

**Creating Spin-Off
Designing Entrepreneurship Conducive Universities**

Elco van Burg

- d. How do the different stakeholders evaluate the outcome of the negotiations? (inventor, financiers, 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 unfold 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

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.