time and across contexts. Instead, the major source of variation in use of established fairness rules and specific fairness heuristics lies in the differential degree of entrepreneurial experience and the formal position of entrepreneurs within the university.

*7.2.4 Question 3*

> *How does the perceived fairness of the relationship with the university influence the*
> *development of the spin-off?*

In Chapter 4, the investigation of the fairness issue continues by assessing the impact of fairness perceptions on the development of the spin-off company. A relationship is found between the perception of unfairness and the occurrence of delays in the venturing process. Unfair perceptions are associated with delays in negotiations, business start-up activities, acquisition of funding, and building external relationships. Conversely, fair perceptions appear to be linked to a more rapid pattern of development. If the early relationship with the university is experienced as fair, the agreement will be reached earlier, negotiations will be less intensive and the cooperation will enfold quicker. This positively influences the ability to acquire funding and engage in strategic cooperation. Fairness perceptions especially play a role during (re)negotiations with the university. After these negotiations the agreement and the perceptions are rationalized and the terms of the relationship and agreement are accepted. Moreover, the role of experience surfaces also from this chapter. Experienced entrepreneurs evaluate the transaction differently in terms of fairness, which increases the likelihood of evaluating the procedure and agreement as fair. Furthermore, experienced

entrepreneurs tend to value cooperation with the university as more important than relatively inexperienced entrepreneurs, and they are prepared to pay for it.

### 7.2.4 Question 4

*What are the cognitive design strategies that can be followed to design effectively and efficiently a support unit that stimulates the creation and development of university spin-offs?*

Chapter 5 turned again to the university level to describe the design strategies that designers employ to use knowledge in the design process and to analyze the contribution of these strategies to the performance of the design process. Organization designers appear to employ three strategies: off-line reasoning and planning, feedback-driven learning, and associative reasoning by way of analogies. Contextual conditions influence the use of these strategies and affect the associated effectiveness and efficiency of the design process. The design strategy of *associative reasoning* serves to acknowledge differences between the situation at hand and the associated case, which tends to result in design processes with high performance. As such, an analogy can function as a powerful vision to integrate design principles, to avoid lock-in in the current situation and to justify design solutions. Moreover, *feedback-driven learning* is in particular instrumental in adapting design principles and design solutions to a context. In addition, this design strategy serves to anchor design solutions in the organization and is necessary for the effectiveness of the design process. Finally, the experience of agent-designers seems to influence the design process to a large extent.

### 7.2.5 Question 5

*How can moral issues regarding spin-off creation be mitigated?*

Chapter 6 shows that three disadvantages of university spin-off creation need attention of both policy makers as well as researchers: research direction change, the anti-commons effect, and the threat to research objectivity. For (university) policy makers, faculty and academic entrepreneurs the awareness of these three

potential disadvantages is important. The change in research directions can probably be mitigated by incentivizing not only the quality of the research but also the direction of the research. The anti-commons effect is more difficult to deal with, although developments in the direction of open science appear to be driven by the intention to enhance the free sharing of academic knowledge. An effective way to mitigate the threat to objectivity appears to increase the transparency of funding flows as well as the enhancement of formal conflict of interest policies. In sum, one of the important design rules following from Chapter 6 is that a 'dual' structure should be created. The two objectives of fundamental science and university spin-off creation have to be separated as much as possible, both managerially and physically.

*7.2.6 Main question*

> *How can a university organization be designed that fosters the creation and development of university spin-offs?*

After recapitulating the conclusions for each of the subquestions, the main question can be answered and general conclusions can be formulated. The answer is formulated as a set of design principles resulting from this thesis. These design principles form a refined and complemented version of the provisional set of principles resulting from Chapter 2. Moreover, for each of the principles a number of practical design solutions are presented. More practical examples of solution elements can be found in Table 2.6.

*Final set of design principles*
To design an organization that fosters the creation and development of spin-offs, universities should apply the following principles:

1.  *Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty.*
Design solutions based on this principle can include different elements. For example, a design can be developed in which spin-off advisors are involved in

entrepreneurship education to present the possibilities and explain the spin-off process and procedures. The TU/e case shows that it could also be helpful to enable students to combine their thesis work with the preparations for starting a venture. Another solution element could be to offer newly hired employees a training regarding technology commercialization.

2. *Support start-up teams in composing and learning the right mix of venturing skills and knowledge by providing access to advice, coaching and training.*

Design solutions based on this principle can include for example, to develop an educational program in which student start-up teams are created from multiple disciplines, thus creating a mix of different skills and knowledge. Another important solution is to advise spin-off teams, for instance with regard to their business plan, facilities, finance, subsidy requests, team formation and intellectual property. In this respect, spin-off advisors need to be creative in finding solutions and approach spin-offs in a personalized way. Furthermore, more experienced entrepreneurs can be involved in the spin-off team either as entrepreneurs or as coaches. These entrepreneurs can be attracted by interesting events and in particular by building personal networks.

3. *Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors.*

Practical solution components based on this principle include the creation of arrangements for spin-offs to use university labs and other resources and the provision of office space with the possibility to use different services. To guide the use of these facilities, flexible contracts and good conditions, but with market prices, are important. Moreover, to help obtaining access to resources, the development and nurturing of a network around the support organization of investors, industry contacts and financers is useful, as this can among others provide a path to obtain significant amounts of funding.

4. *Set clear and supportive rules and procedures to regulate spin-off processes.*

These rules should regard the internal distribution of revenues from the exploitation of inventions and manage the balance between academia and business. In this respect, detailed guidelines include:

a. enhancing fair treatment as perceived by the involved parties, by:
  - setting expectations, especially for inexperienced entrepreneurs;
  - making the negotiation process transparent and as short as possible;
  - guiding the valuation of the company in the negotiation process;
  - specifying an exit strategy for the university;
b. mitigating moral dilemmas between commercial objectives and academic objectives, by:
  - incentivizing not only the quality of the research but also the direction of the research;
  - fostering 'open science', for instance by making all research results publicly and freely available;
  - increasing the transparency of funding flows, for instance by the mandatory acknowledgement of funding;
  - formalizing conflict of interest policies;
  - separating spin-off processes both managerially and physically from academic research and teaching;
c. supporting continued cooperation between the university and the spin-off firm.

5. *Shape a university culture that reinforces academic entrepreneurship, by creating norms and exemplars that motivate entrepreneurial behavior.*

The creation of a culture is something that is hardly designable and to a large extent a result of emergent processes. As such, practitioners could implement design principles 1-4 and hope that an entrepreneurial culture emerges. Moreover, some practical suggestions can be made, which could be helpful to contribute to a culture change. These suggestions involve the creation of commitment at faculty boards, the cultivation of successful entrepreneurs as role models, and the establishment of a separate support unit that is operating 'businesslike'.

To implement these principles effectively and efficiently in a university, designers should apply the principles 6 and 7 simultaneously:

6.  *Use the design strategy of associative reasoning to integrate the different design principles into one coherent design solution while being able to acknowledge differences between the situation at hand and the reference case.*

The practical execution of this principle can include site visits to major exemplars or having managers from one of these benchmark cases visiting the involved university. These visits can provide the source for insights required in the associative reasoning strategy. Besides other universities, analogies could also include very different situations, such as successful enterprises.

7.  *Use the design strategy of feedback-driven learning to adapt design principles and solutions (cf. 1-5) to the context and anchor them in the different layers of the university organization.*

Practically, feedback-driven learning is very context dependent. In general, this includes inviting and using feedback from different people in the organization and its context, thus involving both decision makers, staff members and opinion leaders.

*General conclusions*

This dissertation study leads to three general conclusions. First, this study shows that the development of design principles by a design science approach carries both scientific and practical relevance. Regarding science, these design principles, grounded in extant theory and practice, show blind and white spots in the literature. This leads to identification of areas that need further investigation, such as the fairness issues around university spin-off creation. Regarding practice, the development of design principles serves to codify and improve existing practices as well as to translate new and helpful scientific insights to the pragmatic practices of university designers and decision makers. Overall, the design principles developed in this study form a new foundation for both academic work in this area as well as practical (re)design activities of university spin-off practices.

Second, the study of the formation and the effect of fairness perceptions demonstrates these perceptions are important in the entrepreneurship setting and different from other settings. Therefore, we can conclude that increasing perceptions of fairness in the interaction with entrepreneurs, using the identified

rules and heuristics, is likely to result in better and more effective cooperation, which in turn could improve venture performance.

Third, although popular press and public opinion are often hesitant to commercialization of university science, the spin-off activities are ethically desirable, rather than detrimental for science. Thus, policy makers and entrepreneurs should continue and strengthen efforts to exploit research findings, while taking into account a number of measures to reduce potential disadvantages and regularly reviewing the positive and negative effects.

## 7.3 Theoretical and practical implications

The distinct contributions to theory and practice by each of the studies in this thesis are specified in the respective chapters and are recapitulated in the summary. In this section, I describe and discuss the overall contribution of this thesis.

### 7.3.1 Theoretical implications

In general, this thesis delivers a contribution to the literature for two reasons. First, the design science approach adopted and further developed in this thesis combines a design perspective with more traditional theory and methods from the social sciences, resulting in contributions to both literatures and providing an approach that fits the entrepreneurship phenomenon. As such, this approach provides new insights and procedures for the interaction between social science and design practice, in particular regarding the interaction between emergent and deliberate designing. Moreover, this approach carries validity beyond the context of university spin-off creation. The procedures and results of the confrontation and interaction of both practical knowledge and scientific research results serve to build a cumulative body of knowledge and practice. Therefore, future studies can explore the application of this approach in other disciplines and regarding other topics, as an essential step to develop a common theoretical framework in a particular field. Moreover, the framework built by design science research serves to identify areas that need further investigation. For instance, in this thesis, we found that the issue of fairness needs further investigation and conceptualization, resulting in a deeper understanding of how the formation of fairness perceptions interacts with the development of new ventures.

Second, the application of design science research in this thesis clearly differs from earlier applications of design science research in the management field (e.g., Denyer et al., 2008; Romme and Endenburg, 2006; Van Aken, 2004). In this respect, this study serves to advance theory development regarding university spin-offs. On the one hand, most entrepreneurship research focuses on opportunities and the loci of these opportunities, related to technology and contextual factors such as industry and regional clusters. On the other hand, entrepreneurship researchers assess individual level factors such as cognition, personality and perceptions. Therefore, approaches that combine these different levels of analysis and different lines of reasoning are needed (Shane, 2003; Shane and Venkataraman, 2000). As such, this thesis delivers a major contribution by integrating different perspectives, resulting in diverse contributions as specified in the respective chapters. This results in a set of design principles in which insights regarding the locus of opportunities (i.e., the university) are integrated with findings regarding individual-level (i.e., fairness) perceptions and characteristics (i.e., experience).

### 7.3.2 Practical implications
The set of design principles resulting from this study (as discussed earlier in this chapter) served to integrate several practical recommendations from each of the studies in this thesis. This set of principles refers to basic conditions and practices that need to be created to build capacity for spin-off creation. Practitioners, such as policy makers, technology transfer directors and other university decision makers) can use the results from this study to design their own spin-off support systems in their specific context.

The results of this thesis inform academic entrepreneurs about the challenges at the university level and about specific individual-level conditions that are likely to influence their venture. In this respect, in particular inexperienced entrepreneurs should take note of the value of cooperation with the university, which probably exceeds any difficulties and barriers encountered in this relationship. In particular, these entrepreneurs should be aware of how their perceptions (e.g., of 'unfair' procedures and deals) may guide them toward behavior that may not be beneficial for the venture. Similarly, the staff of spin-off support and

technology transfer units should acknowledge and carefully manage the impact of their 'walk and talk' on (inexperienced) academic entrepreneurs.

## 7.4 Avenues for further research

*7.4.1 Complementing, refining and validating design principles*
In this thesis, I developed a set of design principles to design a spin-off conducive organization of universities. This set of design principles is important for the design activities by practitioners and provides an instrumental research framework for scientists. However, as design knowledge is time and context dependent, this set of design principles is subject to future research that may serve to complement, refine, and further validate these principles.

The final set of design principles needs to be complemented by more insights regarding its implementation. Chapter 2 suggested different phases of the implementation of these design principles as well as in the interplay between emergent and deliberate design activities. These insights, however, are still bounded to the single case in which these design activities were observed. More detailed studies of design processes of spin-off support infrastructures at universities can result in more details of the priorities and timing of the design principles. Moreover, future developments in the institutional context of universities may undermine the findings and design principles resulting from this thesis. Therefore, ongoing research is needed to update the set of design principles, which is inherent to the reflective nature of designing (Reymen, 2001).

Refinement of the design principles can be provided by future studies employing our set of design principles. In this study, I have especially refined design principle 4, dealing with fairness. However, the other design principles can also be further refined. In this respect, especially the fifth design principle, regarding shaping a university culture that reinforces academic entrepreneurship by creating norms and exemplars that motivate entrepreneurial behavior, needs future study. Although organizational culture is a difficult, intangible concept and culture changes are difficult to predict, future studies could probably enrich the current superficial understanding of this design principle in the literature.

Most importantly, design knowledge needs to be validated. In this respect, the first validation has been given by the study's carefully crafted methodology, which included several validity enhancing elements. Furthermore, the provi-

sional framework developed in Chapter 2 has been validated as a research framework by a couple of studies (Barr et al., 2009; Gilsing et al., 2010; Phan et al., 2009). The ultimate design validity test, however, is the practical development of design solutions based on our set of design principles by independent designers, adapted to different contexts. This could provide additional insights in the comprehensiveness, coherence, context-dependency and ease of use of the current framework.

### 7.4.2 Design strategies

The study of design strategies in Chapter 5 suggests several interesting questions for future research. As Chapter 5 aimed to entangle the interaction between design context and the different design strategies, studying various different contexts will enhance understanding this interaction. These other contexts could include the design of new venture or spin-off support units in corporate environments as well as in entirely different milieus. An important question for future studies deals with the contribution of the three design strategies to the performance of the design process (Gavetti et al., 2005; Gavetti et al., 2008). Are there other context characteristics influencing the effectiveness and efficiency of the design process? How is the performance of the design process related to a particular design strategy affected by the interaction with the other strategies?

Moreover, Chapter 5 highlights the central role of the designer and the designer's experience. Here, future studies on design theory need to carefully balance the role of designers and the role of specific design actions codified in principles and rules. In this respect, an interesting issue for future research is the role of experience moderating the use of design strategies in a specific context. This study explored the role of design experience by implicitly focusing on the experience of designers in the empirical domain of organizing and managing (units of) universities, that is, the *depth* of their experience. In addition, future work also needs to consider the range of experiences with other contexts and levels, for example, experience regarding the policy context, that is, the designers' *breadth* of experience (cf. Gavetti et al., 2005). Finally, because design strategies are primarily based on cognitive modes, future studies could also explore how these insights feed back to cognitive psychology.

*7.4.3 Building a theory of fairness perceptions of entrepreneurs*

Chapter 3 and Chapter 4 have provided a number of new insights in the formation of fairness perceptions by entrepreneurs and the effect of fairness perceptions on the new venturing development process. These insights provide building blocks for a theory of fairness perceptions of entrepreneurs, which serves to understand cooperative behavior of entrepreneurs. This theory should include the entrepreneurship specific fairness heuristics related to perceived venture governance and valuation of the company as well as more traditional fairness rules regarding procedural and distributive fairness. Moreover, rules regarding the 'entity' that entrepreneurs are cooperating with and individual-level characteristics such as social embeddedness and experience have to be included. Although we specified a number of testable propositions, we have not fully developed a comprehensive theory of fairness perceptions of entrepreneurs. More research is needed to explore a number of key aspects of such a theory.

First, more insight is needed in the fairness evaluations of cooperation by non-entrepreneurs. To establish the characteristics of the formation of fairness perceptions by entrepreneurs, we should be able to distinguish them from the formation of fairness perceptions by non-entrepreneurs. However, understanding the formation of fairness perceptions by non-entrepreneurs is still at its infancy. The current literature presumably builds on the established justice dimensions, which are particularly valid for employee-employer relationships. Future research should inductively establish the heuristics underlying the formation of fairness perceptions regarding cooperative relationships outside an employee-employer and entrepreneurship context.

Second, a well-formulated theory of fairness perceptions by entrepreneurs should take into account the processual nature of entrepreneurship. Given the predominantly retrospective nature of the process analysis, the richness of this analysis is bounded. Future studies need to adopt an extensive longitudinal research design to explore the precise details of the co-dynamics of the venturing process and the formation of fairness perceptions. These data can also serve to determine the direction of causality in the association of fairness perceptions with the new venture's development progress.

Third, in this thesis the formation of fairness perceptions is treated to a large extent as an individual-level construct. Here, future studies may study the effect

of the social influences within the venturing team and the social interaction with others to assess whether these effects should be included in a theory of fairness perceptions of entrepreneurs.

Finally, our research analyzes university spin-off creation at three technology universities in two different national and cultural settings. Here, future research should test whether our fairness conceptualizations also hold in different settings. The results of Chapter 3 and 4 may carry particular validity for other contexts with unequal power distribution. Such settings are, for example, the relationships between (technology) entrepreneurs and venture capitalists, between entrepreneurs and large corporations that spin out new ventures (led by these entrepreneurs), and between entrepreneurs and large partners (such as between biotech start-ups and large pharmaceutical firms). In this respect, earlier research already indicated that fairness perceptions appear to be very important in corporate spin-off processes (Chesbrough, 2003). Therefore, investigation of this topic in such contexts is likely to result in interesting findings and provide a test of our propositions.

### 7.4.4 Ethos and research commercialization

The popular press as well as the academic literature has debated about the desirability or the bad effects of the commercialization of university research. As ethics is a matter of ethos rather than a discipline in which final answers prevail, the results of Chapter 6 have to be both 'taken home' by practitioners and re-evaluated by research. The created reflective equilibrium of the moral issues concerning university spin-off creation is 'reflective' in the sense that it depends upon the current state of affairs (Rawls, 1999). Future research may discover additional disadvantages or show the (in)effectiveness of the proposed solutions to mitigate the moral issues. Moreover, re-evaluation of the equilibrium by future studies using additional perspectives can enrich the understanding of the moral issues and contribute to form faculty's ethos. More broadly, it would be interesting and relevant to explore the relationship between the ethos of (academic) entrepreneurs and the emergence of the described moral issues. Pursuing these research questions may lead to important insights that extend beyond the context of university spin-off creation, by providing deeper understanding of the multilevel structural effects of the ethos of entrepreneurs.

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# APPENDIX: GENERAL INTERVIEW GUIDE

**Interview scheme university spin offs**

Date:
Location:
Interviewee:
Interviewer:
Time:

**Introduction**
- Background of the research
    - o Research to the design of infrastructures to support university spin-offs
    - o Focus on the relationship between university and academic entrepreneur
- University spin-offs are defined as new ventures that are started to exploit intellectual property created at the host institution.
- Feed-back: research report

**1. Personal background**
a. Can you tell us about your background and your current position?

**2. Spin-off general**
a. What is the goal of TU/e / TU/e Innovation Lab with regard to spin-off creation?
   What is the target group? (students, staff, surrogate, etc)
b. What are the main activities of TU/e Innovation Lab?
c. Can you explain the structure and relationships of the different organizations that support entrepreneurship around TU/e?
    a. How are these organizations being funded?
d. Can you tell something about the history of spin-off creation and technology commercialization at TU/e? How have the structures and policies been changed? What design steps are executed?
e. Can you sketch how the entrepreneurship support helps in the different phases of TU/e spin-offs?
f. What has been the result of the activities?

g. How are the policies and possibilities communicated toward the (potential entrepreneurs)?

Next, we will focus on specific aspects of the spin-off process.

### 3. Facilities

a. What kind of facilities does TU/e Innovation Lab provide for spin-offs? (e.g., office space, cleanrooms and labs, tools, instruments, computers)
b. What is the policy of TU/e Innovation Lab with regard to providing facilities?
c. What is the result of providing these facilities? How does this contribute to the spin-off development?
d. In retrospect, can you think about cases where you would like to have acted differently, with regard to providing facilities?

### 4. Financing

a. How are spin-offs funded?
b. What kind of funding can they usually attract?
   Public funding (subsidies, public pre/seed funds), business angels, venture capitalists, other investors.
c. What returns/paybacks are asked for the funding?
d. What is the usual procedure/process to allocate the shares of the company?
e. Can you give an example of a spin-off process you are very content with?
f. Can you give an example of a spin-off process you would like to have done differently?

### 5. Intellectual property (IP) and negotiations about shares and royalties

a. What is the usual procedure with regard to intellectual property (preferably patents) transfer to a spin-off? (What has it been in the past?)
b. What is the procedure/policy with regard to the distribution of shares and potential revenues of the spin-off between university and spin-off?
   a. Royalties / license fee?
   b. Shares?
   c. Distribution of revenues among inventor, research group/faculty, university, TU/e Innovation Lab, and entrepreneur(s)?
c. Can you sketch a typical negotiation process?
   a. Who does the negotiations? (is there an external party involved?)
   b. Is there a (standardized) procedure? (decision tree?)

    d.   How do the different stakeholders evaluate the outcome of the negotiations? (inventor, financers, university, entrepreneur)

          a.   Do frictions/tensions occur? What tensions? (potential tensions: multiple roles, valuation of the invention, etc...)

    e.   What is the effect of the distribution of shares and revenues on the entrepreneur? (motivation?)

    f.   Can you give an example of a case that you are very content with?

    g.   Can you give an example of a spin-off process you would like to have done differently?

**6. Advice en coaching**

a.   How does TU/e Innovation Lab help start-ups with advice and coaching?

b.   What staff is available for advice and coaching?

c.   Do you actively scout for new ideas, ventures and entrepreneurs within the university?

d.   Do you employ screening criteria to new ventures?

e.   Can you give an example of a case that you are very content with, with regard to advice?

f.   Can you give an example of a spin-off process you would like to have done differently with regard to advice?

**7. Networks**

a.   How does TU/e Innovation Lab help starters to build their network? (network around university, reputation effect)

b.   What network does TU/e Innovation Lab have to help starters? (regional, professional, international,...) How did you develop it?

c.   Do you organize informal network meetings among starters, between starters and investors, etc? What is the effect of these meetings? How did you develop them?

d.   Can you provide an example in which network relationships clearly contributed to the development of the spin-off?

e.   Can you provide an example in which the network was lacking?

**8. Context and future**

a.   What is the influence of the university context on the startup of spin-offs and the success of spin-offs? (research climate, contacts with industry, reputation of university, attitude of staff)

b.   How is spin-off support embedded in the university? (scouting, staff training)

c.  How is spin-off support / entrepreneurship support embedded in the education?
d.  How is the board of the university and departments committed to entrepreneurship support?
e.  What is the influence of the *research* policy of TU/e on spin-off creation?
f.  What is the influence of the *education* policy of TU/e on spin-off creation?
g.  What is the influence of the *personnel* policy of TU/e on spin-off creation?
h.  What is the influence of the regional environment on the creation of new ventures?
i.  What is the influence of national policies?
j.  What are in your opinion be the next steps in the development of policies and structures with regard to spin-off stimulation and technology transfer?

**9. Rest**
a.  What aspects have not been mentioned yet, that are important to spin-off creation?
b.  And with regard to success of spin-offs?

**Concluding**
1.  Documents available (memo's, reports, brochures, etc)?
2.  Other interviewees we *should* talk with?

# SUMMARY

University spin-offs are companies founded to exploit university intellectual property. They serve to transform technological breakthroughs from university research, which would probably remain unexploited otherwise. Therefore, policy makers have become very interested in university spin-offs as a means for technology transfer and economic growth. However, creating university spin-offs is not easy. Some universities generate more spin-offs than others. Furthermore, university spin-off activity creates several difficulties, such as the potential conflict of interest between commercial and academic work and the risk to university reputation if founders of spin-offs act inappropriately. On the other hand, some academic entrepreneurs feel that their behavior is not welcomed by the university, or that the university procedures hinder the development of their venture. Thus, the main question of this dissertation is:

*How can a university organization be designed that fosters the creation and development of university spin-offs?*

In this dissertation, this question is addressed by adopting a *design science* approach, which aims to build valid design knowledge grounded in research and practice (Romme, 2003; Romme and Endenburg, 2006; Van Aken, 2004). Therefore, the main aim of this dissertation is to develop a set of design principles to guide designing a spin-off conducive organization of universities.

This study is based on data from a systematic literature review and on in-depth study of three universities: Eindhoven University of Technology (TU/e) and Wageningen University and Research Center (WUR) in The Netherlands and the Technical University of Catalonia (UPC) in Spain. The empirical analysis draws on, among other data, 73 interviews with 62 entrepreneurs and university representatives. The study starts with codifying pragmatic design knowledge of practitioners, which is connected to a synthesis of existing scientific knowledge regarding university spin-off creation. This reveals that theoretically and practically important questions around fair

distribution of revenues of the spin-off activities are under researched. These fairness perceptions of the entrepreneur influence the development of the venture. Therefore, we subsequently focus on the entrepreneurs and address these questions by in-depth studies of university spin-offs and their founders. This serves to refine the design principles. Subsequently, we study the longitudinal development of three different university spin-off support systems to explore the use and performance of different design strategies which serve to integrate the design principles. Finally, an ethical evaluation of the university spin-off phenomenon serves to explore how moral issues can be mitigated.

## Question 1

This dissertation study searches to answer five subquestions underlying the main research question. These questions address both the university side as well as the academic entrepreneur's side of the main question. The first question deals with the design activities at the university level:

1. *What principles can be established to design a university organization that stimulates (rather than discourages) the creation and development of university spin-offs?*

In Chapter 2, a set of design principles is developed to answer this question. These principles are practice-based as well as grounded in the existing body of research on university spin-offs. Thus, pragmatic knowledge about *how* to create university spin-offs is connected to scholarly work explaining *why* certain practices in this field work and others do not. Therefore, we started with codifying a number of principles based on practitioner's knowledge, which were subsequently connected and combined with research-based principles derived from the body of scientific knowledge. A case-study of spin-off creation at Eindhoven University of Technology illustrates the interplay between initial processes characterized by emergent design and the subsequent process that was more deliberate in nature. The spin-off practices in this case study were, initially, strongly driven by a more pragmatic approach and subsequently reshaped by insights derived from scholarly knowledge. This case study also suggests there are two fundamentally

different phases in building capacity for university spin-off creation: first, an infrastructure for spin-off creation (e.g., including a collaborative network of investors, managers and advisors) is developed, that then enables support activities to individual spin-off ventures. This chapter concludes that, to build and increase capacity for creating spin-offs, universities should implement design solutions drawing on five design principles. These and other results of this study illustrate how design science research connects scholarly research to the pragmatics of actually creating spin-offs in academic institutions.

The study of the design principles shows that one specific area is under researched: the establishment and effect of perceived fairness by the academic entrepreneurs. Therefore, Chapter 3 and 4 explore this issue.

## Question 2

The next subquestion deals with this particular issue of the entrepreneur's fairness perceptions of the relationship with the university. As fairness perceptions appear to influence the creation and development of university spin-offs, it is important to understand how these fairness perceptions are formed by the entrepreneur.

> 2.   *What are the heuristics underlying the formation of fairness perceptions of academic entrepreneurs?*

In Chapter 3, we have identified the heuristics underlying the formation of fairness perceptions by the academic entrepreneurs involved in 26 ventures from TU/e and WUR. The results imply that existing organizational justice rules as represented in the four dimensions of distributive, procedural, interactional and interpersonal fairness are employed by entrepreneurs. Especially procedural and distributive fairness rules are used by the academic entrepreneurs in our sample. However, Chapter 3 also shows the use of nine new fairness heuristics specific to the entrepreneurship setting. These nine heuristics are in their shorthand descriptions: other universities, market norms, performance of the entrepreneur in the negotiation(s), negotiator support, easiness and length of the negotiation(s), cooperation and support by the university, venture governance, future value, and entitlement

of the university. Key specific heuristics that appear to substantially affect the formation of fairness perceptions by entrepreneurs are related to perceived venture governance and the uncertain future valuation of the venture. These specific fairness heuristics complement established fairness rules and serve to theorize about the formation of fairness perceptions by entrepreneurs. The results of Chapter 3 imply that the use of both specific fairness heuristics and established fairness rules is consistent over time and across contexts. Instead, the major source of variation in use of established fairness rules and new fairness heuristics lies in the differential degree of entrepreneurial experience and the formal position of entrepreneurs within the university.

## Question 3

The following subquestion deals with the effect of fairness perceptions on the development of the university spin-off companies:

3.  *How does the perceived fairness of the relationship with the university influence the development of the spin-off?*

Chapter 4 explores how perceptions of (un)fairness in the relationship of academic entrepreneurs with the university affect the development of their venture. Therefore, we studied key events in the start-up processes of a sample of 17 spin-offs from TU/e. Our findings suggest the perception of unfairness relates to substantial delays in the venturing process as well as lower short term performance, while perceived fairness involves a more rapid pattern of development. If the early relationship with the university is experienced as fair, the agreement will be reached earlier, negotiations will be less intensive and the cooperation will enfold quicker. This positively influences the ability to acquire funding and engage in strategic cooperation. Conversely, unfair perceptions delay negotiations, business start-up activities and acquisition of funding, and building external relationships. Fairness perceptions especially play a role during (re)negotiations with the university. After these negotiations, the agreement and the perceptions are rationalized and the terms of the relationship and agreement are accepted. Furthermore,

we find that these perceptions are to some extent conditioned by the experience of the entrepreneur.

## Question 4

The design knowledge that is provided by the set of design principles and the understanding of the role of fairness perceptions has to be integrated into design solutions by organization designers. These designers also have to adapt the design knowledge to the contextual specificities of the situation at hand. Therefore, we are interested in the design strategies that designers employ to use knowledge in the design process and the contribution of these strategies to the performance of the design process. This leads to the following subquestion:

4. *What are the cognitive design strategies that can be followed to design effectively and efficiently a support unit that stimulates the creation and development of university spin-offs?*

Chapter 5 serves to integrate the previous exploration of design principles and the specific design question regarding the role of fairness on the level of organizational design of the university. This chapter draws on a comparative case study of the design processes of the spin-off support units at TU/e, WUR and UPC. We studied how the design processes and context interact. Key contextual characteristics are the degree of loose coupling of organizational units (near-decomposability), the hierarchical nature of the organization, and the interactions between designers and external stakeholders. Organization designers appear to use three strategies in the design process: off-line reasoning and planning, feedback-driven learning, and associative reasoning by way of analogies. Our findings suggest that associative reasoning is the primary design strategy in contexts characterized by a high degree of near-decomposability and hierarchy. As such, an analogy can function as a powerful vision to integrate design principles, to avoid lock-in in the current situation and to justify the design solution. In addition, feedback-driven learning appears to be necessary in anchoring the designs to make the designed unit viable over time.

## Question 5

The topic of this dissertation – the engagement of universities in commercialization of research by means of university spin-offs – raises moral questions. For instance, if one of the main goals of universities is to produce sound knowledge, would the usage of this knowledge for economic benefits not corrupt research 'objectivity'? As a result, engagement of universities in commercializing research raises the question whether this engagement is good or bad. These issues lead to the final subquestion:

*5.     How can moral issues regarding spin-off creation be mitigated?*

Chapter 6 reviews, structures and evaluates the moral issues generated by efforts to commercialize university research by means of university spin-offs. First, the advantages and disadvantages of commercialization of science as appearing from the existing research on university spin-off creation are reviewed. This review suggests that spin-off creation has three substantial advantages: 1) knowledge utilization, 2) economic growth, and 3) learning from the other 'culture'. Furthermore, three substantial disadvantages are identified: 1) the potential change in research direction, 2) the anti-commons effect, and 3) the threat to research objectivity. Subsequently, the arguments are evaluated by deontological and teleological ethical theories. These ethical evaluations show distinct lines of reasoning which result in different evaluations of the university spin-off phenomenon. Based on these ethical evaluations a reflective equilibrium is constructed that can be used as a moral criterion.

All three disadvantages of university spin-off creation need attention of both policy makers and researchers. For (university) policy makers, faculty and academic entrepreneurs, the awareness of these three potential disadvantages is important. The change in research directions can probably be mitigated by incentivizing not only the quality of the research but also the direction of the research. The anti-commons effect is more difficult to deal with, although developments in the direction of open science appear to be driven by the intention to enhance the free sharing of academic knowledge. An effective way to mitigate the threat to objectivity appears to increase the

transparency of funding flows as well as the enhancement of formal conflict of interest policies. In sum, one of the important design rules following from Chapter 6 is that a 'dual' structure should be created. The two objectives of fundamental science and university spin-off creation have to be separated as much as possible, both managerially and physically.

## Set of design principles

After answering the subquestions, a refined and complemented version of the provisional set of principles from Chapter 2 is developed.

To design an organization that fosters the creation and development of spin-offs, universities should apply the following principles.

1.  Create university-wide awareness of entrepreneurship opportunities, stimulate the development of entrepreneurial ideas, and subsequently screen entrepreneurs and ideas by programs targeted at students and faculty.

2.  Support start-up teams in composing and learning the right mix of venturing skills and knowledge by providing access to advice, coaching and training.

3.  Help starters in obtaining access to resources and developing their social capital by creating a collaborative network organization of investors, managers and advisors.

4.  Set clear and supportive rules and procedures to regulate spin-off processes, that:

    a.  enhance fair treatment as perceived by the involved parties, by:
        -   setting expectations, especially for inexperienced entrepreneurs;
        -   making the negotiation process transparent and as short as possible;
        -   guiding the valuation of the company in the negotiation process;
        -   specifying an exit strategy for the university;

    b.  mitigate moral dilemmas between commercial objectives and academic objectives, by:

- incentivizing not only the quality of the research but also the direction of the research;
- fostering 'open science';
- increasing the transparency of funding flows;
- formalizing conflict of interest policies;
- separating spin-off processes, both managerially and physically from academic research and teaching;

c. support continued cooperation between the university and the spin-off firm.

5. Shape a university culture that reinforces academic entrepreneurship, by creating norms and exemplars that motivate entrepreneurial behavior.

To implement these principles effectively and efficiently in university, designers should apply the following principles simultaneously:

6. Use the design strategy of *associative reasoning* to integrate the different design principles into one coherent design solution, while being able to acknowledge differences between the situation at hand and the reference case.

7. Use the design strategy of *feedback-driven learning* to adapt design principles and solutions (cf. 1-5) to the context and anchor them in the different layers of the university organization.

## Theoretical implications

This study contributes to the literature by integrating extant literature regarding university spin-off creation and researching a number of gaps that are essential for theoretical understanding of entrepreneurship and organization design. This study provides both insight in the university's side (the design of the organization) and the entrepreneur's side of the phenomenon of spin-off creation (the fairness perceptions). The assessment of the specific issues of fairness, design strategies and moral issues contribute to particular areas in the entrepreneurship and organization science literature.

Chapter 2 contributes to the organization design literature by focusing on the interplay between emergent and deliberate design, and exploring how

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this interplay can serve to develop a cumulative body of knowledge that is relevant for both practitioners and scholars. An additional contribution involves the area of application of the design science approach: technology commercialization and entrepreneurship in a university setting. As such, the set of design principles serves as a framework that can be used by other scholars to assess spin-off creation at other universities.

Chapter 3 contributes to two strands of literature. First, it contributes to the entrepreneurship literature by exploring the formation of fairness perceptions by entrepreneurs through the use of both existing rules and new, entrepreneurship-specific heuristics. As such, the results of this chapter also serve to understand why entrepreneurs' cooperative behavior may differ from what is expected from a 'rational economic' point of view. Furthermore, this chapter contributes to organizational justice theory by contextualizing the formation of fairness perceptions to an entrepreneurship setting. Here, we found nine specific heuristics affecting the formation of fairness perceptions in entrepreneurship settings, which complement the use of traditional fairness rules.

Chapter 4 contributes to understanding the effects of founders' fairness perceptions, thus opening the 'black box' of the role of these perceptions in venturing processes. Furthermore, this process study regarding fairness extends organizational justice theory by providing a dynamic perspective on fairness perceptions.

Chapter 5 contributes to the innovation and entrepreneurship literature by exploring the interaction between design processes of new venture units and complex design contexts. Moreover, this chapter contributes to the organization design literature by describing the relationship between context characteristics and the use of the different design strategies as well as specifying the contributions of these strategies to the performance of the design process in these contexts.

Chapter 6 contributes to the debate on the commercialization of science by reviewing the advantages and disadvantages and showing that some of them are not empirically supported, while others are substantial. Furthermore, this ethical evaluation contributes to this debate by showing distinct lines of reasoning which result in different evaluations of the university spin-off

phenomenon. The integration in a reflective equilibrium provides a moral criterion which provides an instrument to evaluate university spin-off creation. In addition, the review in this chapter contributes by specifying a number of research directions. More future research directions can be found in the general conclusions in Chapter 7.

Overall, this thesis delivers a major contribution to the literature for two reasons. First, the design science perspective as adopted and further developed in this thesis combines a design perspective with more traditional theory and methods from the social sciences, resulting in contributions to both literatures. As such, this approach provides new insights and procedures for the interaction between social science and design practice, such as the different roles of emergent and deliberate design. More importantly, this approach carries validity beyond the context of university spin-off creation. The procedures and results of the confrontation and interaction of both practical knowledge and scientific research results serve to build a cumulative body of knowledge and practice.

Second, this thesis applies design science research, supported by social science theory and methods, to academic entrepreneurship. In this respect, the cumulative body of knowledge, codified in the set of design principles, is an essential step to a common theoretical framework for (academic) entrepreneurship. As such, this thesis delivers a major contribution by providing an approach to integrate these different perspectives as well as by specifying a set of design principles in which insights regarding the locus of opportunities (i.e., the university) are integrated with findings regarding individual-level (i.e., fairness) perceptions and characteristics (i.e., experience).

## Practical implications

The set of design principles resulting from this study (as discussed earlier in this chapter) served to integrate several practical recommendations from each of the studies in this thesis. This set of principles refers to basic conditions and practices that need to be created to build capacity for spin-off creation. Practitioners can use the results from this study to design their own spin-off support systems in their specific context.

The results of this thesis inform academic entrepreneurs about the challenges at the university level and about specific individual-level conditions that are likely to influence their venture. In this respect, in particular inexperienced entrepreneurs should take note of the value of the cooperation with the university, which probably exceeds any difficulties and barriers encountered in this relationship. In particular, these entrepreneurs should be aware of how their perceptions (e.g., of 'unfair' procedures and deals) may guide them toward behavior that may not be beneficial for the venture. Similarly, the staff of spin-off support and technology transfer units should acknowledge and carefully manage the impact of their 'walk and talk' on (inexperienced) academic entrepreneurs.

# SAMENVATTING

Spin-offs van universiteiten zijn bedrijven die opgericht worden om intellectueel eigendom van deze universiteiten te exploiteren. Deze spin-offs zijn in het bijzonder nuttig om doorbraken in technisch onderzoek, met potentieel dat anders ongebruikt zou blijven, om te zetten naar producten en diensten met marktwaarde. Daarom zijn beleidsmakers erg geïnteresseerd in universitaire spin-offs, als middel voor overdracht van technologie en als mechanisme om economische groei te stimuleren. Het creëren van spin-offs is echter niet eenvoudig en sommige universiteiten hebben hierin meer succes dan anderen. Daarnaast kunnen spin-off activiteiten problemen veroorzaken, zoals belangenconflicten tussen commerciële activiteiten en academische taken en reputatieschade voor de universiteit bij verkeerd handelen door de oprichters van een spin-off. Aan de andere kant ervaren sommige academische ondernemers dat hun gedrag niet wordt gewaardeerd door de universiteit of dat universitaire procedures de ontwikkeling van hun onderneming remt. Uit deze observaties volgt de hoofdvraag van deze dissertatie:

*Hoe kan een universiteitsorganisatie worden ontworpen die het ontstaan en de ontwikkeling van universitaire spin-offs stimuleert?*

Deze vraag wordt in dit proefschrift benaderd vanuit een zogenaamde ontwerpwetenschappelijke benadering. Deze benadering streeft naar het ontwikkelen van valide ontwerpkennis die gebaseerd is op zowel wetenschappelijke resultaten als inzichten uit de praktijk (Romme, 2003; Romme en Endenburg, 2006; Van Aken, 2004). Daarom is het belangrijkste doel van dit proefschrift om een set ontwerpprincipes te ontwikkelen die richting kan geven aan het ontwerpen van een universiteitsorganisatie die het creëren van spin-offs bevordert.

Dit onderzoek is gebaseerd op data vanuit een systematisch literatuuronderzoek en op een diepgaande studie van drie universiteiten: Technische Universiteit Eindhoven (TU/e) en Wageningen Universiteit en Research

Center (WUR) in Nederland en de Technische Universiteit van Catalonië (UPC) in Spanje. Voor de empirische analyse worden onder andere 73 interviews met 62 ondernemers en universiteitsvertegenwoordigers gebruikt. Het onderzoek begint met het in kaart brengen van de ontwerpkennis van mensen uit de spin-off praktijk. Deze kennis wordt vervolgens gerelateerd aan een synthese van bestaande wetenschappelijke kennis over het ontstaan van academische spin-offs. Dit laat zien dat vragen met theoretische en praktische relevantie, die te maken hebben met een redelijke verdeling van opbrengsten van spin-off activiteiten, maar weinig zijn onderzocht. De perceptie van redelijkheid (fairness) door de ondernemer beïnvloedt de ontwikkeling van de nieuwe onderneming. Daarom worden deze vragen vervolgens bestudeerd. Dat levert een verfijning van de geformuleerde ontwerpprincipes op. Vervolgens bestuderen we de ontwikkeling van de spin-off ondersteuning en de organisatie daarvan bij de drie universiteiten over een periode van ongeveer tien jaar. Zo kan onderzocht worden hoe verschillende ontwerpstrategieën zijn gebruikt en wat de prestaties van deze ontwerpstrategieën zijn. Dat geeft inzicht in hoe de ontwerpprincipes in de praktijk geïntegreerd kunnen worden. Als laatste bevat dit proefschrift een ethische evaluatie van academische spin-offs, met als doel om te onderzoeken hoe morele problemen kunnen worden gereduceerd.

## Onderzoeksvraag 1

In dit proefschrift wordt de hoofdvraag opgesplitst in vijf onderzoeksvragen. Deze vragen betreffen zowel de kant van de universiteit als de kant van de academische ondernemer. De eerste vraag betreft de ontwerpactiviteiten op het niveau van de universiteit:

1. *Welke principes kunnen geformuleerd worden om een universiteits-organisatie te ontwerpen die het ontstaan en de ontwikkeling van universitaire spin-offs stimuleert (in plaats van belemmert)?*

Als antwoord op deze vraag is in hoofdstuk 2 is een set ontwerpprincipes ontwikkeld. Deze principes zijn gebaseerd op de praktijk en op het bestaande onderzoek naar universitaire spin-offs. Op deze manier is pragmatische

kennis over *hoe* academische spin-offs gecreëerd worden verbonden met wetenschappelijk onderzoek dat verklaart *waarom* bepaalde praktijken werken en andere niet. Met dat doel is begonnen met het in kaart brengen van een aantal ontwerpprincipes die gebaseerd zijn op kennis van mensen uit de spin-off praktijk, die vervolgens verbonden en gecombineerd zijn met principes die afgeleid zijn uit het bestaande wetenschappelijke onderzoek. Een gevalsstudie naar het ontstaan van spin-offs vanuit de TU Eindhoven illustreert de interactie tussen de eerste ontwerpprocessen die meer emergent waren en het daaropvolgende meer planmatige ontwerpproces. De spin-off praktijken binnen deze universiteit waren eerst sterk gedreven door een pragmatische aanpak en daarna herontworpen met behulp van inzichten uit wetenschappelijk onderzoek. De casus suggereert dat er twee fundamenteel verschillende fases zijn in het creëren van potentieel voor het laten ontstaan van academische spin-offs: eerst wordt een infrastructuur voor spin-offs ontwikkeld (bijvoorbeeld een samenwerkend netwerk van investeerders, managers en adviseurs), wat vervolgens de daadwerkelijke ondersteuningsactiviteiten voor individuele spin-off bedrijven mogelijk maakt. De belangrijkste conclusie van hoofdstuk 2 is dat, om de capaciteit voor het laten ontstaan van spin-offs te creëren en te versterken, universiteiten ontwerpoplossingen moeten maken volgens vijf ontwerpprincipes. Deze en andere resultaten uit dit hoofdstuk laten zien hoe ontwerpwetenschappelijk onderzoek wetenschappelijk onderzoek kan verbinden met de pragmatische praktijk waarin de spin-offs daadwerkelijk gecreëerd worden. Het onderzoek naar ontwerpprincipes laat ook zien dat één specifiek gebied weinig is onderzocht: de totstandkoming en het effect van de perceptie van redelijkheid, zoals dit ervaren wordt door de academische ondernemers. Daarom wordt dit onderwerp in hoofdstuk 3 en 4 verder onderzocht.

## Onderzoeksvraag 2

De volgende vraag betreft dit specifieke aspect over de perceptie van redelijkheid met betrekking tot de relatie met de universiteit, zoals dit ervaren wordt door de academische ondernemers. Omdat de perceptie van redelijkheid de oprichting en ontwikkeling van academische spin-offs lijkt te

beïnvloeden, is het belangrijk om te begrijpen hoe deze perceptie tot stand komt.

2.  *Wat zijn de heuristieken waarmee de perceptie van redelijkheid gevormd worden bij academische ondernemers?*

De heuristieken waarmee de perceptie van redelijkheid gevormd wordt zijn geïdentificeerd in hoofdstuk 3 in een onderzoek naar academische ondernemers die 26 spin-offs van TU/e en WUR gestart hebben. De resultaten laten zien dat bestaande, reeds onderzochte regels over redelijkheid gebruikt worden door ondernemers. In de 'organizational justice' literatuur worden deze bestaande regels ondergebracht in de dimensies van distributieve, procedurele, interactionele en interpersoonlijke redelijkheid. Vooral procedurele en distributieve redelijkheidsregels worden door de academische ondernemers uit deze studie gebruikt. Hoofdstuk 3 laat echter ook zien dat er negen nieuwe heuristieken zijn, die specifiek zijn voor de ondernemerschaps-context. Deze negen heuristieken kunnen kortweg omgeschreven worden als: andere universiteiten, marktnormen, prestaties van de ondernemer in de onderhandeling(en), ondersteuning van de onderhandelaar, gemak en lengte van de onderhandeling(en), samenwerking en ondersteuning door de universiteit, bestuur en eigendom van de onderneming, toekomstige waarde en als laatste de rechten van de universiteit. Belangrijke specifieke heuristieken, die in belangrijke mate de totstandkoming van een perceptie van redelijkheid beïnvloeden, hebben te maken met het bestuur en eigendom van de onderneming en de onzekere toekomstige waarde van de onder-neming. Deze ondernemerschapspecifieke redelijkheidsheuristieken vullen de bestaande redelijkheidsregels aan en zijn nuttig voor het vormen van een theorie over de totstandkoming van de perceptie van redelijkheid bij ondernemers. De resultaten van hoofdstuk 3 impliceren dat het gebruik van zowel specifieke als bestaande redelijkheidsheuristieken consistent is, zowel over de tijd als in verschillende contexten. De belangrijkste bron van variatie in het gebruik van deze regels en heuristieken bestaat uit de mate van ervaring en de formele positie van de ondernemers binnen de universiteit.

## Onderzoeksvraag 3

De volgende onderzoeksvraag betreft het effect van de gepercipieerde redelijkheid op de ontwikkeling van de academische spin-off onderneming:

> 3. *Hoe beïnvloedt de gepercipieerde redelijkheid van de relatie met de universiteit de ontwikkeling van de spin-off?*

In hoofdstuk 4 wordt onderzocht hoe de perceptie van (on)redelijkheid van de relatie van academische ondernemers met de universiteit de ontwikkeling van een spin-off beïnvloedt. Met dat doel zijn de belangrijkste gebeurtenissen uit de ontstaansprocessen van 17 spin-offs van de TU/e onderzocht. De resultaten laten zien dat gepercipieerde onredelijkheid gerelateerd is aan relatief grote vertragingen in het oprichtingsproces en aan lagere prestaties op de korte termijn, terwijl gepercipieerde redelijkheid gepaard gaat met een snellere ontwikkeling van de onderneming. Als de vroege relatie met de universiteit als redelijk ervaren wordt, zal er eerder een overeenkomst met de universiteit bereikt worden, zullen de onderhandelingen minder tijdsintensief zijn en zal de samenwerking sneller tot stand komen. Dit heeft vervolgens een positieve invloed op het verkrijgen van financiering en op de mogelijkheid om strategische samenwerking aan te gaan. Aan de andere kant vertraagt gepercipieerde onredelijkheid de onderhandelingen, de activiteiten voor het opstarten van de onderneming en het verkrijgen van financiering. Ook vertraagt deze gepercipieerde onredelijkheid het opbouwen van samenwerking met externe partijen. Deze percepties van redelijkheid spelen vooral een rol tijdens onderhandelingen met de universiteit. Als de onderhandelingen zijn beklonken worden de overeenkomst en de percepties gerationaliseerd en de overeengekomen afspraken worden geaccepteerd. Ook laten de resultaten zien dat de ervaring van de ondernemer grote invloed heeft op de percepties van redelijkheid.

## Onderzoeksvraag 4

Organisatieontwerpers moeten de ontwerpkennis uit de ontwerpprincipes en uit het begrijpen van de rol van gepercipieerde redelijkheid integreren in

ontwerpoplossingen. Deze ontwerpers moeten daarvoor bestaande ontwerpkennis aanpassen aan de specifieke context waarbinnen ze ontwerpen. Daarom is vormen de verschillende ontwerpstrategieën die ontwerpers kunnen gebruiken om de ontwerpkennis toe te passen het onderwerp van de volgende deelstudie. Hierbij staat ook de bijdrage van de verschillende strategieën aan de prestaties in het ontwerpproces centraal. Dit leidt tot de volgende onderzoeksvraag:

4.   *Wat zijn de cognitieve ontwerpstrategieën die gevolgd kunnen worden om effectief en efficiënt een organisatie te ontwerpen die het ontstaan en de ontwikkeling van academische spin-offs stimuleert?*

Hoofdstuk 5 integreert het voorafgaande onderzoek naar ontwerpprincipes en de specifieke inzichten over de rol van gepercipieerde redelijkheid in ontwerpinzichten op het niveau van de universiteit. Dit hoofdstuk gebruikt een vergelijkende gevalsstudie over ontwerpprocessen van spin-off ondersteunende organisatieonderdelen op de TU/e, de WUR en UPC. Hier is onderzocht hoe de ontwerpprocessen en de specifieke context interacteren. Belangrijke contextuele karakteristieken zijn de mate waarin organisaties ontleed kunnen worden in verschillende onderdelen (near-decomposability), de hiërarchie van de organisatie en de interacties tussen organisatieontwerpers en externe belanghebbenden. Organisatieontwerpers blijken drie strategieën te gebruiken in het ontwerpproces: 'offline' beredeneren en plannen, leren via terugkoppeling en associatief redeneren door middel van analogieën. De resultaten laten zien dat associatief redeneren de belangrijkste ontwerpstrategie is in een context die gekarakteriseerd kan worden door een hoge mate van 'ontleedbaarheid' en hiërarchie. Hier kan een analogie werken als een sterke visie die ontwerpprincipes kan integreren en de ontwerpoplossingen kan verantwoorden. Ook voorkomt een analogie dat een organisatie opgesloten raakt in de bestaande ideeën. Daarnaast blijkt leren via terugkoppeling noodzakelijk te zijn om een ontwerp te verankeren en zo de levensduur van het ontwerp te garanderen.

## Onderzoeksvraag 5

Het onderwerp van dit proefschrift – het commercialiseren van onderzoek van universiteiten door middel van spin-offs – roept morele vragen op. Als het bijvoorbeeld één van de belangrijkste doelen van de universiteit is om valide kennis te genereren, leidt dan het gebruiken van deze kennis voor economische doelen niet tot een aantasting van de onderzoeksobjectiviteit? Dit leidt tot de laatste onderzoeksvraag, die gaat over de vraag of het goed of fout is dat universiteiten onderzoeksresultaten commercieel benutten:

5. *Hoe kunnen morele problemen rond het creëren van spin-offs worden verminderd?*

In hoofdstuk 6 worden de morele problemen, die voortkomen uit de inspanningen om universitair onderzoek te commercialiseren door middel van spin-offs, verzameld, gestructureerd en geëvalueerd. Ten eerste worden de voordelen en nadelen van het commercialiseren van universitaire onderzoeksresultaten verzameld uit het bestaande onderzoek naar universitaire spin-offs. Dit overzicht laat zien dat spin-off activiteiten drie substantiële voordelen hebben: 1) het benutten van kennis, 2) economische groei en 3) het leren van de andere cultuur. Aan de andere kant zijn er ook drie substantiële nadelen: 1) de mogelijke verandering van onderzoeks-richting, 2) het verminderen van openbaarheid van kennis en 3) het gevaar voor het verlies aan onderzoeksobjectiviteit. Vervolgens zijn deze argumenten geëvalueerd met behulp van deontologische en teleologische ethische theorieën. Deze ethische evaluaties laten verschillende manieren van redeneren zien, die ook verschillende evaluaties van het spin-off-fenomeen opleveren. Gebaseerd op deze ethische evaluaties is een reflectief evenwicht opgesteld dat gebruikt kan worden als morele maatstaf.

Drie nadelen van het creëren van academische spin-offs verdienen de aandacht van zowel beleidsmakers als onderzoekers: de verandering van onderzoeksrichting, het verminderen van openbaarheid van kennis en het verlies aan onderzoeksobjectiviteit. Voor (universitaire) beleidsmakers, onderzoekers en academische ondernemers is het in ieder geval belangrijk dat men op de hoogte is van deze mogelijke nadelen. De verandering van

onderzoeksrichting kan mogelijk worden verminderd door niet alleen de kwaliteit van het onderzoek, maar ook de onderzoeksrichting te belonen. Het verminderen van openbaarheid van kennis is moeilijk op te lossen, maar hier bieden de ontwikkelingen richting 'open wetenschap' de hoop dat de vrije kennisdeling van onderzoeksresultaten mogelijk blijft. De bedreiging van de onderzoeksobjectiviteit kan mogelijk verminderd worden door de transparantie van financieringsstromen te verbeteren en door belangen-conflictprocedures consequent te implementeren en uit te voeren. Eén van de belangrijke ontwerpregels die volgt uit deze resultaten is dat het verstandig is om een 'dubbele' structuur te maken. In deze structuur kunnen fundamenteel onderzoek en universitaire spin-offs zo veel mogelijk gescheiden worden, zowel qua management als fysiek.

## Set van ontwerpprincipes

Nu de verschillende onderzoeksvragen zijn beantwoord kan een verfijnde en gecompleteerde versie van de ontwerpregels uit hoofdstuk 2 samengesteld worden.

Om een organisatie te ontwerpen die het ontstaan en de ontwikkeling van spin-offs bevordert, moeten universiteiten de volgende principes toepassen.

1. Creëer bewustheid van de ondernemerschapsmogelijkheden op heel de universiteit, stimuleer het ontwikkelen van ondernemende ideeën en selecteer vervolgens de ondernemers en ideeën door programma's die gericht zijn op studenten, onderzoekers en docenten.

2. Ondersteun teams van starters in het samenstellen van een team met de juiste mix van ondernemerschapsvaardigheden en –kennis door het bieden van toegang tot advies, coaching en training.

3. Ondersteun starters in het verkrijgen van toegang tot (financiële) middelen en in het ontwikkelen van hun sociale kapitaal door het creëren van een netwerkorganisatie van investeerders, managers en adviseurs.

4. Maak heldere en ondersteunende regels en procedures om spin-off processen te reguleren. Deze regels en procedures moeten:
   a. de gepercipieerde redelijkheid van de relatie bevorderen door:

- verwachtingen te managen, in het bijzonder voor onervaren ondernemers;
- het onderhandelingsproces transparant en zo kort mogelijk te maken;
- richting te geven aan het waarderen van de onderneming in het onderhandelingsproces;
- een exit strategie voor de universiteit te specificeren;

b. morele dilemma's tussen commerciële activiteiten en academische doelstellingen verminderen door:
- niet alleen de kwaliteit, maar ook de richting van onderzoek te belonen;
- 'open wetenschap' te bevorderen;
- de transparantie van financieringsstromen te verhogen;
- procedures over belangenconflicten te formuleren en uit te voeren;
- spin-off processen te scheiden van academisch onderzoek en onderwijs, zowel qua management als fysiek;

c. doorgaande samenwerking tussen de universiteit en de spin-off onderneming ondersteunen.

5. Bevorder een universiteitscultuur die academisch ondernemerschap versterkt door het creëren van normen en voorbeelden die aanzetten tot ondernemerschap.

Ontwerpers moeten de volgende principes tegelijkertijd toepassen om de bovenstaande principes effectief en efficiënt te implementeren in een universiteit.

6. Gebruik de ontwerpstrategie *associatief redeneren* om vanuit de verschillende ontwerpprincipes één samenhangende ontwerpoplossing te ontwikkelen, terwijl intussen de verschillen tussen de geassocieerde situatie met de ontwerpsituatie erkend kunnen worden.

7. Gebruik de ontwerpstrategie *leren via terugkoppeling* om de ontwerpprincipes en –oplossingen (cf. 1-5) aan te passen aan de context en hen te verankeren in de verschillende lagen van de universiteitsorganisatie.

## Theoretische implicaties

Dit onderzoek draagt bij aan de literatuur door bestaand onderzoek over academische spin-offs te integreren en een aantal aspecten te onderzoeken die onderbelicht zijn in de literatuur en die van belang zijn voor het begrijpen van ondernemerschap en organisatieontwerp. Dit onderzoek biedt zowel inzicht in de kant van de universiteit (het organisatieontwerp) als de kant van de ondernemer met betrekking tot het creëren van universitaire spin-offs (redelijkheid). Het onderzoek naar het specifieke vraagstukken van redelijk-heidspercepties, ontwerpstrategieën en morele problemen draagt bij aan specifieke gebieden in de ondernemerschaps- en organisatiekunde literatuur.

Hoofdstuk 2 draagt bij aan de literatuur over organisatieontwerp door een focus op de interactie tussen emergent en gepland ontwerp. In dit hoofdstuk is bestudeerd hoe deze interactie kan dienen om een samenvattende kennisbasis te ontwikkelen die door zowel mensen uit de praktijk als door onderzoekers gebruikt kan worden. Daarnaast draagt dit hoofdstuk bij door de ontwerpwetenschappelijke benadering toe te passen in een context waar dit nog niet eerder gebeurd is, namelijk op het gebied van technologie-commercialisatie en universitair ondernemerschap. De ontwikkelde ontwerp-principes kunnen gebruikt worden als een raamwerk voor het onderzoeken van het creëren van spin-offs op andere universiteiten.

Hoofdstuk 3 draagt bij aan twee delen van de literatuur. Ten eerste dragen de resultaten bij aan de ondernemerschapsliteratuur door het bepalen hoe gepercipieerde redelijkheid door ondernemers tot stand komt, daarbij gebruik makend van zowel bestaande regels als nieuwe, ondernemerschap-specifieke heuristieken. In dit opzicht helpen de geïdentificeerde heuristieken om te begrijpen waarom het samenwerkingsgedrag van ondernemers soms verschilt van wat rationeel van hen verwacht zou kunnen worden. Vervolgens dragen de resultaten ook bij aan de 'organizational justice' literatuur, door het ontstaan van redelijkheidspercepties te verklaren in een ondernemerschapscontext. Negen specifieke heuristieken zijn gevonden die het ontstaan van de perceptie van redelijkheid in een ondernemerschaps-context verklaren, die een aanvulling vormen op bestaande regels over redelijkheid.

Hoofdstuk 4 draagt bij aan het begrijpen van het effect van gepercipieerde redelijkheid van oprichters. Op deze manier wordt de invloed van deze percepties op het ondernemerschapsproces belicht. Verder breidt deze studie de bestaande inzichten uit de 'organizational justice' theorie uit door een dynamisch perspectief op redelijkheidspercepties te bieden.

Hoofdstuk 5 draagt bij aan de innovatie- en ondernemerschapsliteratuur door het onderzoeken van de interactie tussen ontwerpprocessen van organisatieonderdelen voor het stimuleren van ondernemerschap en de complexe context waarin deze ontwerpprocessen plaatsvinden. Ook leveren de resultaten van dit hoofdstuk nieuwe inzichten op voor de literatuur over het ontwerpen van organisaties, door het in kaart brengen van de relaties tussen karakteristieken van de context, het gebruik van ontwerpstrategieën en de bijdrage van deze strategieën aan het succes van de ontwerpprocessen.

Hoofdstuk 6 draagt bij aan het debat over het commercialiseren van onderzoeksresultaten door de voordelen en nadelen ervan in kaart te brengen, te laten zien dat voor sommige van deze voor- en nadelen geen empirisch bewijs is, terwijl anderen wel ondersteund worden door de empirie. Deze ethische evaluatie laat bovendien zien dat verschillende manieren van redeneren resulteren in heel verschillende uitkomsten. De integratie van deze evaluaties in een reflectief evenwicht levert een instrument op om het creëren van spin-offs te evalueren. Daarnaast levert dit overzicht een bijdrage door het specificeren van een aantal onderzoeks-richtingen. In het algemeen worden in de algemene conclusies in Hoofdstuk 7 een aantal richtingen voor toekomstig onderzoek gegeven.

In het algemeen levert dit proefschrift twee belangrijke bijdragen aan de literatuur. Ten eerste combineert het ontwerpwetenschappelijk perspectief een ontwerpperspectief met meer traditionele theorie en methoden, wat een bijdrage aan beide soorten literatuur oplevert. Deze benadering geeft nieuwe inzichten over de interactie tussen sociale wetenschappen en de ontwerppraktijk, zoals de verschillen tussen emergent en meer planmatig ontwerpen. Bovendien is deze aanpak ook toepasbaar in andere situaties, buiten de context van universitaire spin-offs. De procedures en resultaten van de confrontatie en interactie van praktische kennis en wetenschappelijk onderzoek helpen om een samenvattende kennisbasis te creëren.

Ten tweede wordt in deze dissertatie de ontwerpwetenschappelijke benadering, ondersteund door sociaalwetenschappelijke theorieën en methoden, toegepast op academisch ondernemerschap. De samenvattende kennisbasis, zoals onder woorden gebracht in de ontwerpprincipes, vormt een belangrijke stap naar een gemeenschappelijk theoretisch raamwerk over (academisch) ondernemerschap. In dit opzicht levert dit proefschrift een belangrijke bijdrage door een benadering te bieden die de verschillende perspectieven kan combineren. Ook worden de verschillende inzichten samengevat in een set ontwerpprincipes waarin inzichten over de locatie van kansen (de universiteit) geïntegreerd worden met bevindingen over percepties op individueel niveau (redelijkheidspercepties) en individuele karakteristieken (ervaring).

## Praktische implicaties

Dit onderzoek levert een set met ontwerpprincipes op (die hierboven besproken zijn) die de verschillende praktische aanbevelingen samenvatten. Deze ontwerpprincipes geven een aantal basisvoorwaarden aan voor het opbouwen van potentieel voor het creëren van universitaire spin-offs. Ook worden bij deze ontwerpprincipes voorbeelden gegeven van toepassing van deze principes. In de praktijk kunnen mensen die betrokken zijn bij spin-offs deze resultaten gebruiken om in hun specifieke context organisaties te ontwerpen die spin-offs stimuleren en ondersteunen.

De resultaten van dit onderzoek zijn ook nuttig voor academische ondernemers. Zij kunnen hieruit leren over de uitdagingen op het niveau van de universiteit en over specifieke invloeden op individueel niveau die de onderneming beïnvloeden. In het bijzonder ondervaren ondernemers kunnen hieruit leren over de waarde van samenwerking met de universiteit, die waarschijnlijk alle mogelijke problemen en hobbels in deze relatie te boven gaat. Deze ondernemers kunnen uit dit onderzoek opmaken hoe hun perceptie over (on)redelijkheid hen kan aanzetten tot gedrag dat niet in het voordeel van de onderneming is. Wat dit betreft kunnen ook de spin-off adviseurs en andere spin-off professionals van de universiteit kennis nemen van de invloed van hun spreken, hun handelen en wandelen, op (onervaren) academische ondernemers.

# ABOUT THE AUTHOR

Elco van Burg was born on September 5, 1983 in Amstelveen, the Netherlands. After completing secondary school at Calvijn College in Goes (1995-2001), he studied at Eindhoven University of Technology. After his BSc degree, he achieved a cum laude MSc (ir.) degree in Industrial Engineering and Management Science in 2006. Meanwhile he started studying Theology, for which he obtained a BEd degree in 2007 and a MA degree from Utrecht University in 2010. In September 2006, Elco started working as a PhD candidate at the Innovation, Technology Entrepreneurship and Marketing group at the Department of Industrial Engineering and Innovation Sciences of Eindhoven University of Technology. This PhD position was funded by TU/e Innovation Lab, for which Elco was also involved in a couple of European Commission projects. His dissertation research resulted in "Creating spin-off: Designing entrepreneurship conducive universities". Elco has published in *Organization Science*, *Journal of Product Innovation Management* and *Technovation*. Furthermore, he presented his research at the *Academy of Management*, the *European Academy of Management*, the *European Group of Organization Studies Colloquium*, the *Organization Studies Summer Workshop*, the *Triple Helix Conference*, and the *European Conference on Entrepreneurship and Innovation*. His research and involvement in academia have been awarded with the 'Best Paper Award for Innovation Management' of the European Business School and the 'Best Reviewer Award' of the entrepreneurship division of the Academy of Management.

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