MASTER

Business models for the Entrepreneurial University of the future
the case of the Eindhoven University of Technology

Seerden, M.T.

Award date:
2015

Link to publication
Business models for the
Entrepreneurial University of the future
The case of the Eindhoven University of Technology

By
Michiel T. Seerden

BEng in Industrial Design
Student identity number 0721332

In partial fulfilment of the requirements for the degree of
Master of Science
in Innovation Management

Eindhoven University of Technology (TU/e)
Faculty of Industrial Engineering & Innovation Sciences (IE&IS)
Innovation Technology Entrepreneurship & Marketing Group (ITEM)

Supervisor 1: dr.ir. I.M.M.J. (Isabelle) Reymen, TU/e, IE&IS, ITEM
Supervisor 2: dr. S.A.M. (Sharon) Dolmans, TU/e, IE&IS, ITEM
TU/e School of Industrial Engineering

Series Master Theses Innovation Management

Subject headings: entrepreneurship, corporate entrepreneurship, entrepreneurial university, triple helix, strategy, design science, creativity, innovation, and business model.
ACKNOWLEDGEMENTS

Last year was a year with many highlights from an academic as well as business perspective. I started this thesis while I was developing and managing my start-ups, some start-ups have flourished since the start, with a climax consisting of a lawsuit against the government with one of my start-ups. Simultaneously I enjoyed working on this academic project, especially on the latter part whereby a design-science approach was incorporated to complement my academic with business skills.

These experiences wouldn’t have been possible without a number of people, who I would like to thank here. First of all I would like to express my gratitude and appreciation to all of the people closely involved. I would like to thank Isabelle Reymen for her support and advice, especially regarding guiding me through the process of writing this thesis. I am very grateful in the way you helped me with my quest to write and structure my thesis. Every time I entered and left your office, I stepped over the doorway with a smile. Sharon Dolmans thank you for your feedback and flexibility towards my project. Robert Al a special thanks for your advice and support to tweak and fine-tune my business models.

In addition I would like to express my gratitude and appreciation to all the people who made my time at the TU/e lots of fun! In particular I would like to thank my fellow students, which were always in for a joke while simultaneously also often combined their academic work with their entrepreneurial endeavours. I learned a lot during the Bachelor Industrial Design, minor Entrepreneurship & Innovation, Certificate of Technology Management and Certificate of Technology Entrepreneurship and master Innovation Management. Therefore I would like to thank all employees from the ITEM and Innovation Lab department of the TU/e. In addition I would like to thank the chairman of the board of this university for the use and abuse of the universities services. The least I can do is to thank him.

Last but not least I would like to thank my parents, girlfriend and friends. Thank you for your support and advice while I was pursuing this project. This helped me to complete my academic work while simultaneously chasing my entrepreneurial dream.
MANAGEMENT SUMMARY

This thesis focuses on the development of the concept of the entrepreneurial university in general, and for the Eindhoven University of Technology in specific. The literature on the concept of the entrepreneurial university is limited but emerging. There is in the literature no one-size-fits-all definition of the entrepreneurial university; rather that there is an invaluable plurality of approaches, which are inventive, yet practical, which distinguish the entrepreneurial style (OECD, 2012).

Stimulated by external expectations for economic development and internal pressures to generate new sources of income, universities have been rapidly escalating their involvement to become more entrepreneurial (Mowery et al., 2004). An important driver pushing universities to become more entrepreneurial is that the nature and funding structure of universities is changing. If top universities want to continue carrying out cutting-edge scientific research, universities need to seek alternative funding, as the cost of such research has risen above the budgets that governments can provide (Wissema, 2010). Also, the Eindhoven University of Technology needs to diversify its funding base due to the fact that the Dutch government is not increasing governmental funding towards universities. Hence, future growth must be facilitated in another way (Mengelers, 2015). Therefore, the goal of this thesis is to explore and develop business models for the entrepreneurial university of the future, and for the Eindhoven University of Technology in specific.

By developing new business models, the university’s funding base can be diversified through adding new revenue streams to the existing university funding structure. A business model describes the value an organization offers to various customers and identifies the capabilities and partners required for creating, marketing, and delivering this value and relationship capital, with the goal of generating profitable and sustainable revenue streams (Osterwalder & Pigneur, 2010). Therefore, business models are excellent to explore and develop new revenue streams, in order to diversify the universities funding base. The next sections briefly describe the structure of this thesis including: research method, literature review and analyses, designs, conclusions and managerial implications, and contributions and limitations to further research.
Management summary

Research method

To develop new business models for the Eindhoven University of Technology, a variety of information was required. First, a systematic literature review and research synthesis give an overview of the recent academic and business literature on this topic. In the systematic literature review the concept of the entrepreneurial university is studied and supplemented with theories regarding the concept of corporate entrepreneurship.

Subsequently three case study analyses were conducted. The first analysis regarded case studies of universities on the leading edge of the concept of the entrepreneurial university in the literature; the second looked at case studies from the literature regarding the concept of corporate entrepreneurship. These two analyses resulted in the development of a new set of characteristics typifying the entrepreneurial university. Based on this new set, a third analysis was conducted to benchmark the entrepreneurial characteristics of the Eindhoven University of Technology. Thereafter, a direction toward a general solution was set to develop new business models for entrepreneurial universities, with the goal to diversify the university’s funding base, for the Eindhoven University of Technology in specific.

Designs

During the design process of developing the business models, three design solutions based on the general solution direction were selected and developed in detail. Each design solution was based on an opportunity to valorize whereby a business model was developed to optimize existing or create new revenue streams for the Eindhoven University of Technology. The selected design solutions (i.e. business models), were not aimed at simply commercializing research knowledge (as the valorisation paradigm outlines in the literature), but were instead intended to explore new revenue streams and optimize existing revenue streams. The resulting three designs are as follows: the first design solution was based on optimizing the lifelong learning strategy of universities; the second design solution was about disrupting the way students pay for one the most important products of a university, namely knowledge; and the third design solution was a business model based on a university-wide recruitment platform for companies to attract students.
Conclusion and managerial implications

The literature review and the analyses suggest that most academic literature solely focused on studying the valorisation of knowledge, as the valorisation paradigm outlines, in relation to the concept of the entrepreneurial university. In the literature this is a research gap, since scholars mostly build on the valorisation paradigm to study the concept of the entrepreneurial university.

Accordingly, the Eindhoven University of Technology exhibits the characteristics of an entrepreneurial university; however, most of the exhibited characteristics originate from the university’s third mission and the valorisation paradigm. This agrees with what was found in the literature indicating that: most universities are reported to embrace this concept by first valorising their knowledge. Although a decade ago a strategy like this would be sufficient, the current competitive university environment calls for more than simply adding a department for technology transfer or an incubator for techno-starters (Wissema, 2010). Therefore not only for the Eindhoven University of Technology, but also for other universities, this calls for a new perspective, a new paradigm. To start designing business models for entrepreneurial universities, it is important to remove the ideological and conceptual barriers associated with the entrepreneurial university in the current literature.

In removing such barriers, universities need to broaden their ‘commercialization’ focus to become the entrepreneurial university of the future, beyond the traditional focus of the valorisation paradigm. In order to broaden their ‘commercialization’ focus, university management should understand that with new business models not only knowledge can be valorised, but also other resources are promising candidates, such as the university’s students, employees, data, and property. If university management wants to adhere to this new paradigm of entrepreneurial universities, important is that university management seeks to define their own entrepreneurial path based on existing university capabilities and resources.

To successfully work towards the entrepreneurial university of the future and to implement the proposed design solutions, university management can learn from this study, existing theories and practices regarding the entrepreneurial university and as well as from existing corporate entrepreneurship theories and practices. In general companies already have this broader ‘commercialization focus’, beyond the valorisation of knowledge. In terms of their organization, universities are comparable
Management summary

to businesses; they even operate much like established business (Etzkowitz, 2001). A promising avenue is therefore that if universities want to successfully design and implement new business models to diversify their funding base, they need to learn from the literature regarding both the concept of corporate entrepreneurship and the concept of the entrepreneurial university.

Contributions, limitations, and further research

Overall, this thesis provides an overview of the entrepreneurial university in theory and practice. While a large diversity of literature was consulted to establish a solid theoretical base, three unique contributions to the existing literature were added: (1) the entrepreneurial university literature was compared and supplemented with insight from corporate entrepreneurship; (2) the literature regarding the entrepreneurial university was supplemented with a business-minded perspective to bridge the gap between managerial practice and academic research in this field; and (3) the entrepreneurial characteristics of the Eindhoven University of Technology were benchmarked to develop business models for this university's particular entrepreneurial path. These business models are generic because they are based on resources that most universities can valorise. Therefore, these business models can also be used as a starting point for other entrepreneurial universities to diversify their funding base.

While every effort was made to anticipate possible limitations, the study has the following limitations: findings from corporate entrepreneurship and the entrepreneurial university cannot always be generalized to the business context since studies of corporate entrepreneurship and the entrepreneurial university have a different unit of analysis; universities are comparable to established business, but their organization and key employees differ significantly: how university management actually approaches the strategy regarding the entrepreneurial university remains unknown. Additionally, a major part of the research regarding the Eindhoven University of Technology is based on policy documents and therefore does not necessarily need to correspond with practice. A major part of these limitations originates from the fact that the setup of this study is explorative.

Future research opportunities include empirical research on how university management actually approaches their strategies regarding the entrepreneurial university, including testing of the design solutions and developing an in-depth
business plan for a specific design solutions, while simultaneously establishing a minimal viable product that matches product functionality with actual market needs. In addition, it is important to understand that rather trying to characterize the concept of the entrepreneurial university with reference to an assumed fixed point, we may be in a state of continuous transition with evolving characteristics.
# TABLE OF CONTENTS

1 INTRODUCTION ........................................................................................................... 1

2 RESEARCH METHODOLOGY ....................................................................................... 4
  2.1 Research design ......................................................................................................... 4
  2.2 Systematic literature review and research synthesis .................................................. 5
  2.3 Analysis ...................................................................................................................... 7
  2.4 Design ....................................................................................................................... 8

3 THEORETICAL BACKGROUND ..................................................................................... 9
  3.1 Entrepreneurship ....................................................................................................... 9
  3.2 The entrepreneurial university .................................................................................. 11
  3.3 Corporate entrepreneurship ...................................................................................... 20

4 ANALYSES .................................................................................................................. 26
  4.1 Case studies of the entrepreneurial university ............................................................ 26
  4.2 Case studies of corporate entrepreneurship .................................................................. 32
  4.3 Benchmarking the entrepreneurial characteristics of the TU/e .................................. 35

5 DESIGN ....................................................................................................................... 45
  5.1 General solution direction ......................................................................................... 45
  5.2 Design solutions ........................................................................................................ 48

6 CONCLUSIONS, CONTRIBUTIONS, IMPLICATIONS AND LIMITATIONS ............ 56
  6.1 Conclusions ............................................................................................................... 56
  6.2 Contributions ............................................................................................................ 58
  6.3 Managerial implications ............................................................................................ 59
  6.4 Limitations and further research ............................................................................... 61

7 REFERENCES ............................................................................................................... 63
APPENDICES..................................................................................................................80

Appendix I: Evolution of the concept of entrepreneurship..............................................80

Appendix II: original two functions of the university and its transition towards the triple helix model .....................................................................................................................82

Appendix III: Underlying concepts of the concept of corporate entrepreneurship......84

Appendix IV: The concept of the entrepreneurial university versus the concept of academic entrepreneurship .................................................................87

Appendix V: Clark’s five characteristics of the entrepreneurial university ..............89

Appendix VI: Etzkowitz’s five characteristics of the entrepreneurial university ..........91

Appendix VII: Etzkowitz’s & Leydesdorffs 7 types of universities. .........................92

Appendix VIII: Universities on the leading edge of the concept of the entrepreneurial university .........................................................................................................................93

Appendix IX: Best practices of corporate entrepreneurship ....................................104

Appendix X: Organogram TU/e ....................................................................................114

Appendix XI: An explanation of the most important stakeholders in the entrepreneurial ecosystem of the TU/e .................................................................115
# FIGURES AND TABLES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visual overview of the thesis structure.</td>
</tr>
<tr>
<td>2</td>
<td>Framing the unit of analysis regarding the concept of the entrepreneurial university.</td>
</tr>
<tr>
<td>3</td>
<td>Visualization of the new set of characteristics in the triple helix model.</td>
</tr>
<tr>
<td>4</td>
<td>Initial taxonomy of interrelated phenomena.</td>
</tr>
<tr>
<td>5</td>
<td>Taxonomy of corporate entrepreneurship (Sharma &amp; Chrisman, 1999).</td>
</tr>
<tr>
<td>6</td>
<td>Visualization of design solution 2, visualized using the Board of Innovation framework.</td>
</tr>
<tr>
<td>7</td>
<td>Visualization of design solution 3, visualized using the Board of Innovation framework.</td>
</tr>
<tr>
<td>8</td>
<td>Visualization of design solution 1, visualized using the Board of Innovation framework.</td>
</tr>
<tr>
<td>9</td>
<td>Organogram TU/e.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trends catalysing the entrepreneurial university (Wissema, 2010).</td>
</tr>
<tr>
<td>2</td>
<td>Set of key characteristics regarding the entrepreneurial university.</td>
</tr>
<tr>
<td>3</td>
<td>Overview of the selected universities that are on the leading edge regarding the concept of the entrepreneurial university.</td>
</tr>
<tr>
<td>4</td>
<td>Overview of the selected firms with case studies regarding the concept of corporate entrepreneurship.</td>
</tr>
<tr>
<td>5</td>
<td>Financial overview TU/e. Amounts in millions of euros (TU/e 6, 2014).</td>
</tr>
<tr>
<td>6</td>
<td>Distribution of first, second and third stream. Amounts in millions of euros (TU/e, 2014A).</td>
</tr>
<tr>
<td>7</td>
<td>Visualization of the general solution direction in this thesis.</td>
</tr>
<tr>
<td>8</td>
<td>Clark's five characteristics of the entrepreneurial university.</td>
</tr>
<tr>
<td>9</td>
<td>Etzkowitz's five characteristics of the entrepreneurial university.</td>
</tr>
<tr>
<td>10</td>
<td>Universities on the leading edge of the concept of the entrepreneurial university.</td>
</tr>
<tr>
<td>11</td>
<td>Best practices of corporate entrepreneurship.</td>
</tr>
</tbody>
</table>
Entrepreneurship is nowadays generally recognized as a vital determinant of economic growth. If entrepreneurship is at the root of economic improvement, the implication that ‘we need more of it’ is not difficult to derive (Stevenson & Jarillo-Mossi, 1986). When one thinks of entrepreneurship, one often associates it with business. However, governmental and educational entities can also be entrepreneurial. Etzkowitz et al. (2000) suggested that entrepreneurship has already been creatively extended beyond the sphere of business, into education and government. In the education sphere universities have been rapidly escalating their involvement to become more entrepreneurial (Mowery et al., 2004). In the literature on universities, this phenomenon of universities becoming more entrepreneurial is recognized as the entrepreneurial university, a university that encompasses and extends the research university. There is in the literature no one-size-fits-all definition of the entrepreneurial university, but there is, rather, an invaluable plurality of approaches, inventive and yet practical, which distinguish the entrepreneurial style (OECD, 2012).

Currently, a transformation from the research university to the entrepreneurial university is currently under way (Etzkowitz, 2008). The journey has begun in many universities across Europe and beyond, and is likely to increase in pace in this decade as universities reflect and respond to their changing environments (Hannon et al., 2013). As universities become entrepreneurs they do not give up their previous functions of teaching and researching (Etzkowitz, 2003). Given the current global changes of entrepreneurship, it is unlikely that the government or industry will reduce its pressure on the university sector to engage in its entrepreneurial activity and contribution to the economy (Philpott et al., 2011).

The origin of universities to become more entrepreneurial is often stimulated by external expectations for economic development and internal pressures to generate new sources of income (Mowery et al., 2004). In order to sustain themselves, universities need to change their financial structures and seek to diversify their funding base. If top universities want to continue carrying out cutting-edge scientific research, universities need to seek alternative funding, as the cost of
such research has risen above the budgets that governments can provide (Wissema, 2010).

The Eindhoven University of Technology, in particular, is being driven to become more entrepreneurial by the facts that its nature and funding base are changing. Therefore the mission of this thesis is to explore and develop business models for the entrepreneurial university of the future, and for the Eindhoven University of Technology in specific. These business models are to help the university to become more entrepreneurial and to diversify its funding base.

To be able to answer the research question, five research sub-questions are formulated as the basis of analysis in this thesis. In addition literature regarding both entrepreneurial universities and corporate entrepreneurship will be studied. The latter widens the scope of the design solutions beyond the traditional focus concerning the knowledge-valorisation paradigm, in order to broaden the ‘commercialization’ focus in this study.

1. **What is the current state of the concept of the entrepreneurial university in theory and practice?** The answer to this sub-question can be found in Chapters 3.2 and 4.1.
2. **Which specific characteristics define entrepreneurial universities?** The answer to this sub-question can be found in Chapter 3.2.4 and 3.2.5.
3. **Which concepts of corporate entrepreneurship are relevant to the concept of the entrepreneurial university?** The answer to this sub-question can be found in Chapter 3.3 and 3.4
4. **How is the Eindhoven University of Technology funded?** The answer to this sub-question can be found in Chapter 4.3.6.
5. **To what extent does the Eindhoven University of Technology exhibit the characteristics of an entrepreneurial university?** The answer to this sub-question can be found in Chapter 4.3.9

To be able to design additional successful business models for the Eindhoven University of Technology, the analysis had to be broad, comprehensive, and to-the-point. The analysis was to be followed by design solutions exploring new business opportunities, specifically for the Eindhoven University of Technology. Three design solutions were selected and developed in detail. Subsequently, a sub-question was formulated specifically for the design solutions:
6. Which business models are specifically interesting for the Eindhoven University of Technology in order to develop a diversified funding base?

The answer to this sub-question can be found in Chapter 5.2.

This study provides the Eindhoven University of Technology a framework to explore new business opportunities. This thesis project takes a science-based design approach, conducting a systematic literature review and research synthesis resulting in three specific design solutions. Conclusions, implications and limitations are described in the Chapter 6. A visual overview of the structure of the thesis can be found in Figure 1.

**Subtopics**

1. Introduction to the thesis, purpose of the research, theoretical and practical relevance of the research, research questions, and overview of the thesis.

2. Research design, systematic literature review, research synthesis, and analysis design.

3. Introduction to entrepreneurship, entrepreneurial university, and corporate entrepreneurship.

4. Entrepreneurial university in practice, corporate entrepreneurship in practice, concepts of corporate entrepreneurship that are relevant for the concept of the entrepreneurial university, and entrepreneurial characteristics of the TU/e.

5. Introduction to design theory, general solution direction, and three design solutions.

6. Conclusions, contributions, managerial implications, and limitations for future research.

*Figure 1: Visual overview of the thesis structure.*
2 RESEARCH METHODOLOGY

2.1 Research design

A significant part of the knowledge produced by research at universities should not only clear the hurdle of academic rigor but also that of relevance. Research needs to be relevant for the world of management and business, and students may expect that they can use their knowledge in their career outside academia (Van Aken, 2007). Van Aken (2004) argues that academic management research has a serious utilization problem. The mainstream research in this field tends to be description-driven, based on the paradigm of the explanatory sciences. He argues, therefore, that the relevance problem can be mitigated if such research could be complemented with prescription-driven research, based on the paradigm of the ‘design sciences’, like Medicine and Engineering, and resulting in what may be called ‘management theory’. The relevance of the products of academic management research may be improved if it would also include prescriptive or solution-oriented knowledge. Therefore the design of the research builds on the idea, proposed by Simon (1996), that organization and management research is a science of design.

In this thesis, by implementing a science-based design research methodology, research was connected to practice by contextualizing research findings via design solutions (Van Burg et al., 2008). It basically connects the body of scientific knowledge to the pragmatic, action-oriented knowledge of practitioners (Van den burg et al., 2008). Therefore throughout this study a science-based design approach is followed whereby the focus was to explore business models to diversify the university’s funding base.

Next this study is based on exploratory research; therefore this study is a valuable means of figuring out ‘what is happening; to seek new insights; to ask questions and to assess phenomena in a new light’ (Robson, 2002). This kind of research design was chosen because entrepreneurship is a rather new arena for the unit of analysis: the Eindhoven University of Technology. Overall, the design of the research is based on what is and explores what can be, and in the latter part of this study the research is connected to practice by contextualizing research findings via design solutions.
2.2 Systematic literature review and research synthesis

Unless the literature review is thorough and fair, it is of little scientific value. For this reason, this literature review will synthesize recent existing work that is seen to be fair (Kitchenham, 2004). Already existing work does not have well-established answers to the identified research questions, so creating a solid theoretical base in advance was vital. At the same time this theoretical base was the starting point to figuring out ‘what is happening’ in order to find new insights.

The first part of the thesis consists of a systematic literature review. The academic literature regarding entrepreneurship, the entrepreneurial university, and corporate entrepreneurship was studied. In addition, desk research was conducted to find other relevant archival information. Overall, a wide variety of topics was present, meaning that the literature had to be reviewed in a systematic manner. Relevant search terms were selected and consisted, among others, of the following: entrepreneurship, entrepreneurship theory, entrepreneurial spirit, entrepreneurial ecosystem, corporate entrepreneurship, entrepreneurial organization, entrepreneurship corporations, innovation in entrepreneurship, entrepreneurship success, intrapreneurship, paradigm entrepreneurship, corporate venturing, strategic renewal, ambidextrous organizations, spin-off, disembodied experimentation, hybrid faculty, lean venturing, entrepreneurial economy, engineering entrepreneurship, entrepreneurial university, emergence entrepreneurial university, academic entrepreneurship, university history, university of the future, entrepreneurial university case study, entrepreneurial university practice, corporate entrepreneurship case study, corporate entrepreneurship practice, triple helix model, entrepreneurial university cases, entrepreneurship university, university finances, university revenue streams, third stream university, funding universities, business models, design science, design science theory, design science methodology, design solution, axiomatic design. In addition, many combinations of the above terms were searched to explore and gain new insights into the matter.

To dig deeper into certain topics, a more focused literature review was conducted by implementing operators in the search strings. In addition, the search technique of digital browsing was used to effectively select potentially interesting articles based on their relevance. In general, the above terms resulted in a broad variety of articles. If a small amount of only moderately relevant articles was found, synonyms and other constructs were used to substitute terms. If this still resulted in
irrelevant articles, the chaining or snowballing technique was used to track down potentially interesting references.

To perform the literature search, Google Scholar was used as the primary retrieval system, and JSTOR and Web of Science were used as secondary and tertiary retrieval systems to select the most influential publications. To select the papers with the most topical information, the publication date, sector, number of citations, impact factor, and journal rankings were taken into account. Each article was put into the digital reference manager Mendeley to make the articles easily accessible and to keep the overview during the study. Recent literature was used by looking to the publication dates. Apart from the perceived relevance, the quality of the articles was taken into account by looking into the highest individual citation score and papers published in journals with a high Journal Impact Factor (2010). The most influential selected journals were the *Academy of Management Review* (6.720), *Academy of Management Journal* (5.250), *Journal of International Business Studies* (4.184), *Journal of Finance* (4.151), *Journal of Management Studies* (3.817), *Organization Science* (3.800), *Journal of Management* (3.747), *Administrative Science Quarterly* (3.684), *Strategic Management Journal* (3.583), *Technovation* (2.993) and *Research Policy* (2.508). Again, in addition, the snowballing technique was used to find more relevant publications. Overall, the literature search was not sequential, but involved many stages of iteration to improve the search results in order to use the most recent and relevant articles.

The main aim of the systematic literature review and the research synthesis was to give an answer to the first three sub-questions: to answer what the current state of the concept of the entrepreneurial university is (sub-question 1), to answer which specific characteristics entrepreneurial universities exhibit (sub-question 2), and to answer which concepts of corporate entrepreneurship are relevant to the concept of the entrepreneurial university (sub-question 3).

Interestingly, the systematic literature review resulted in the development of a new set of characteristics for the concept of the entrepreneurial university. The analyses were conducted based on this new set. Another interesting finding was that during the literature review, I noticed a fair amount of conflicting and contradictory research outcomes; therefore I made every effort to identify and report research that does not support these views, as well as to identify and report research that does (Kitchenham, 2004).
2.3 Analysis

In order to explore and develop business models for the entrepreneurial university of the future, a variety of information was required to supplement the literature. The aim of the analysis was to explore and not to define into great detail. Overall, the analysis consisted of several sequential steps to create a solid base on which to design business models for the Eindhoven University of Technology. To create this base and to setup a systematic approach, three sequential analyses were conducted.

The first analysis was concerned about case studies in the literature. These case studies looked at universities on the leading of the concept of the entrepreneurial university in practice. The aim of this analysis was to supplement the literature with insights from practice and seek an answer to sub-question 2 (given in Chapter 3.2.4 and 3.2.5). In addition, this analysis was conducted to get a better grip on the plurality of inventive and practical approaches that distinguish the entrepreneurial style of entrepreneurial universities (OECD, 2012). Another goal of the first analysis was to explore business models implemented by these entrepreneurial universities and whether new characterizations, other than the seven core characterizations from the new set, would be observed in practice.

The second analysis was conducted on case studies in the literature regarding the concept of corporate entrepreneurship. The aim of this analysis was to answer which findings of corporate entrepreneurship are relevant to the concept of the entrepreneurial university (this supplements the answer of sub-question 3 with findings from practice). In addition, this analysis was undertaken to help develop design solutions beyond the traditional academic focus of the knowledge-valorisation paradigm.

The third analysis was conducted to catalogue the entrepreneurial characteristics of the Eindhoven University of Technology. The aim of this analysis was to find out how this university is currently funded (sub-question 4) and to answer to what extent the Eindhoven University of Technology exhibits the characteristics of an entrepreneurial university (sub-question 5). Therefore, an analysis was conducted to determine the entrepreneurial characteristics of the TU/e, based on policy documents of the university’s current and future context. As a guiding framework, the new set of characteristics of the concept of the entrepreneurial university was used to analyse to what extent this university exhibits the characteristics of an entrepreneurial university.
2.4 Design

Design knowledge is used to create what should be: things that do not yet exist. It is the activity of transforming an existing situation into a desired one (Simon, 1996). Everyone is designing on a daily basis, designing solutions to the minor or major problems of everyday life. Design thinking is a discipline that uses the designer’s sensibility and methods to match people’s needs with what is technologically feasible and with a viable business strategy that can create customer value and market opportunity (Brown, 2008). In addition, design activities are performed to know and understand user needs, define the problem to satisfy customer needs, conceptualize a solution through synthesis, and perform an analysis to optimize the proposed solution (Suh, 2001). A design is the interface between the immaterial domain of thinking and communicating, on one hand, and the domain of material and social reality, on the other (Van Aken, 2007). The design process working towards a successfully implemented solution, even in the last stage of this cycle, is both iterative and open. In order to structure this design process and to diminish its fuzziness from the start, a science-based design approach helped to develop successful designs.

Based on the analyses and the systematic literature review, direction for a general solution was set. Throughout the research conducted in this study, it was interesting that the business models which emerged were not based on the avenues academics described in literature as they proposed to align with the knowledge valorisation paradigm. Instead, business models emerged based on utilizing resources other than knowledge: for example, making use of the university’s employees, students, and data. Therefore the selected design solutions were not based upon commercializing research knowledge (as the valorisation paradigm outlines). Due to this impetus, the majority of design solutions are based upon diversifying the university’s funding base by exploring new revenue streams and optimizing existing revenue streams. This is also in line with the goal of this thesis, to specify business models that are specifically interesting for the Eindhoven University of Technology in order to develop a diversified funding base (sub-question 6).
3 THEORETICAL BACKGROUND

Since the goal of this thesis is to develop a business model to diversify the university’s funding base, a definition is needed of a business model. Since the thesis is in itself an extensive study to highlight the most important literature concerning business models, it is out of the thesis’s scope to extensively elaborate on this concept into detail. However, to get sufficient understanding of a business model, the following definition is used throughout: a business model describes the value an organization offers to various customers and portrays the capabilities and partners required for creating, marketing, and delivering this value and relationship capital with the goal of generating profitable and sustainable revenue streams (Osterwalder & Pigneur, 2010). To visualize the business model the Board of Innovation Network was used (Board of Innovation, 2015). This tool was chosen to visualize the concept primarily because of the tool’s focus on business-model innovation, and, in specific, regarding its emphasis on service design and new monetization strategies.

To fully understand and explore the concept of the entrepreneurial university, the concept of entrepreneurship is first elaborated upon to understand what we are talking about when stating that an entity is entrepreneurial. This elaboration is followed by a section concerning the concept of the entrepreneurial university, in which the current state of this concept in theory is studied. In the literature, there is no one-size-fits-all definition of the entrepreneurial university, but rather a plurality of approaches distinguishing the entrepreneurial style (OECD, 2012). In addition, literature regarding corporate entrepreneurship is studied. This type of literature might help to develop design solutions beyond the traditional focus of the knowledge valorisation paradigm.

3.1 Entrepreneurship

Entrepreneurship is currently getting hype in the research literature, and scholars are gaining insight into particular aspects of entrepreneurial decisions and activities and its importance for economic growth. However, scholars do not have a clear overarching overview of this phenomenon. Overall, the academic field of entrepreneurship research is a vibrant and rich field, shaped by many different
Theoretical background

research questions, approaches, and methods. Such richness is perhaps also the greatest obstacle to the further development of the field in the literature (Norn et al., 2011). Please read Appendix I: ‘Evolution of the concept of entrepreneurship’ to fully understand the concept from a twentieth century perspective and how it currently expresses itself. This appendix starts by elaborating on the origin of the concept and how this phenomenon evolved over time to its current state.

As there is no single definition of entrepreneurship, which reflects the fact that it is a multi-dimensional concept (Gartner, 1990). In addition, there is a large and ever-growing number of studies that each shed a small ray of light on the vast, multi-faceted and highly complex social and economic phenomenon of entrepreneurship (Norn et al., 2011). Out of these individual perspectives, Gartner (1990) authored an important academic study on the definition of entrepreneurship that explored the underlying meanings for academics and entrepreneurs. His work resulted in a set of eight factors. The most important attributes were value creation, organization, innovation and the acquisition of resources. Interestingly, Gartner (1990) was the first who noted that scholars must define the concept of entrepreneurship more specifically, because the concept of entrepreneurship had many different meanings attached to it. However Gartner (1990) did not create a final definition of entrepreneurship, stating that no single definition of entrepreneurship needs to emerge, because if a single definition could be found it would be so simple that it would fail to reflect the thing it purports to define.

While various themes of entrepreneurship can reflect different parts of the same phenomenon (Gartner, 1990), it is important in this study to take one single definition of this concept that captures the essence of entrepreneurship by integrating the most important themes Gartner (1990) selected. A single definition is needed to get grip on the concept of entrepreneurship and its underlying concepts, which are elaborated in the coming sections. Therefore the following definition of entrepreneurship is used throughout this report: ‘the process of creating value by bringing together a unique combination of resources to exploit an opportunity’ (Stevenson & Jarillo-Mossi, 1986).
3.2 The entrepreneurial university

At the start of studying the concept of the entrepreneurial university in literature, the literature regarding this concept indicated that most universities are reported to embrace this concept by first valorising their knowledge. In the literature this is a research gap, since scholars mostly build on the valorisation paradigm to study the concept of the entrepreneurial university. However not only knowledge could be valorised, but also other resources could be valorized such as the university’s students, employees, data, and property with new business models. In order to develop new viable business models, specific information is needed about how a university currently generates income. Therefore this section starts with explaining the unit of analysis when studying the concept of the entrepreneurial university and is followed by a section whereby an explanation is given of different existing university income streams to develop an initial understanding how the university generates income. Hereafter the definition of this concept and its current state in literature is studied.

3.2.1 Unit of analysis

If entrepreneurship is at the root of economic improvement, the implication that ‘we need more of it’ is not difficult to draw (Stevenson & Jarillo-Mossi, 1986). When one thinks of entrepreneurship, one often associates it with business. However also governmental and educational entities can become more entrepreneurial. Etzkowitz et al (2000) suggested that entrepreneurship is already been creatively extended beyond the sphere of business, into education and government. In the education sphere universities have been rapidly escalating their involvement to become more entrepreneurial (Mowery et al., 2004).

To develop a clear initial understanding regarding this concept, it is vital to state what entity or stakeholder is actually becoming entrepreneurial. Importantly, the literature regarding the entrepreneurial university studies the university as an entity itself and therefore the focus is neither on the university’s environment nor on entrepreneurial academia. This angle entails that in this chapter the main focus is neither on the relationships between university, government, and industry (Etzkowitz & Leydesdorff, 1997 & 1998; Etzkowitz, 2001 & 2003) nor on the development of entrepreneurial academics (please read Appendix IV for more about the concept of academic entrepreneurship versus the concept of the entrepreneurial university).
Theoretical background

Instead the university itself is the unit of analysis (see Figure 2 for a visualization of the unit of analysis when studying the concept of the entrepreneurial university).

![Figure 2: Framing the unit of analysis regarding the concept of the entrepreneurial university.](image)

To get an understanding how the unit of analysis evolved over the past century, please read Appendix II. Appendix II elaborates upon the original two functions of the university, how the university made the transition towards the triple helix model, and how it eventually made the transition to its current format: the entrepreneurial university. Overall, the entrepreneurial academic format is being fashioned from a variety of historic university systems to meet the widespread need for the generation of new firms to stimulate employment and productivity growth (Etzkowitz, 2002). The original model of the university (a teaching and research institution) has transitioned to a model in which research results are routinely scrutinized for commercial as well as scientific potential. This journey has begun in many universities across Europe and beyond, and is likely to increase in pace in this decade as universities reflect and respond to their changing environments (Hannon et al., 2013).

Wissema (2010) argues that the emergence of the entrepreneurial university is the result of nine trends. He states that these trends are catalysing the transition
towards the entrepreneurial university. Please see Table 1 to find out which nine trends are catalysing the transition towards the entrepreneurial university.

<table>
<thead>
<tr>
<th>#</th>
<th>Trends towards the entrepreneurial university (Wissema, 2010).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The pressures on quality that are the result of a massive influx of students since the 1960s.</td>
</tr>
<tr>
<td>2</td>
<td>The impossibility to govern universities in the traditional way as a result of the increase in student numbers and the resulting strong intertwining with government departments.</td>
</tr>
<tr>
<td>3</td>
<td>Globalisation, which also affects universities and leads to competition on three fronts: students, academics and research contracts.</td>
</tr>
<tr>
<td>4</td>
<td>The rise of interdisciplinary research and the resulting frictions with the faculty organization.</td>
</tr>
<tr>
<td>5</td>
<td>The increased cost of cutting-edge research.</td>
</tr>
<tr>
<td>6</td>
<td>The challenges offered by the establishment of specialized top research institutes outside the universities.</td>
</tr>
<tr>
<td>7</td>
<td>Government demands that universities play a role in technology-based economic growth in the knowledge-based economy.</td>
</tr>
<tr>
<td>8</td>
<td>The opening up of corporate research and the opportunities offered by collaboration with industry as a consequence.</td>
</tr>
<tr>
<td>9</td>
<td>The rise of academic entrepreneurship, kicked off by the university-driven IT companies in the US.</td>
</tr>
</tbody>
</table>

*Table 1: Trends catalysing the entrepreneurial university (Wissema, 2010).*

### 3.2.2 Explanation on university income streams

As mentioned in the introduction of this thesis, an important impetus for universities to become more entrepreneurial is that they are often stimulated by external expectations for economic development and internal pressures to generate new sources of income (Mowery et al., 2004). Therefore in this section, light is shed on
Theoretical background

the different income streams of universities. Based on changes in these streams, the universities generally must become more entrepreneurial.

Initially, the two traditional principal functions of universities were to teach and to research. From both functions universities receive income, often from government. The income stream flowing in from these functions are the so-called first and second streams. The first stream comes from funds regarding institutional support from government and the second stream from funds regarding governmental research. However, as can be concluded from the previous chapters, universities have a third mission based on the commercialization of research, which generates the so-called third stream amongst other things. These third-stream activities are therefore concerned with the generation, use, application, and exploitation of knowledge and other university capabilities outside academic environments. Overall, the third stream is about the interactions between universities and the rest of society (Molas-Gallart et al., 2002). Notably, entrepreneurial universities will be financed in the near future by output financing, rather than input financing (Wissema, 2010). Input financing concerns the creation of capacity, which is then combined with a government inspection system, whereas output financing means that research grants are tendered, any university can participate, and only the best offers will win (Wissema, 2010).

3.2.3 Towards a definition of the entrepreneurial university

In the previous sections, light is shed on how the format of the university evolved over time, as well as why it evolved over time in the way it did, and an elaboration was given concerning university income streams. Based on this knowledge, facilitates our understanding of the current state of the entrepreneurial university in theory.

The literature on the concept of the entrepreneurial university is limited but emerging. Especially limited are the university models, conceptualizations, and frameworks (Guerrero & Urbano, 2010). Since Clark (1998) used this term in his work, several scholars (Sporn, 2001; Kirby, 2005; Rothaermel et al., 2007) have used the term, while others have proposed alternative terminology such as the third-generation university (Wissema, 2009). In the literature, definitions of the concept of the entrepreneurial university are diverse and ambiguous (Kirby et al., 2011). Significant differences in the meaning and scope of the term arise from the literature,
Theoretical background

depending on the context and specificity of the cases studied and the discourse of the researchers (Blenker et al., 2008).

The Organization for Economic Co-operation and Development (OECD, 2012) did an interesting and comprehensive study in collaboration with the European Commission, creating a guiding framework for entrepreneurial universities. One of its conclusions is that no single definition can be developed to work across European higher education institutions because it is difficult and controversial. The OECD stresses that there are several attempts to define the entrepreneurial university in the literature, but none of them reach consensus. Overall, no one-size-fits-all definition was found in the literature to define the concept of the entrepreneurial university, but rather a plurality of inventive and creative approaches distinguish the entrepreneurial style (OECD, 2012).

3.2.4 Tensions of the entrepreneurial university

One of the central tensions in the emerging discourse about entrepreneurial universities is between those who see research as a public good and those who focus only on the need to integrate university-based knowledge production with the rest of the economy. This tension is particularly strong in university cultures where public money is still the largest source of funding (Jacob et al., 2003). In the academic field, some researchers see this phenomenon as a deformation of the purpose of the research university (Slaughter and Leslie, 1997) or some see the entrepreneurial paradigm as a threat to the traditional integrity of the university (Pelikan, 1992). Other critics have responded by stating the potentially detrimental effects of ‘entrepreneurial science’ on the long-term production of scientific knowledge by voicing fears that academic science can be instrumentalised and even manipulated by industry (D’este et al., 2010). Others, like Brooks (1993), believe that this entrepreneurial form should be encapsulated in a special class of institutions of higher learning.

As Kuhn (1962) stated: there is no smooth path for any paradigm change. The shift of the university system from an ivory tower focusing on the traditional roles of research and teaching into a collective entrepreneurial source of technology is no exception, and, unsurprisingly, many academics are attempting to resolve the conflicts that arise as universities become more entrepreneurial (Del Campo et al.,
Theoretical background

Leading up to this section the theoretical background regarding the concept of the entrepreneurial university was explored. Because there is no one-size-fits-all definition of the entrepreneurial university, a deeper understanding of this concept can best be gained by studying its characteristics. Such study suggests that most of the recent literature is based on the earlier studies of Etzkowitz and Clark. Both authors were at the very heart of the creation of this concept in the literature and, as such, have published many of the most cited articles in authoritative journals regarding this concept. Their work has defined the core characteristics of this concept. However, neither author developed a clear list of characteristics, but instead published a wide range of articles. Often, each article was based on a selection of characteristics. The most important, most cited, well-elaborated and clearly deepened characteristics identified in these articles are summarized and studied in detail in the following section. These characteristics serve as a starting point to develop thoughts and to organize ideas towards the concept of the entrepreneurial university and are later deployed in the analysis and design chapter.

3.2.5 Characteristics of the entrepreneurial university

Burton Clark, perhaps the most influential writer in this field, identified five characteristics of entrepreneurial behaviour in his 1990s case studies of various university transformations. Clark's study on entrepreneurial universities was aimed at identifying recurring elements among the cases, and therefore his methodology was intended to identify empirical regularities among the five organizations that he researched (Bronstein & Reihlen, 2014). His five-element approach has become the benchmark and point of reference in the entrepreneurial-university literature over the past two decades (Bratianu and Stanciu, 2010).

While Clark (1998) is perhaps the most influential writer in this field and received notable support from early authors on this topic, like Shattock (2000) and Van Vught (1999), his work regarding these characterizations is not universally accepted (Woollard et al., 2007) and the depth of his research has been criticized (Finlay, 2004; Woollard et al., 2007). According to Woollard et al. (2007) this critique stems from the fact that Clark's sample institutions were small and developed their
entrepreneurial characteristics in a considerably less competitive environment than that which institutions face today. Despite the fact that Clark's (1998) samples can be questioned in the present decade, they can still be used as a starting point to develop a coherent set of characteristics typifying the entrepreneurial university.

Please read Appendix V to know which five characteristics Clark identified of the entrepreneurial university. In the coming sections Clark's five characteristics are identified as C1 – C5.

3.2.5.2 Etzkowitz's characteristics of the entrepreneurial university


3.2.6 Combining Clarks and Etzkowitz’s work

From the literature of these two influential authors, it is concluded that while some characteristics regarding this concept do overlap, most differ. A comparison of the characteristics identified between these two authors outlines these differences: Etzkowitz’s characteristics (E1 – E5) are clearly based upon his earlier work concerning the triple helix model. In addition, he gives, overall, more abstract characterizations, again often concerning the closer relationships between university, government, and industry. Therefore Etzkowitz’s propositions are more useful on an organizational or policy level in relation to industry and government. On the other hand, Clark proposes five characteristics (C1 – C5) that go beyond the triple helix model. Only the first characteristic (C1, the ‘expanded developmental periphery’) is concerned with the university’s relationship with industry and government. The latter four characteristics (C2 – C5) are instead about the internal environment of universities. These characteristics differ significantly from Etzkowitz’s characteristics, and therefore cannot be combined or aggregated to create a new set of overarching characteristics.
Theoretical background

The one and only set of characteristics that matches to some degree between both authors’ works are Etzkowitz’s characteristic of ‘expanded developmental periphery’ (C1) and Clark’s characteristic of ‘capitalization of knowledge’ (E1). Clark describes in this characteristic important elements of the third mission, whereby he sheds light on the knowledge valorisation paradigm. This relates directly to Etzkowitz’s theoretical base concerning the closer relationships between the university, government, and industry (triple helix model). Since Etzkowitz’s second (E2), third (E3) and fourth (E4) characteristics are strongly connected to the triple helix model, I propose to merge these three characteristics into one characteristic because they are about the hybridization, independence, and interdependence of the relationships in the triple helix model.

The characteristics of these two authors were plotted in a table to develop an encompassing new set of characteristics to describe the concept’s core. The core characteristics are framed in Table 2. The first column is the identifier of the new characteristic; the second column describes the key characteristic (supplemented with the number of the specific characteristic proposed by Etzkowitz or Clark).

<table>
<thead>
<tr>
<th>#</th>
<th>Core characteristic</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>A focus on the capitalization of knowledge, e.g. by expanding the developmental periphery (C1 + E1). Aimed at the realization of the university’s third mission.</td>
<td>(Etzkowitz, 2000, 2004, 2010; Clark 1998)</td>
</tr>
<tr>
<td>S2</td>
<td>A hybrid form of managing the tension between the interdependence (E2) and independence (E3) relationships with industry and government. This requires that the resolution of the tensions between the principles of interdependence and dependence are an impetus for the creation of hybrid organizational formats to realize both objectives simultaneously (E4).</td>
<td>(Etzkowitz, 2000, 2004)</td>
</tr>
<tr>
<td>S3</td>
<td>A university embodying reflexivity. This involves continuous renewal of internal structures (E5) based on governmental or industrial changes.</td>
<td>(Etzkowitz, 2004)</td>
</tr>
<tr>
<td>S4</td>
<td>A diversified funding base (C2).</td>
<td>(Clark, 1998)</td>
</tr>
</tbody>
</table>
### Theoretical background

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S5</strong></td>
<td>A strengthened steering core with decision-making authority and autonomy, professional and accountable (C3).</td>
<td>(Clark, 1998)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S6</strong></td>
<td>A stimulated academic heartland, purposeful scholarly work is recognized, encouraged and innovative, collaborative research is pursued and remunerated according to its relevance (C4).</td>
<td>(Clark, 1998)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S7</strong></td>
<td>An integrated entrepreneurial culture. This is represented by a strong set of beliefs, principles and consistent practices, all of which ought not to be treated independently of structures and procedures through which they are expressed, thus an institutional perspective is required (C5).</td>
<td>(Clark, 1998)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2**: Set of key characteristics regarding the entrepreneurial university.

The seven characteristics of Table 2 are mapped in Figure 3 to gain insight into their position in the triple helix model.

**Figure 3**: Visualization of the new set of characteristics in the triple helix model.
3.2.7 Future types of universities

Universities have always managed to adapt to their changing environment and to new competition, perhaps by shifting the emphasis between their functions, perhaps by embracing new functions and occasionally even forming new species (Etzkowitz et al., 2000). In this light, Etzkowitz et al. (2000) challenged himself to develop definitions of future types of universities. Please read Appendix VII to gain insight into which seven types of universities will emerge in the future, according to these authors (including the entrepreneurial university).

More interesting is that in the same paper he also describes three variants of the entrepreneurial university in more detail: the transitional entrepreneurial university, the full-fledged entrepreneurial university, and the entrepreneurial university as an extension of the science park (Etzkowitz, 2003). The transitional entrepreneurial university is a transitional phase from the research university. The transitional entrepreneurial university continues to operate with problem formulation and research goals as an internal process that takes place within specific disciplines and academic research groups. Making it different from other universities, in this variant specific economically and socially useful results are taken into account, and specific steps are taken to see that they are used (Etzkowitz, 2003). The full-fledged entrepreneurial university is a university that exhibits the characteristic that problem definition comes from outside sources as well as from within the university and scientific disciplines. This type of university takes the initiative to put knowledge to use (Etzkowitz, 2003). The entrepreneurial university as an extension of the science park is a new kind of entrepreneurial university that is organized on the base of a science park, research institute, or group of firms. These universities have begun as an extension of a firm or research institute. In this model, economic activity precedes the development of academic work, which is then built and closely tied to its originating source. Eventually, academic activities may grow into a full-fledged entrepreneurial university (Etzkowitz, 2003).

3.3 Corporate entrepreneurship

Etzkowitz (2001) concluded that universities operate as firm-like entities. Universities do not operate like start-ups or other forms of new businesses; instead they operate much like established businesses. Like businesses, universities focus on value creation, exploitation of existing capabilities, and operating excellence (Mason &
Rohner, 2002). In addition, the internal organization of a research university consists of a series of research groups that have firm-like qualities, especially under conditions in which research funding is awarded (Etzkowitz, 2003). A promising venue is that universities can learn not only from the concept of the entrepreneurial university to become more entrepreneurial, but also from the literature regarding the concept of corporate entrepreneurship. In this light, corporate entrepreneurship literature is studied in the upcoming sections, with particular emphasis on how firms become entrepreneurial by creating value based on resources inside the organization.

The parallel between the concept of corporate entrepreneurship and the entrepreneurial university has not yet been studied in the literature. One would expect scholars to have studied the linkages between those two concepts because both study comparable entities that become entrepreneurial. Nevertheless, I found no literature linking both concepts in my literature review.

3.3.1 Defining corporate entrepreneurship

The introduction of this chapter highlights the concept of entrepreneurship. From an academic perspective, scholars believed that the main traits to be generally associated with entrepreneurship were also desirable traits for large corporations (Stevenson & Jarilli, 1990). This association created the start of the academic corporate entrepreneurship field. Nowadays, corporate entrepreneurship has emerged as an important subfield in the field of entrepreneurship (Schildt et al., 2005). During the 1980s, the emergence of corporate entrepreneurship was a centrepiece in organizational efforts aimed at enhancing product innovativeness, risk-taking, and proactive responses to environmental changes (Covin & Slevin, 1991). Increasingly, it is recognized that these entrepreneurial activities are not confined to the domain of small firms or start-ups but that entrepreneurship is also taking place in larger and better-established firms (Schildt, 2005). Corporate entrepreneurship initiatives allow the firm to learn about new technologies (Mowery, Oxley, & Silverman, 1996; Stuart & Podolny, 1996), new markets (Keil, 2002; Barkema & Vermeulen, 1998;), and new ways to operate (Ahuja & Lampert, 2001; Birkinshaw, 1997; Stuart, 2000). These activities are critical for the long-term survival and competitiveness of firms.
Zahra (1996) also stated that corporate entrepreneurship is important for organizational survival and renewal. This is essential to ensure corporate profitability and growth by enhancing a firm’s innovation, redefining its business concept, and renewing its operations. Brazeal (1993) even argues that if innovation is to be pursued as a long-term strategic move for prosperity, rather than a survival tactic in troublesome times, an alternative focus is needed. Energies should be redirected toward responsibilities involving the overall corporate system rather than limiting efforts to venture initiation activities (Brazeal, 1993).

As firms embrace the concept of corporate entrepreneurship, it creates paradoxical challenges within established organizations. Whereas the search for new opportunities requires experimentation, flexibility, and divergent thinking, exploitation of existing operations is generally associated with efficiency, refinement, and focus. Combining both types of activities within the same system, therefore, leads to the presence of multiple and often-conflicting goals, and poses considerable challenges to established organizations (Janssen, 2011). To define the concept of corporate entrepreneurship, the next section of this chapter determines the taxonomy of the different parts of this concept.

3.3.2 Corporate entrepreneurship taxonomy

3.3.2.1 Initial taxonomy of interrelated phenomena

Guth and Ginsberg (1990) stated that ‘strategic management research that contributes to increasing the frequency and success of corporate entrepreneurship will, in our view, be highly valued in the academic and practitioner communities.’ Many authors have since continued to highlight the importance of corporate entrepreneurship and tried to further define the concept. To create a clear understanding of this concept, a taxonomy is created by combining a broad variety of more recent literature.

Schildt (2005) states that the label of corporate entrepreneurship has been attached to a wide variety of phenomena. These phenomena range from ‘established’ organizations entering a new business; individuals or groups championing innovations within a corporate context; entrepreneurial efforts that renew the organization by changing its business, structure, or strategy; and situations in which an entrepreneurial philosophy permeates an organization (Schildt, 2005). Logically, corporate entrepreneurship is strongly aligned with the entrepreneurial
concept. Stevenson and Jarillo-Mossi (1986) provide a definition of entrepreneurship: 'the process of creating value by bringing together a unique combination of resources to exploit an opportunity'. However the domain of entrepreneurship is not solely restricted to the conceptual sense of the independent new venture creation process (Wortman, 1987). In line with the opportunity-based approach, Ireland, Kuratko and Horris (2006) define corporate entrepreneurship as a process through which individuals in an established firm pursue entrepreneurial opportunities to innovate without regard to the level and nature of currently available resources. The conceptual model of entrepreneurship is applied in an organization-wide environment where these organizations consistently behave in entrepreneurial manners. Unlike the entrepreneur, the intrapreneur acts within an existing organization, whereby this concept is more widely applied, compared to corporate venturing.

Within the realm of existing organizations, corporate entrepreneurship encompasses two types of phenomena that are or are not interrelated (Guth & Ginsberg, 1990; Zahra & Covin, 1995; Sharma and Chrisman, 1999): the birth of new business within an existing firm and the transformation of existing firms through the renewal or reshaping of the key ideas on which they are built.

Scholars have not consistently used these two labels to describe the phenomenon of corporate entrepreneurship; instead scholars have used a variety of labels to describe these first two types of corporate entrepreneurship (Sharma & Chrisman, 1999). Some researches states that there are actually three types of phenomena that encompass the concept of corporate entrepreneurship. They add a third, called innovation. Organizational innovation can be performed in relation to products, services, operations, processes, and people (Baregheh et al., 2009). According to Zahra and Covin (1994), Innovation is widely considered to be the life blood of
corporate survival and growth. While there is some overlap between the various definitions of innovation, overall the number and diversity of definitions leads to a situation in which it has no clear and authoritative definition (Baregheh et al., 2009).

Since the literature regarding the concept of corporate entrepreneurship needs to be compared with the literature of the concept of the entrepreneurial university, it is important to take into account that universities operate not like start-up’s or other forms of new business, but instead much like established businesses. Instead of studying the derivatives of the birth of new business, the derivatives of the transformation of existing firms through the renewal or reshaping of the key ideas on which they are built is studied more in depth (figure 4, lower-right part). Its most important underlying concepts are intrapreneurship, corporate venturing, and strategic renewal. By stating their definitions, it is easier for readers and scholars to build upon each other’s work to decide whether research findings are applicable to their situation. To gain a deeper understanding of these concepts, please read Appendix III.

3.3.2.2 Taxonomy of corporate entrepreneurship

Up to this point, the sections regarding the literature on corporate entrepreneurship have been concerned with reconciling the different terms used in this field. As the review has moved from broad concepts to more concrete definitions, I have created an overview to classify these terms (see Figure 5). Sharma and Chrisman’s (1999) hierarchy and terminology was used.

![Figure 5: Taxonomy of corporate entrepreneurship (Sharma & Chrisman, 1999).](image-url)
3.3.3 Conclusion

While studying the literature of the concepts of the entrepreneurial university and of corporate entrepreneurship, overlap between both concepts was found. A sound assumption is that this overlap stems from their origin, as both are based on the entrepreneurial paradigm. The way in which the university evolved over time intersects with the concept of strategic renewal. The university transformed through a renewal of its key ideas (Guth and Ginsberg, 1990), which transformed during previous academic revolutions. A second corporate entrepreneurial concept, intrapreneurship, intersects a concept in the literature on the entrepreneurial university, academic entrepreneurship. Both refer to actors that undertake a range of initiatives to facilitate and commercialize knowledge (Meyers et al., 2011). These actors introduce and manage an innovative project within the organizational environment, as if he or she were an independent entrepreneur (Hisrich, 2001). The concept of external corporate venturing overlaps with a trend in the last century: universities have focused on the generation and commercialization of intellectual property, and as a result new external companies, spin-offs, were founded. Notable, however, is that focussing on generating and commercializing intellectual property has been proven to be difficult for universities, as the analysis in section 4.1 will point out.
The theoretical breadth of the concepts of the entrepreneurial university and corporate entrepreneurship were therefore illustrated in the previous chapter. An understanding of the theoretical terms was given and definitions and characterizations of the concepts were developed. Vital is that theory is aligned with practice and improves problems in practice, and also the other way around. For this reason, case studies regarding these two concepts were studied in the first two analyses, both with a special focus on how they are put forward in practice. The first analysis regarded case studies of universities on the leading edge of the concept of the entrepreneurial university in the literature; the second looked at case studies from the literature regarding the concept of corporate entrepreneurship. These two analyses resulted in the development of a new set of characteristics typifying the entrepreneurial university. Based on this new set, the third analysis was conducted to benchmark the entrepreneurial characteristics of the Eindhoven University of Technology. This benchmark was conducted in favour of the thesis’s mission: to explore and develop new business models for the entrepreneurial university of the future, and for the Eindhoven University of Technology in specific.

4.1 Case studies of the entrepreneurial university

The literature of the concept of the entrepreneurial university is in its embryonic stage (Guerro & Urbano, 2010). This analysis complements the literature by examining universities on the leading edge of the entrepreneurial university. In addition, this analysis was conducted to get a better grip on the invaluable plurality of creative and practical approaches that distinguish the entrepreneurial style of entrepreneurial universities (OECD, 2012). Another important goal was to explore business models implemented by these entrepreneurial universities and, moreover, to see whether alternative characterizations, other than the newly developed set of seven characterizations of entrepreneurial universities (the new set based on Etzkowitz’s and Clark’s work, please see section 3.2.6 and Table 2), would be observed in practice.
4.1.1 Universities on the leading edge of the entrepreneurial university

A selection was made of case studies describing universities that are on the leading edge regarding this concept. It is in itself an extensive study to pinpoint how universities express this concept in practice. That is why an important pillar of the selection of the case studies was a study of the world’s most highly regarded entrepreneurial universities, from Graham (2014). She studied over 200 universities, representing every continent in the world, and these universities were identified by experts as demonstrating established or emerging leadership in entrepreneurship.

In her work, three universities were consistently cited as the world leaders regarding this topic: MIT, Stanford University and the University of Cambridge. Next, she identified Aalto University as an entrepreneurial university in more challenging conditions. Aalto University and Chalmers University of Technology were added to this thesis’s selection due to their success in more challenging conditions, publications in important journals, and their status as entrepreneurial European universities. Importantly, by taking these two specific universities into account, the sample goes beyond Clark’s sample institutions, on which he was criticized by Woollard et al. (2007). According to Woollard et al. (2007), Clark’s sample institutions developed their entrepreneurial characteristics in a considerably less competitive environment than the one that institutions face today. With these considerations in mind, the following selection of case studies were chosen:

<table>
<thead>
<tr>
<th>#</th>
<th>University</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Massachusetts Institute of Technology (MIT)</td>
<td>O’Shea et al. (2007)</td>
</tr>
<tr>
<td>3</td>
<td>Aalto University</td>
<td>Graham (2014), Aula et al. (2005), Markkula et al. (2009)</td>
</tr>
<tr>
<td>4</td>
<td>Chalmers University of Technology</td>
<td>Clark (1998), Jacob et al. (2003), Dahlstrand et al., 2010, OECD (2012)</td>
</tr>
<tr>
<td>5</td>
<td>Katholieke Universiteit Leuven</td>
<td>Drucker (1993), Debackre (2000),</td>
</tr>
</tbody>
</table>
**Table 3:** Overview of the selected universities that are on the leading edge regarding the concept of the entrepreneurial university.

In total, fourteen case studies were read and closely examined. The new set of characteristics of entrepreneurial universities (please see Table 2) was used, to assess to what extent the characteristics apply to the above-mentioned universities. The findings are recorded in Appendix VIII, where each characteristic is explained per university. Because the case studies provided a rich and wide body of information regarding the new set of characteristics, each characteristic is described concisely, to provide an overview, per selected university, in this appendix.

**4.1.1.1 Analysis of case studies**

Universities were analysed according to the newly developed set of characteristics (please see Table 2). The most significant overlapping findings are mentioned in the next section. Significant findings particularly related to one, or at most two, universities are mentioned in the subsequent section of this chapter.

**4.1.1.2 Overlapping findings**

The most significant findings were categorized according to when they were proven to be important in the transition towards the entrepreneurial university.

Findings that overlapped across universities before the transition towards the entrepreneurial university are as follows:

- All universities were traditionally dependent on government funding to a high degree, independent of whether the institution was government-owned or privately owned. Evidence was found was that if these top universities want to continue carrying out cutting-edge scientific research, they need to seek for alternative funding, as the cost of such research has risen above the budgets that governments can provide (in agreement with findings from Wissema [2010]).
- In order to make the transition, the university environment has proven to be vital. Important stakeholders in the university environment are external
research institutions, faculty management, students, academics, serial entrepreneurs, government, and industry.

- Another interesting factor that enabled the transition was money. All universities were able to attract large funds from government or industry.

Basically these findings enabled the transition to an entrepreneurial university.

Overlapping findings during or after the transition towards the entrepreneurial university are as following:

- Over time the selected, universities have proven to be remarkably adaptable over the course of their long history, while the environment in which they operated was in constant flux.

- In the triple helix model, the cooperation with industry was closer and more important compared to cooperation with government. The MIT is a great example of close industry partnerships and more loose government partnerships. Their institutional partnerships with industry do not even involve a federal component (O’Shea et al., 2007).

- Non-European universities, particularly, were most successful while they were traditional, fundamentally research universities (Lenoir, 2004).

- All universities have developed organizational mechanisms to commercialize research across institutional borders.

- Surprisingly, intellectual property gained from research did not create or develop significant revenue streams. For example, at the university of Stanford, an IP strategy was pursued whereby rather than exploiting the patent positions to specific firms to exclude access, the university served as a repository of economically useful knowledge that was made available to all of the firms in the region (Etzkowitz, 2002). Next, Aalto University switched its focus from developing and securing intellectual property to supporting regional start-ups (Graham, 2014). Another interesting phenomenon in Sweden is that, currently, like in most other Nordic countries, researchers have sole ownership of any intellectual property that may accrue from the research in which they engage. There is an impetus from the government of Sweden to change this law (Jacob, et al., 2003).

Based on the literature of the previous chapters, it was expected that the analysis would yield more overlapping findings; however, instead most findings were
Analyses

university-specific (often due to the university’s history and environment), and are explained in the following section.

4.1.1.3 University-specific findings

The most specific findings per university are described in this section.

MIT has a long tradition of industrial and military funding, which has led to commercially oriented innovations. By sustaining faculty entrepreneurship in this university, policies supportive of commercialization have evolved. On the surface, their culture appears to be quite traditional; however, an entrepreneurial culture is present. MIT’s successful tradition and history of commercializing radical technologies has created a ‘success-breeds-success’ start-up culture among the academics there. An interesting finding is that MIT is dominated by engineers (53% of students) and supplemented with non-beta students (O’Shea et al., 2007). A related finding that needs further research in order to explore its possibly vast potential regarding the entrepreneurial university is: does this mix of alphas and betas create a synergetic collaboration whereby innovations can be created and successfully marketed?

Stanford pursues a unique IP strategy: rather than exploiting the patent positions of specific firms to exclude access, the university serves as a repository of economically useful knowledge made available to all of the firms in the region (Etzkowitz, 2002). Another stand-out feature is that in its diversified funding base yields high returns, the result of the commercialization of land and property to acquire additional income—Stanford even has its own shopping centre (Lenoir, 2004).

In order to merge, Aalto needed massive funding. Due to business and government ecosystems that the three universities participated into in advance, this funding was possible. Of particular importance in the funding process were serial entrepreneurs, government funding agencies, and investors, which were all located in the Helsinki area (Graham, 2014). To support the needed change of internal structures, the university’s senior management has been a vocal supporter of the entrepreneurship movement at Aalto from the earliest stages of its formation. Interesting to note is that they supported without an explicit university policy on entrepreneurship. According to Graham (2014), this was a vital factor that allowed the student-led movement, and its integration with the local entrepreneurial community, to grow organically while offering strong support. This is seen as the
base of the success of its current ecosystem, as access to senior management would be unlikely in an established institution, particularly for a student group whose membership was still relatively small (Graham, 2014).

The technical university Chalmers University of Technology was included due to its privatization being less dependent on government funding compared to other state-owned universities in Sweden. Cooperation with industry has therefore been traditionally linked strongly to the university. Chalmers administrators and academics looked to US universities, particularly to Stanford and MIT, in order to legitimate its early efforts to transform itself (Jacob et al., 2003).

The Katholieke Universiteit Leuven (KUL) made the transition towards an entrepreneurial university in which there was a tendency to run research groups as quasi-businesses. A driving force for the university to forge broad alliances with industry was increased competition for funds and the search for alternative funding sources. Some pioneer research groups, led by a few academics with broader entrepreneurial experience acquired during their US doctorates or other training stages, created the most productive university industry research groups within the university system, which remain presently (Ranga et al., 2003). Next, the entrepreneurial concept in this university was stimulated by the ability of researchers belonging to different departments at the university or even belonging to different faculties to decide to join forces and to integrate the commercial-industrial component of their R&D portfolio in a research division at the technology transfer office.

4.1.2 Differences between theory and practice regarding the entrepreneurial university

A notable difference was observed while studying the concept of the entrepreneurial university in theory and practice. Etzkowitz (2001) and Soete (1999) stated that the US entrepreneurial university emerged ‘bottom-up’ in contrast to the emergence in Europe, where the introduction of academic entrepreneurship is a recent ‘top-down’ phenomenon in response to the innovation gap between the US and Europe. Literature regarding the cases of Aalto and the Katholieke Universiteit Leuven are show the opposite, however; these cases with European universities show that the concept is also emerging bottom-up in Europe currently. Fine examples are the student-led transition at Aalto and the transition led by pioneer research groups within the Katholieke Universiteit Leuven.
4.1.3 Conclusion

The case studies of the universities on the leading edge regarding the concept of the entrepreneurial university show a confirmation of the set of core characteristics. However, these characteristics cannot be used as a direct blueprint to develop an entrepreneurial university. There is no encompassing blueprint to create and develop an entrepreneurial university based on these characteristics. This finding can be usefully supplemented with recent work from Philpott et al. (2011): university management should be aware of ‘one-size-fits-all’ practices, which claim universal applicability and instead seek to define their own entrepreneurial paths based on existing university capabilities and unique operating context. The researchers found that progression towards the entrepreneurial university ideal is highly context-dependent and may not suitable for all universities. For the mainstream, it needs to be nurtured and managed as a strategic, deliberate act (Wolcott, 2007). Therefore a simplistic attempt by a university to replicate and transpose policies and practices regarding this concept, without a deeper and more holistic understanding of both their own history and environment, will probably be unsuccessful. Creating an entrepreneurial university takes time, as both infrastructural and cultural changes are necessary to achieve successful implementation.

The introduction already mentioned that an important driver pushing universities to become more entrepreneurial is that the funding structure of universities is changing. This analysis resulted in a finding that acts as an important kind of ‘enabler’ to diversify the university’s funding structure. The findings suggest that new business models must be based on existing university capabilities and unique operating context to diversify the university’s funding base.

4.2 Case studies of corporate entrepreneurship

4.2.1 Corporate entrepreneurship in practice

Throughout this thesis, the unit of analysis is the university itself; nevertheless the literature pointed out that insights could be gained from how corporations have adopt the entrepreneurial paradigm. Six case studies of best practices and worst practices of the concept of corporate entrepreneurship were studied. These case studies were selected on the basis of their perceived relevance regarding the concept of the entrepreneurial university, and the quality of the case studies was taken into account
by looking to individual citation scores and studies published in journals with a high Journal Impact Factor (2010).

The first four case studies emphasize successful results, while the latter two case studies emphasize the worst practices of the concept. The latter two cases were selected because in the case studies regarding the concept of the entrepreneurial university, only successful implementations were studied. These latter cases are included in order to also study unsuccessful implementations.

<table>
<thead>
<tr>
<th>Firm</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>Applegate et al. (2005), Harreld, O’Reilly &amp; Tushman (2009), Schumpeter (1934), Kirzner (1973), Gerstner (2011)</td>
</tr>
</tbody>
</table>

*Table 4: Overview of the selected firms with case studies regarding the concept of corporate entrepreneurship.*
In this analysis, the set of characteristics developed in to supplement the concept of the entrepreneurial university was not taken into account because it is unknown whether these entrepreneurial characteristics directly apply to firms. Any overlap between the case studies regarding the concept of corporate entrepreneurship and the entrepreneurial university is discussed in a later section.

The details of each case study regarding the concept of corporate entrepreneurship can be found in Appendix IX. In this appendix, the most important findings are described. Each description starts with an historical overview of the firm, then highlights important events in the operating context of the firm and its stakeholders, and shows how the firm pursued and set up corporate entrepreneurship during these events. Descriptions of the content were made concise and brief to keep an overview in this appendix because all case studies and other literature provided a rich and wide body of information regarding this concept.

### 4.2.2 Interesting findings

The cases of IBM, Google, Philips and 3M highlight the importance of exploiting, as well as exploring, by creating an ambidextrous organization. Philips created a corporate incubator, 3M and Google created a policy where people can work freely on their ‘own’ projects, and IBM developed their three-horizon program to effectively exploit opportunities in an entrepreneurial manner. Success factors for the development of a successful business case surrounding these opportunities are generous rewards, active and frequent senior level sponsorship, dedicated A-team leadership, disciplined mechanisms for cross-firm alignment, resources fenced and monitored to prevent cuts, actions linked to critical milestones, and quick start, quick stop if needed.

The last two cases highlighted the failures of companies exhibiting entrepreneurial manner. Following up on exploited opportunities, Xerox proved to be successful in developing innovative technologies. However, Xerox proved incapable of capitalizing on entrepreneurial opportunities; this firm did not commercialize these new technologies in an effective manner. Even worse, and in accordance with this finding, the Polaroid case illustrated that this firm did not identify and exploit new entrepreneurial opportunities whatsoever.

All strategies were based on a coherent aim: fostering the process of creating value by bringing together a unique combination of resources to exploit a corporate
opportunity. However, what works for one firm will not necessarily work for another, as the cases illustrated. **Corporate entrepreneurship will not just happen. For the mainstream, it needs to be nurtured and managed as a strategic, deliberate act (Wolcott, 2007). There is no straightjacket approach for incorporating entrepreneurship. Each firm needs a tailored corporate entrepreneurship approach.**

‘You’ve got to be flexible and take some risks. Some things work and some don’t. Corporate entrepreneurship is fundamentally a learning process.’ - Mike Giersch, Vice president IBM Strategy

### 4.3 Benchmarking the entrepreneurial characteristics of the TU/e

From the literature, as well as the case studies regarding the two concepts of the entrepreneurial university and corporate entrepreneurship, one important finding stood out because of its importance regarding the results of the literature review and case studies, and was also analysed to create a solid base for the business models: university management should seek to define their own entrepreneurial path based on existing university capabilities and unique operating contexts. There is no encompassing blueprint to create and develop an entrepreneurial university. A simplistic attempt by a university to replicate and transpose policies and practices regarding this concept without a deeper and more holistic understanding of both their own history and environment will, therefore, probably be unsuccessful. Agreeing with this finding, the corporate entrepreneurship case studies point out that there is no straightjacket approach for incorporating entrepreneurship. As at universities, each firm needs a tailored corporate entrepreneurship approach—a tailored approach based on existing capability and unique operating context.

The goal of this study is to design viable business models for the university of the future, in particular for the Eindhoven University of Technology. Therefore a breakdown of the specific entrepreneurial characteristics of this university was conducted to analyse to the extent to which this university is an entrepreneurial university. To gain insight, the basis of this breakdown was the set of the seven characteristics of an entrepreneurial university (please see Table 2).
4.3.1 History and environment of the TU/e

The Eindhoven University of Technology is a public technical university established in 1956, located in Eindhoven, the Netherlands. It is a research-driven and design-oriented technology university. It focuses on coherent education, research, and knowledge valorisation in the field of engineering science and technology (TU/e, 2011). The university houses nine different departments and is currently home to 3055 staff members, 8211 students, 1210 PhD students, 290 PDEng students and 240 professors (TU/e, 2015A; TU/e, 2015B). Despite the economic crisis and budget cutbacks announced by the Dutch government for the period up to 2014, the university has a rather ambitious strategic vision for the period up to 2020, called the ‘Strategic Vision 2020’. The aims of their vision are to establish a University College that fosters both in-depth and wide-interest, society-interest-driven education for upcoming engineers; to establish a combined Graduate School to manage the graduate programs; to increase the student body by 50 percent; to increase the number of annual Ph.D graduations by 50 percent; to increase knowledge valorisation; to increase the international position of the university to within the top 100 universities; and to increase the embeddedness of the university within the city and the Brainport region by transforming the campus into a high-grade science park with laboratories (TU/e, 2015C). The Times Higher Educational World University Rankings in 2014-2015 listed the university in 144th place, scoring particularly well on collaboration with industry. This university is among the world’s ten best-performing research universities in terms of research cooperation (TU/e, 2015D).

4.3.2 Characteristic S1

A focus on the capitalization of knowledge, e.g. by expanding the developmental periphery (C1 + E1). Aimed at the realization of the university’s third mission.

According to the Elsevier/Science works valorisation ranking, the TU/e is the best university when it comes to cooperating with business and the scientific articles these activities have produced in the Netherlands (Van Leeuwen, 2013). In addition, this university has created the highest number of spin-offs generated from its own scientific research (Van Leeuwen, 2013). Another indicator of the close relationship with industry is that 15% of the scientific articles are the result of collaboration with industry. This means that this university has the strongest collaboration with industry
of all universities worldwide (CWTS LeidenRanking, 2014). As TU/e president Jan Mengelers stated, ‘This result underlines the intensive and stable collaboration between TU/e and industry around the world, as well as the close links with the Brainport Eindhoven region. It shows once again that TU/e is the place ‘where innovation starts, with the right balance between science for society and science for industry’ (Mengelers, 2014).

From the university’s annual report for 2013, it is concluded that a specific and prioritizing focus was shaping concrete interdepartmental research and innovation areas in a manner that reflects the university’s strategic areas. The board agreed that by strengthening its research and valorisation focus, it improved its international competitiveness and attractiveness to potential partners in the high-tech ecosystem (TU/e, 2014A). In the document Strategic Plan TU/e 2020 (2011), a very important topic was knowledge valorisation, and the document specifically aimed at (1) achieving more structured R&D cooperation with high-tech industry, (2) increasing effectiveness of knowledge and technology transfer to SME’s, (3) increasing the participation in entrepreneurship / business-oriented education, and (4) increasing the number of successful start-ups. The university aims to position itself in the middle of society to develop a true collaboration and meeting place (Mengelers, 2015). The university wants to cooperate with the high-tech industry, but also with medium-sized and small enterprises (Mengelers, 2015, TU/e, 2011).

4.3.3 Characteristic S2

A hybrid form of managing the tension between the interdependence (E2) and independence (E3) relationships with industry and government. This involves that the resolution of the tensions between the principles of interdependence and dependence are an impetus for the creation of hybrid organizational formats to realize both objectives simultaneously (E4).

Mengelers (2015) proposes to add a fourth actor to the triple helix model. He argues that this model should be expanded to a quadruple model, whereby society gets more authority. Society can exert much more influence and guide the innovation process nowadays due to the ‘connected world’ (Mengelers, 2015). Mengelers (2015) stated that the traditional triple helix model of collaboration between government, industry, and universities should be expanded with the input from citizens. In other words, the university should be a source of information for small
business, public organizations, and citizens. The triple helix should therefore be positioned as a collaborative model that undergoes increasing adjustments over time. These adjustments are dependent on the context and conditions of that period of time in order to provide an answer to the challenges of that era. He urges that companies, governments, and universities should no longer operate from an ivory tower. They fulfill more and more the role of an architect, facilitator, or assistant while incorporating public input. The modern economy is increasingly becoming a knowledge democracy (Mengelers, 2015).

4.3.4 Characteristic S3

A university embodying reflexivity. This involves continuous renewal of internal structures (E5) based on governmental or industrial changes.

During the anticipation of the transition towards the third generation, the TU/e was founded in 1956. There was a strong need for industry to employ improved educated engineers. Assumedly, this is the reason that ‘The university has always been relatively strongly connected to industry’ (Mengelers, 2015). In order to serve the practical application for society and business, the TU/e has been in a continuous state of transition to adapt to the changing needs of its stakeholders: students, industry, and society. A notable change in the future of the field of education is the strong influence on blended learning by making use of massive online open courses (Mengelers, 2015). Additional changes in the near-term future will take place under the influence of lifelong learning, modular education, and changing certification.

In order to develop a more reflexive university, a strategic plan was made for the university to respond to internal and external developments. It sets out a multi-year project program to implement the Strategic Plan. This plan elaborates on the role that the TU/e wants to fulfil in the near future (TU/e, 2011).

4.3.5 Characteristic S4

A diversified funding base (C2).

Mengelers (2015) states that the Dutch government will not increase governmental funding towards universities, so future growth must be facilitated in another way. To dig deeper into the financials regarding this university, and in particular to pinpoint its funding base, the university’s annual report from 2013 was studied. In relation to Mengelers’ (2015) notion, already in 2013 the board of the university showed
concern regarding the decline of funds flowing in from the first and third streams, concern that is also found in the TU/e’s financial overview from 2009 to 2013.

<table>
<thead>
<tr>
<th>Financial indicator</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total income</td>
<td>292.1</td>
<td>312.6</td>
<td>317.1</td>
<td>305.2</td>
<td>317.9</td>
<td>+</td>
</tr>
<tr>
<td>- First stream</td>
<td>183.6</td>
<td>186.4</td>
<td>185.4</td>
<td>180.6</td>
<td>190.9</td>
<td>+</td>
</tr>
<tr>
<td>- Second stream</td>
<td>17.8</td>
<td>20.2</td>
<td>23.0</td>
<td>22.1</td>
<td>24</td>
<td>+</td>
</tr>
<tr>
<td>- Third stream</td>
<td>63.1</td>
<td>76.2</td>
<td>75.6</td>
<td>71.1</td>
<td>70.1</td>
<td>-</td>
</tr>
<tr>
<td>Total costs</td>
<td>287.13</td>
<td>308.0</td>
<td>314.6</td>
<td>299.3</td>
<td>308.5</td>
<td>+</td>
</tr>
<tr>
<td>Net result</td>
<td>2.5</td>
<td>2.5</td>
<td>0.9</td>
<td>3.1</td>
<td>5.3</td>
<td>+</td>
</tr>
<tr>
<td>Equity</td>
<td>120.2</td>
<td>122.8</td>
<td>123.8</td>
<td>126.8</td>
<td>132.2</td>
<td>+</td>
</tr>
<tr>
<td>Solvency ratio</td>
<td>0.45</td>
<td>0.43</td>
<td>0.43</td>
<td>0.36</td>
<td>0.35</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table 5: Financial overview TU/e. Amounts in millions of euros (TU/e 6, 2014).*

Clearly the second stream declined in recent years, and simultaneously the first stream increased as the total amount of new students increased from 1201, in 2009, to 1597, in 2013 (TU/e, 2014A).

In order to get a grip on the distributions of the first, second and third streams, these streams were compared to the overall income of the university.

<table>
<thead>
<tr>
<th>Year</th>
<th>First stream</th>
<th>Second stream</th>
<th>Third stream</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>60.1%</td>
<td>7.5%</td>
<td>22.1%</td>
<td>10.4%</td>
</tr>
</tbody>
</table>

*Table 6: Distribution of first, second and third stream. Amounts in millions of euros (TU/e, 2014A).*
Analyzes

According to the Strategic Plan TU/e 2020 (2011), the goal of the third stream should be >25% in 2020. In 2013, 22.1% had already flowed in from tertiary funding in total revenues.

Notably, the overall income in 2012 decreased and in 2013 increased again. Also, from 2009 to 2010 the total amount of the third stream increased significantly while in the latter years this stream levelled off. The annual report of 2013 projected that the net result would balance out in 2014, 2015, and 2016 to +/- 0.0 million euro. This projection highlights the importance of the dependence and development of the third money stream in the near future.

Also emerging from study was that the TU/e is expanding its patent fund. The case studies regarding the entrepreneurial universities proved that funds flowing in from intellectual property are minimal. Due to this surprising finding, a meeting was scheduled with Steef Blok. Blok is the director of the Innovation Lab, the technology transfer office of the university. The Innovation Lab is a department with a team of consultants, coaches, and professors ready for staff, students, and external parties to translate knowledge into business (TU/e, 2015E). During this meeting, Blok (2015B) noted that this university generated approximately 500,000 euros of income from patents over 20 years. That is an average of 25,000 euro a year. An insignificant number compared to the total income of this university in 2014, which was 317.9 million euro.

Blok (2015B) noted that the patent earnings are ‘a mere drop in the ocean’. Therefore the university has recently changed its goal regarding its patent strategy. Its current goal is to transfer as much intellectual property into practice as they can, to the benefit of the university’s partners, community, society, and economy (Blok, 2015A). Therefore the university has developed the easy access model: ‘All IP has inherent value, but only a small portion has significant commercial value for the university. For that small portion of IP we will seek to exploit it with our commercial partners. For all other IP we will seek to transfer it for free to partners who can demonstrate how it will benefit society or economy.’ In addition, Blok states that ‘licensing is not a money-machine for universities’ and that ‘patents originated from universities are hardly ever successful product creators’, since ‘5% of IP generates returns, 95% does not generate returns’. Therefore the university has turned around the traditional technology transfer model to the so called ‘easy access model’. In this model the Innovation Lab gives IP away for ‘free’. According to Blok (2015A), this will
help to start relationships more positively; while the company grows the relationships grows alongside it, and ultimately those relationships will be the ones that lead to more research and further collaboration.

4.3.6 Characteristic S5

A strengthened steering core with decision-making authority and autonomy, professional and accountable (C3).

By looking to the universities’ organogram, it can be concluded that a traditional organization structure is employed. See Appendix X for a visualization of the organogram (TU/e, 2014A). At the top of the pyramid there is an executive board that manages nine faculties, the Stan Ackermans Institute, TUE Holding BV, and eleven central services. Each faculty has a faculty board consisting of a dean, vice-dean, operational director, and other faculty members (TU/e, 2014A).

In the Strategic Plan TU/e 2020 (2011), the university states that there is currently no need to change the existing nine-department structure; however, change will arrive in the coming years as a departments’ self-reliance comes under pressure when student intake successively dips below a particular level and the basis for top-quality research becomes too narrow. The relatively small scale of the university helps to cultivate and to facilitate a personal atmosphere, efficient lines of communication, and interdisciplinary and interdepartmental cooperation (TU/e, 2011). On the subject of interdepartmental cooperation, ‘The clustering of allied departments may become necessary in time’ (TU/e, 2011).

4.3.7 Characteristic S6

A stimulated academic heartland, purposeful scholarly work is recognized, encouraged and innovative, collaborative research is pursued and remunerated according to its relevance (C4).

The research conducted at the TU/e is internationally prominent. For example, the European Union ranked this university third in terms of publications in scientific journals. Overall, its researchers and research programs achieve high scores in international research assessments (TU/e, 2014B). Of the 350 best performing research universities around the world, this university creates the largest scientific output in cooperation with industry, according to the ranking given by the Leiden Center for Science and Technology Studies (CWTS LeidenRanking, 2014).
Overall, researchers at this university have the scope to do fundamental research on the basis of fascination and academic freedom. In the Strategic Plan TU/e 2020 (2011), the university implies that this is an essential condition for a research university, remaining a key factor that takes international excellence in the individual disciplines as a prerequisite in rising successfully to interdisciplinary and multidisciplinary challenges.

4.3.8 Characteristic S7

An integrated entrepreneurial culture. This is represented by a strong set of beliefs, principles, and consistent practices, all of which ought not to be treated independently of structures and procedures through which they are expressed, thus an institutional perspective is required (C5).

In order to envision entrepreneurship throughout all faculties in the university, Reymen (2015A) created a document whereby she provides an overview of the current status, challenges, and opportunities for entrepreneurship education. The input and insights are based on many involved stakeholders, such as the entrepreneurship faculty, several students, members from the Innovation Lab, a member from Start-up Eindhoven, the executive board, and other related staff members. Entrepreneurship education is currently one of the fastest-growing pillars in this university, and while this trend creates many opportunities, the increasing number of stakeholders involved in entrepreneurship education also calls for a more integrated approach (Reymen, 2015A). Broadly speaking, the education program for students aims for maximum actual experience instead of top-down instruction, the ecosystem offers a platform for outward looking, and furnishes possibilities for iterative experimentation and action under uncertainty. ‘A students future can be as part of an entrepreneurial ecosystem as an entrepreneur, but also as a product developer, intrapreneur, new business developer or innovation manager’ (Reymen, 2015A).

A wide variety of stakeholders are involved in the entrepreneurial ecosystem of TU/e, consisting of internal stakeholders, like Innovation Lab, ESBC, Start-up Eindhoven, staff in the technical departments at the university, the innovation and entrepreneurship lecturers, and researchers (ITEM), but also of external stakeholders like the spin-offs of the university, TU/e alumni, companies at the High Tech Campus, OEM’s like VDL and Philips, SME’s in the region, and collaborations with other
universities and knowledge institutes. Please read Appendix XI for an explanation of the most important internal stakeholders in the entrepreneurial ecosystem of the TU/e.

The TU/e aims to play an active, positive role in growing a vibrant and strengthened ecosystem: ‘By creating such a university-based entrepreneurial ecosystem, we will follow the example of world leading institutes like the MIT, Stanford University, and the University of Cambridge, and highly-regarded universities operating in more challenging conditions (Graham, 2014) that are characterized as emerging world leading universities like Technion, Aalto University, the University of Michigan, Kaist, and the University of Auckland’ (Reymen, 2015A). The university aims to stimulate the entrepreneurial ecosystem from the ‘bottom up’ with a ‘community-led approach’ catalysed by students, alumni, and regional entrepreneurs. The Strategic Plan TU/e 2020 (2011) notes that the participation in entrepreneurship-oriented education needs to be increased.

4.3.9 Conclusion

At first glance, the seven characteristics point out that this university could best be characterized as a research university. The prime mission of this university is to teach and to research. To conduct research, the university therefore closely cooperates with industry to commercialize knowledge, and this relation is very successful if we look to the large scientific output. Notably, the university recently changed its aim regarding its patent strategy. The university’s current goal is to transfer as much IP into usage as possible, to the benefit of its partners, community, society, and economy, for free if needed (Blok, 2015A).

However, based on Etzkowitz’s (2003) research we can argue that this university exhibits some characteristics of an entrepreneurial university and can therefore be characterized as a type of university between a research university and an entrepreneurial university: a transitional entrepreneurial university. This type of entrepreneurial university specifically takes economically and socially useful results into account and specifies steps to see that they are used (Etzkowitz, 2003). Important to note is that many of the universities Etzkowitz studied have moved beyond Etzkowitz’s characterization of the entrepreneurial university, which is not surprising because his research was conducted more than a decade ago.
Based on the three analyses concluded is that this university cannot be compared with the top universities regarding the concept of the entrepreneurial university. This university primarily distinguishes itself with its research. Therefore it is not surprising that the entrepreneurial elements this university exhibits originate from the commercialization of knowledge. The universities on the leading edge regarding this concept clearly distinguish themselves beyond the knowledge valorisation paradigm by their entrepreneurial style.

Looking to the seven characteristics of entrepreneurial universities, the Eindhoven University of Technology can become more entrepreneurial by implementing changes in several fields. For example, this university could stimulate its reflexivity and continuous renewal of internal structures, implement changes on an organizational level to encourage more autonomy, stimulate changes in the academic heartland, integrate a more entrepreneurial culture, adopt changes to its IP strategy, or diversify its funding base. The focus of the designs will be on the latter characteristic: a diversified funding base (please see Table 2, characteristic S4). This focus was chosen because it is based on the most important lessons of sections 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, and a research gap that was found while conducting this study. Section 5.1 elaborates on why this specific focus was chosen.
Design knowledge is used to create what should be, things that do not yet exist. It is the activity of transforming an existing situation into a desired one (Simon, 1996). In the previous chapter, the existing situation of the Eindhoven University of Technology was described. By design, the existing situation of the Eindhoven University of Technology can be transformed into a more desirable one. The desired situation is outlined in the section 5.1. This section is followed by a section with three different design solutions. Each design solution was based on an opportunity to valorize whereby a business model was developed to optimize existing or create new revenue streams for the Eindhoven University of Technology. The idea behind the proposed design solutions is to explore, to put out a feeler. Thus, no detailed business cases or business plans are covered in the given design solutions. The development of such documents requires a comprehensive study in itself and is therefore beyond the scope of this thesis.

5.1 General solution direction

This section not only describes the direction of the design solutions, but also describes the most important theories in which they are grounded. These theories must be kept in mind while reading the design solutions in order to understand the concepts from a business perspective, as well as from an academic perspective.

5.1.1 Foundation of the designs

The literature review and analyses concluded that most academics focus solely on studying the valorisation of knowledge in order to cohere with the concept of the entrepreneurial university. In the past, universities used to add a department for technology transfer or an incubator for techno-starters (Wissema, 2010) to adapt to the concept of the entrepreneurial university. In the literature, what falls outside of the scope of the entrepreneurial university forms a research gap, since academics mostly focused on the valorisation paradigm to study the concept of the entrepreneurial university.

Accordingly, the Eindhoven University of Technology exhibits characteristics of an entrepreneurial university; however, also most of the exhibited characteristics
Design

originate from the university's third mission and the knowledge valorisation paradigm. This is agrees with what was found in the literature, as most universities embraced this concept by first valorising their knowledge. Although a decade ago a strategy like this would be sufficient, the current competitive university environment calls for more than simply adding a department for technology transfer or an incubator for technostarters (Wissema, 2010). Therefore not only for the Eindhoven University of Technology, but also for other universities, the present day conditions call for a new perspective, a new paradigm for universities. To start designing business models for entrepreneurial universities, it is therefore important to remove the ideological and conceptual barriers associated with the entrepreneurial university in the current literature.

In removing such barriers, universities need to broaden their ‘commercialization’ focus to become the entrepreneurial university of the future, beyond the traditional focus of the valorisation paradigm. Instead of solely focusing on knowledge valorisation, universities should broaden their commercial focus. However, we must not forget that the entrepreneurial university is not a commercial enterprise in which everything is aimed at profit maximization (Wissema, 2010): ‘It is not a kind of engineering bureau with some enhanced educational facilities. Rather, it continues to be true to its mission: to create new knowledge and to make education part of the knowledge-creating process. This mission has to be carried out in today’s context.’ (Wissema, 2010). Instead, university management should seek to define their own entrepreneurial path based on existing university capabilities and unique operating contexts (Philpott, 2011). In order to answer the question of the way in which universities need to broaden their commercial focus and to clearly specify the general solution direction, we must first take a step back and find out what has driven the universities to become entrepreneurial.

Important drivers pushing universities to become more entrepreneurial are that the nature of universities is changing and that the way they are funded is changing. The Eindhoven University of Technology needs to diversify its funding base also because Dutch government will not increase governmental funding towards universities. Future growth must be facilitated in another way (Mengelers, 2015). In addition, the cost of research has risen above the budgets that governments can provide (Wissema, 2010). Therefore the third stream contributions are
increasingly seen as important and distinctive in their own right, deserving of specific policies and resources to ensure their effective functioning (Veugelers & Del Rey, 2014). In order to adapt to this phenomenon, the Eindhoven University of Technology needs to diversify its funding base. A more diversified funding base is required (Clark, 1998). This involves looking for alternative streams from local, regional, and supranational public agencies, NGOs, and revenues from student services, as well as alternative platforms such as e-learning, symposia, and networking events (EOCD, 2012).

New revenue streams could be found by entering into new business related to the universities’ products and markets, like firms did to adopt to the corporate entrepreneurship phenomenon. The general solution direction is to diversify the university’s funding base by developing business models that valorise existing university resources like students, employees, data, property, or other internal resources.

Table 7: Visualization of the general solution direction in this thesis.
5.2 Design solutions

Based on the most important lessons of the systematic literature review and the analyses, the general solution direction was set. Based on this direction, new business models for the entrepreneurial university were explored and developed for the Eindhoven University of Technology, by taking into account the universities capabilities and context. In total, three design solutions are described in this chapter. The first design solution is based on optimizing the lifelong learning strategy of universities; the second design solution is concerned about disrupting the way students pay for one the most important products of a university, namely knowledge; and the third design solution is a business model based on a university-wide recruitment platform. Each section of a design solution consists of the following subsections: opportunity context, concept, and explanation of the revenue streams. At the end of this section, a visual representation of the business model appears, created using the Board of Innovation Network. This tool was chosen to visualize the concept primarily because of the tool’s focus on business-model innovation, and, in specific, regarding its emphasis on service design and new monetization strategies. All business models are based on the university’s existing capabilities and unique operating context; however, in addition these business models can help the university to develop its own entrepreneurial path.

5.2.1 Design solution 1: Lifelong learning

5.2.1.1 Opportunity background

The idea of lifelong learning is already a century old. In 1926, Lindeman provided the intellectual basis for a comprehensive understanding of education as a continuing aspect of everyday life. In 1929, Yaexlee drew on the work of Lindeman and pointed out that lifelong education builds upon and affects all existing educational providers, including both schools and institutions of higher education (Tight, 1996).

The Eindhoven University of Technology is reflecting on lifelong learning and, in particular, on how to position and manifest itself in this market. Assumedly, they are waiting until other universities create a successful strategy regarding this matter, since new technologies are disrupting lifelong learning in unforeseen ways (e.g. massive open online courses [MOOCs]). The impact of these digital technologies therefore requires ongoing investigation to explore its understandings. Nevertheless, high-tech companies increasingly want to offer their best engineers the opportunity to
gain a broader horizon through second-Master’s programs and advanced, demand-driven programs; in addition, interest is growing in shorter workshops and programs for technology knowledge workers (TU/e, 2011).

5.2.1.2 Concept

To enable lifelong learning at this university, preferably an online platform needs to be developed that will act as the link between university, company, and employee. This platform is the pillar of the lifelong learning strategy. To actually start implementing this concept, this university would do well to pick a small amount of customer segments and to develop a highly sophisticated program tailored to these specific customer segments. Preferably, these customer segments will fit with the existing capabilities and unique operating context of this university. Appropriate customer segments could, therefore, be highly qualified engineers. For example, a master’s of business innovation program could be developed to kick-start their careers in high-tech companies. A futuristic and a bit far-fetched idea is to create ‘copies’ of top executives from a select group of engineers in the lifelong learning program. These ‘copies’ can be used as back up or possible successors inside the company, because some specific employees could be vital for the daily operation. This would lower human resource risks at the top levels.

If a lifelong learning strategy could be implemented in this university, not only could its students benefit from this solution but also the university’s key partners, companies like ASML or Philips. The relationships in the triple helix model, especially with industry, could become even closer.

5.2.1.3 Revenue structure

Companies will pay a monthly or yearly fee for making use of the lifelong learning platform. In return, specific employees will be allowed access to the platform to educate themselves. Overall, developing a lifelong learning platform could generate a third stream. Please see Figure 6 (below) for a detailed visual of this design solution.
5.2.2 Design solution 2: Revising the student payment model

5.2.2.1 Opportunity background

Basically, a customer is a party that receives or consumes goods or services. In order to receive the goods or services, the customer needs to exchange money. In order to study in college, the student is required to pay for education. The total revenue stream flowing in from tuition and examination fees from students was 17.1 million euro in 2013 (TU/e, 2014A). In total, 5.4% of the yearly income of the Eindhoven University of Technology consists of tuition and examination fees.
Important to acknowledge is that the government also financially contributes (first stream) to let students study at universities. In order to simplify, and due to the fact that it will not contribute to this design solution, the government, as a stakeholder in this process, is excluded from the delineation of the concept. Importantly, this design solution is not aimed at exploring new third streams but instead at optimizing existing revenue streams. The following concept is disruptive and therefore has its drawback, but it uniquely serves a both commercial and societal goal.

5.2.2.2 Concept and revenue structure

Business-wise, it is an innovative thought to do more with existing customers instead of focusing solely on attracting more customers. In this light, the following design solution is developed in order to optimize the student revenue stream, to increase the customer’s lifetime by offering the same services to the customer over a longer period of time.

The pillar of this design solution is to change the payment model to a model on which the student can make use of the university’s key activities, without the traditional annual fee, the tuition fee. In the revised payment model, the student does not pay the university directly vis-a-vis tuition fees, but instead by an indirect fee. When the student graduates, finds a job and earns income, the student starts paying a certain percentage of his income to the university. This percentage will be based on the level of education he enrolled in throughout his college years. It follows that postgraduate students pay a higher percentage compared to students enrolled only in undergraduate education. To make sure students will pay a percentage of their income to the university, the government can be used as an actor to collect this percentage from the student. A student who wants to pay using the proposed model could also make use of the university’s services at a later time, for example while the student is pursuing a career, but requires additional knowledge that the university can provide.

If this design solution could be realized, the student revenue stream would significantly drop because the university would receive payments for their services at a later time. A large financial gap would result. In order to bridge this financial gap, the capital of other parties would be needed. If government were willing to contribute, pension funds would be ideal for funding this gap in cooperation with government. If they are willing to financially bridge this gap, older employed people in the
Design

Netherlands would be paying for the education of the younger generation. In return, they would get a solid return on their investment. In addition, more students would be able to enrol in university, because less financial capital would be needed in order to enrol in college. Please see Figure 7 for a detailed visual of this design solution.

Figure 7: Visualization of design solution 2, visualized using the Board of Innovation framework.
5.2.3 Design solution 3: Online recruitment platform

5.2.3.1 Opportunity background

Looking from a business perspective, the customers of universities are students. One of their most important activities is to satisfy these customers with education. Their customers enrol in university for different reasons, for example, in order to follow their dreams, have better job prospects, get a career not just a job, earn more money, explore cultures, become more independent, or develop new skills or life experience, etc. As a result, by enrolling in university, these customers gain knowledge through the education provided by universities.

After the university has provided the education and the student has graduated, finding a matching job is often a key priority. After all, the possible student loan must be repaid, and the customer enters a new phase in his or her life in which money is needed in order to provide the basic necessities. At this particular point in time, the recruitment business guides and unburdens the student by matching jobs on the basis of the student's knowledge and skills. These kinds of businesses receive a royalty of up to 25% of the student's yearly salary, if the student chooses to work for x months at one of their offerings. Another payment model that these recruitment businesses employ is to charge an hourly fee over the student’s yearly wage. Overall, the recruitment industry employs successful business models whereby lucrative revenue streams are generated.

6.4.1.2 Concept

After the effort the universities have put in to let the student graduate, they basically give the student away for free and let the recruitment business earn the money. To put it bluntly, this industry earns money because of the education given by the universities. Universities educate, while this industry earns on their activity. Businesswise, universities should exploit this activity in-house. Universities already have a broad variety of key partners due to their research function, particularly this university, because the Eindhoven University of Technology ranks best among Dutch universities when it comes to cooperating with business (Van Leeuwen, 2013). By successfully employing an in-house recruitment strategy, a first and third income stream can be developed from the same customer. Every business would love that; it is like killing two birds with one stone.
To make this idea more concrete, the following concept is developed to successfully employ an in-house recruitment strategy. In this way, the recruitment process can be controlled and managed by the university itself. The pillar of this strategy would be an online recruitment platform. After graduation, the student would be automatically made visible in this platform for interested business, whereby the student would showcases his or her education, work experience, and other extra-curricular activities. An important functionality of the platform is that professors or other fellow students could recommend specific companies, like other well-known business-oriented social networking services. An unique competitive advantage to this solution would be that this platform would have tailored and up-to-date educational data, to which these other platforms do not have direct access.

5.2.3.2 Revenue structure

Access to the platform for businesses could be sold on a monthly or yearly basis. After a couple of months, valuable data would be generated per department, like the most interesting branches per department or the most interesting companies per department. This kind of data would even synergize the cooperation with companies in the existing triple helix model. The generated data could also be used for students to automatically recommend companies or vacancies after graduation. From a commercial perspective it is interesting that this platform could be sold to other universities (white label). If this were possible, it would take the concept and revenue stream for the university to the next level.

Overall, this is a low-cost design solution, with a proven business model that would be able to generate a significant third stream by extending the existing student value chain with an in-house recruitment platform. Please see Figure 8 on the next page for a detailed visual of this design solution.
Figure 8: Visualization of design solution 3, visualized using the Board of Innovation framework.
6 CONCLUSIONS, CONTRIBUTIONS, IMPLICATIONS AND LIMITATIONS

6.1 Conclusions

The entrepreneurial university is emerging and is a highly promising field for universities. Several attempts have been made by academics to define the concept, but all are diverse, ambiguous, and highly dependent on their context. Overall, there is in the literature no one-size-fits-all definition of the entrepreneurial university; rather that there is an invaluable plurality of approaches, which are inventive, yet practical, which distinguish the entrepreneurial style (OECD, 2012; answer to sub-question 1). The entrepreneurial style is typified by seven characteristics: (1) a focus on the capitalization of knowledge; (2) a hybrid form of managing the tension between the interdependence and independence of relationships with industry and government, (3) a university embodying reflexivity that involves continuous renewal of internal structures based on governmental or industrial changes, (4) a diversified funding base, (5) a strengthened steering core with decision-making authority that is autonomous, professional, and accountable, (6) a stimulated academic heartland whereby purposeful scholarly work is recognized and encouraged, and research is pursued and remunerated according to its relevance, and (7) an integrated entrepreneurial culture. The literature regarding this concept was supplemented with an analysis of universities on the leading edge of the concept of the entrepreneurial university: MIT, Stanford University, Aalto University, Chalmers University of Technology, and the Katholieke Universiteit van Leuven. These case studies showed a confirmation of the set of core characteristics (answer to sub-question 2).

One very important insight was gained during the literature review and the case studies regarding the concept of the entrepreneurial university and the concept of corporate entrepreneurship. The set of seven characteristics cannot be used as a direct blueprint to actually develop an entrepreneurial university. There is no encompassing blueprint to create and develop an entrepreneurial university based on these characteristics. In addition, it is important to understand that rather trying to characterize the concept of the entrepreneurial university with reference to an assumed fixed point, we may be in a state of continuous transition with evolving
characteristics. Progression towards the entrepreneurial university is highly context-dependent (like its definition). Instead, university management should seek to define their own entrepreneurial path based on existing university capabilities and unique operating contexts. Accordingly, the corporate entrepreneurship findings proved that what works for one firm will not necessarily work for another. There is no straightjacket approach for incorporating entrepreneurship. Each firm needs a tailored corporate entrepreneurship approach (answer to sub-question 3).

Overall, the Dutch government will not increase governmental funding for universities (Mengelers, 2015). The universities’ annual report for 2013 pointed out that already in 2013 the board of the university showed concern regarding the decline of funds flowing in from the first and third stream. In past years, the second stream declined while the first stream increased. Importantly, the analysis of universities on the leading edge of the concept of the entrepreneurial university proved that funds flowing in from intellectual property are minimal. Recently, the Eindhoven University of Technology has turned-around the traditional technology transfer model to the so called ‘easy-access model’. In this model the Innovation Lab gives IP away for ‘free’ (answer to sub-question 4).

At first glance this university could best be characterized as a research university. The prime mission of the university is to teach and to research. However it exhibits some characteristics of an entrepreneurial university and can therefore be characterized as a type of university between a research university and an entrepreneurial university: a transitional entrepreneurial university. The entrepreneurial elements that were found have their origins in the knowledge-valorisation paradigm. The universities on the leading edge regarding the concept of the entrepreneurial university clearly distinguish their selves beyond the knowledge-valorisation paradigm with their entrepreneurial style (answer to sub-question 5). To successfully realize the concept of the entrepreneurial university at the Eindhoven University of Technology, it is vital to build upon its unique operating context and capabilities to enable it to find its own entrepreneurial path.

In the literature, what falls outside of the scope of the entrepreneurial university forms a research gap, since academics mostly focused on the valorisation paradigm to study the concept of the entrepreneurial university. Although a decade ago a strategy like this would be sufficient, the current competitive university environment calls for more than simply adding a department for technology transfer.
or an incubator for techno-starters (Wissema, 2010). Therefore not only for the Eindhoven University of Technology, but also for other universities, this calls for a new perspective, a new paradigm. To start designing business models for entrepreneurial universities, it is important to remove the ideological and conceptual barriers associated with the entrepreneurial university in the current literature. Thus, universities must broaden their ‘commercialization’ focus to transition to the model of the entrepreneurial university of the future, beyond the traditional focus of the valorisation paradigm. In order to broaden their ‘commercialization’ focus, university management should understand that with new business models not only knowledge can be valorised, but also other resources are promising candidates, such as the university’s students, employees, data, and property.

The first design solution is based on optimizing the lifelong learning strategy; the second design solution is concerned about disrupting the way students pay for one the most important products of a university, knowledge; and the third design solution is a business model based on a university-wide recruitment platform. The overall idea behind the proposed design solutions is to put out a feeler with design solutions that could supplement the Eindhoven University of Technology’s entrepreneurial path, based on existing university capabilities and unique operating context. Overall, the best design solution is the last one, the university-wide recruitment platform for companies to attract students. This concept is a low-cost design solution and has a proven business model that would be able to generate a significant third stream by extending the existing student value chain with an in-house recruitment platform.

If universities want to successfully design and implement new business models to diversify their funding base, they need to learn from the literature regarding the concept of corporate entrepreneurship, in addition to the concept of the entrepreneurial university (answer to sub-question 6).

6.2 Contributions

This thesis contributes to the entrepreneurial university in theory and practice, and in particular for the Eindhoven University of Technology. Becoming entrepreneurial is essential for organizational survival, but the existing literature does not provide an overview of how to design solutions for universities to become more entrepreneurial.
While a large diversity of literature was consulted to establish a solid theoretical base, three unique contributions to the existing literature were added: (1) the entrepreneurial university literature was compared and supplemented with corporate entrepreneurship insights and lessons. Notably, the parallel between the concept of corporate entrepreneurship and the entrepreneurial university is not yet studied in the literature. One would expect scholars to have studied the linkages between those two concepts because both study comparable entities that become entrepreneurial. Nevertheless no literature linking both concepts was found. Another contribution is that (2) the literature regarding the entrepreneurial university was supplemented with a business-minded perspective to bridge the gap between managerial practice and academic research in this field. The academic research mostly focused on the valorisation paradigm to study the concept of the entrepreneurial university, this falls outside of the scope of the entrepreneurial university in the literature and forms a research gap. Third, it benchmarked the entrepreneurial characteristics of the Eindhoven University of Technology and designed solutions to develop its own entrepreneurial path based on its capabilities and unique operating context. These business models are generic because they are based on resources that most universities can valorise. Therefore, these business models can also be used as a starting point for other entrepreneurial universities to diversify their funding bases.

6.3 Managerial implications

Many universities are struggling with the implementation of the concept of the entrepreneurial university. If university management wants to enable the transition towards an entrepreneurial university, solutions in addition to the traditional focus of knowledge valorisation need to be developed. In the literature, most of the theories of the entrepreneurial university originate from the university’s third mission and the knowledge-valorisation paradigm. It was surprising that intellectual property gained from research did not create or developed significant revenue streams.

Universities need to build business models in the way that businesses do. In terms of their organization, universities are comparable to businesses; they even operate much like established business (Etzkowitz, 2001). University management should therefore understand that not only knowledge can be valorised (as the valorisation paradigm outlines), but other resources as well. Other potential
resources to valorise using business models are university students, employees, data, and property.

Intellectual and visionary leadership is needed to enable the transition towards the entrepreneurial university for two major reasons: first, to remove ideological and ‘concept of a university’ barriers associated with the entrepreneurial paradigm; and second to carry this through the nature of the university itself, beyond its existing culture, mission, and strategy (Gibb, 2013). **Management should seek to define their own entrepreneurial path based on existing university capabilities and unique operating context (Philpott, 2011).** In addition, management should be aware of ‘one-size-fits-all’ practices, which claim universal applicability and should instead seek to define their own entrepreneurial paths. A simplistic attempt by a university to replicate and transpose policies and practices regarding this concept without a deeper and more holistic understanding of their own history and environment will therefore probably be unsuccessful. All stakeholders must be aware that the inherent challenges faced by the university sector in adopting the entrepreneurial mission are within the structure of a comprehensive university, together with declining the risks of damaging the established contribution of the university to the economy in the areas of education and basic research, its original two functions (Philpott et al., 2011).

To successfully implement this concept, university management can learn from this study that covers important existing theories and practices regarding the concept of the entrepreneurial university and of the concept of corporate entrepreneurship. Above all, **this thesis helps universities, and in particular the Eindhoven University of Technology, to develop their own entrepreneurial path.** A team of entrepreneurial academics and business stakeholders should make use of this thesis to explore and evaluate new business models for the university of the future. The team needs to be led by a few interdepartmental academics with broader entrepreneurial experience. In addition the team should be supplemented with non-academic, business-minded experts. To support the needed change, the university’s senior management must be a vocal supporter of this movement in its earliest stages.
6.4 Limitations and further research

This section will start with limitations concerning the systematic literature review, analyses, and designs. The last piece of this section will end with promising further research venues.

While every effort was made to anticipate possible limitations, the study has the following limitations: the literature review and research synthesis draw on a large variety of research streams through which the research of corporate entrepreneurship is used to supplement the entrepreneurial university literature. However, findings from corporate entrepreneurship and the entrepreneurial university cannot always be generalized to the business context since studies of corporate entrepreneurship and the entrepreneurial university have a different unit of analysis. Although this is a promising research venue for the concept of the entrepreneurial university, many concepts in the entrepreneurial university literature are not tested in the business context.

In the analyses, a major part of the research regarding the Eindhoven University of Technology was based on policy documents and therefore does not necessarily need to correspond with practice. Another limitation is that it remains unknown how university management actually approaches and develops strategy regarding the concept of the entrepreneurial university.

During the design phase, an explorative approach was used. The scopes of the designs are therefore broad, instead of being convergent. As a result, the business models were developed on a more conceptual level. That is also an important limiting aspect of this thesis: the designs explore, yet do not define. In addition, the designs need to be underpinned with more theory. Grounded on theory, a comprehensive business plan needs to be written that needs to be tested and assured by experts in the university and business environment. The testing of the design solutions is also absent.

One of the most promising future research opportunities is therefore to ground the design solutions with more theory, test these design solutions, and develop an in-depth business plan for a specific business solution. This comprehensive business plan should minimally consist of a business model, product offering, PEST analysis, competitors analysis, SWOT analysis, sales forecast, cost structure, profit and loss account, cash flow statement, change plan, delta analysis,
Conclusions, contributions, implications and limitations

resistance analysis and intervention strategy, and action and communication plan. Another future research opportunity is to study how university management actually approaches and develops a strategy regarding the entrepreneurial university.

A surprising finding was that intellectual property gained from research did not create or develop significant revenue streams. A future research opportunity is therefore to gain deeper understanding of the motives of giving intellectual property away for free, especially with regards to the universities on the leading edge of this concept. In addition, it would be interesting to find out if there are any entrepreneurial universities that have successfully valorised intellectual property.

The parallel between the concept of corporate entrepreneurship and the entrepreneurial university has not yet been studied in the literature. One would expect scholars to have studied the linkages between those two concepts because both study comparable entities that become entrepreneurial. Nevertheless, I found no literature linking both concepts in my literature review.
REFERENCES


References


References


References


References


Rijksmuseum (2014). *1602 Handel met de Oost: VOC Aziatisch netwerk, een zware en eentonige reis*. [ONLINE] Available at:


References

TU/e (2015D). *Over de universiteit: feiten en cijfers - rankings* [ONLINE]
Available at: https://www.tue.nl/universiteit/over-de-universiteit/feiten-en-

TU/e (2015E). *About Innovation Lab.* [ONLINE] Available at:


Cambridge: Cambridge University Press.

Last accessed 20th April 2015.

Business Ownership in Bringing Down Unemployment in Japan.*
Rotterdam.


Veugelers, R. & E. Del Rey, 2014, *The contribution of universities to innovation,
(regional) growth and employment*, EENEE Analytical Report 18.

deliver social change*. [ONLINE] Available at:
http://www.vodafone.com/content/index/about/foundation/mobiles_for_good.ht

References


Appendices

APPENDICES

Appendix I: Evolution of the concept of entrepreneurship

One of the first modern entrepreneurial companies that conducted business all over the world was the Dutch East Indie Company (VOC). In the sixteenth and eighteenth century the Dutch East Indie Company was the largest, most powerful and dominant European trading firm in the world, trading more than 150 different products all over the world. It was the first public firm to issue negotiable shares and it developed into the first multinational corporation in history. This early form of private entrepreneurship demanded high investments in freights, purchase of cargos and payment of seamen, commercial agents and others. Commercial expertise and a wide trading network was needed for the coastal and long distance routes (Rijksmuseum, 2014). Till the beginning of the twentieth century the entrepreneurial concept remained a shadowy entity without a clearly defined form and function. Only Schumpeter, and to some degree Professor Knight succeeded in infusing this concept with life and in assigning this concept to a specific type of activity (Schumpeter, 1934; Baumol, 1968).

After World War II entrepreneurship had only been a sideshow in economic theory. According to neo-classical economics, the entrepreneur was not part of the economic model, leaving no room for enterprise and initiative but only for passive calculation (Baumol, 1968). The lack of interest in entrepreneurship in the second half of the past nineteenth century can be attributed to the widespread idea that entrepreneurship would be come more and more obsolete as capitalism developed (Brouwer, 2002). The consensus was that large bureaucracies would predominate organizational forms of capitalism and that entrepreneurship would fade out as a consequence. At that time traditional entrepreneurship theories suggest that entrepreneurship would retard economic growth (Audretsch, 2003). The model of the economy during that time, the so-called managed economy, was the political, social and economic response to an economy dictated by the forces of large-scale production, reflecting the predominance of the production factors of capital and unskilled labor as the sources of competitive advantage (Audretsch & Thurik, 2004). Kirchoff (1994) named this phenomenon dynamic capitalism.

This turned out a lot different due to political and economic events in the turn of the 21st century, which broke away from the evolutionary path, which authors as
Schumpeter (1934) and King (Baumol, 1968) foresaw. Firms did get larger on average, but this trend has been revised since 1973 (Brouwer, 2003). Evidence proves that the economic activity moved away from large firms to small firms in the 1970s and 1980s. The trend from large firms toward the re-emergence of small business was not solely limited to North America (Audretsch & Thurik, 2004), it can also be seen back in Europe. For example, in the Netherlands the business ownership rate fell during the post-war period. In 1984 it reached the lowest point of 8.1% (Stel et al, 2002). However Europe slowly followed suit towards the more entrepreneurial economy compared to the USA. The European response varied strongly across countries.

During the 1980s and in early 1990, European policy makers looked to Silicon Valley with skepticism and doubts (Thurik & Wennekers, 2004). In the second stage, during the mid-1990’s, Europe recognized that the high performance of entrepreneurial economy in Silicon Valley did deliver a sustainable long-run performance. Only in the final years of the twentieth century, the European policy makers reached consensus about the determinants of economic growth and that this new entrepreneurial economy was superior to the old managed economy, moreover a commitment had to be forged to creating this new entrepreneurial economy. The so-called Green Paper (presented in the spring of 2003) on Entrepreneurship of the European Commission is the first EU document extolling the virtues of entrepreneurship as the most important driver in the economy and paving the way for Union-wide stimulation programs (Thurik & Wennekers 2004).

Nowadays literature suggests that the managed economy has been replace by the entrepreneurial economy throughout all developed countries (Audretsch & Thurik, 2004). After this shift, entrepreneurship is generally recognized as a vital determinant of economic growth. If entrepreneurship is at the root of economic improvement, the implication that ‘we need more of it’ is not difficult to draw (Stevenson & Jarillo-Mossi, 1986).
Appendices

Appendix II: original two functions of the university and its transition towards the triple helix model

Original two functions of the university

The original two functions of universities were teaching (mostly priests, public servants, lawyers and so on) and second conducting research in a variety of disciplines (Etzkowitz, 2000). Over time two relatively distinct types of teaching emerged. One to develop the full potential of the individual student, and the other to produced trained people with the knowledge and skills that were useful to society.

Research, or scholarship, also evolved over time with two fundamental changes. The first change was that scholarship was broadened to include the creation of new knowledge (research), as well as the reanalysis of existing knowledge. Second a distinction emerged between the two types of research: knowledge “for it’s own sake” as opposite to knowledge to meet the needs of society (Etzkowitz, 2000).

The transition towards the triple helix model

In this evolution particularly important were the changing relationships (and often evolving tensions) with key external actors in the university’s environment. From the start the relationship of the university with the church was crucial. However, over later centuries, most universities moved to a non-denominational status (Etzkowitz, 2000). Another important stakeholder in its environment during later centuries was its relationship with the monarch, the government, particularly as most universities became part of the public sector.

In the 20th century the university appears to be arriving at a common entrepreneurial format, coming from different academic and national traditions (Etzkowitz, 2000). This entrepreneurial university encompasses a third mission: a mission of economic development, in addition to its original two functions of research and teaching (Readings, 1996). Etzkowitz (1993, 2000, 2001, 2008) states that the emergence of the entrepreneurial university is a response to the increasing importance of knowledge in national and regional innovation system and the recognition that the university is a cost effective and creative inventor and transfer agent of both knowledge and technology. Etzkowitz (1993, 1995, 1997) further elaborates that one model through we can interpret these changes is the triple helix model.
This model attempts to account for a new configuration of institutional forces emerging within innovation systems. Etzkowitz and Leydesdorff (1997, 1998) suggest that the close links between universities, government and industry can be couched in the term of the “triple helix model”. This triple helix model postulates that the interaction in university-industry-government is the key to improve the conditions for innovation in a knowledge based society. During the past centuries the institutional spheres of university, government and industry were relatively separate and distinct but have become inextricably intertwined, often through governmental initiatives (Etzkowitz, 2001). Therefore the model denotes a transformation in the relationship among university, government and industry as well as within each of these spheres. As institutions increasingly take the role of the other, the traditional match of institution to function is superseded (Etzkowitz, 2003). Formerly these institutional spheres operated at arms length in most societies, nowadays these functions are increasingly interwoven with a spiral pattern of linkages emerging at industrial policy-making processes (Etzkowitz, 2000). The concept of this model was initiated by Etzkowitz and Leyersdorf, but includes encompassing elements of precursor works by Lowe (1982) and Sábato and Mackenzi (1982).

Currently it appears that the second academic evolution is emerging. This second academic revolution integrates the third mission by contribute to economy, with the traditional teaching and research functions into an entrepreneurial university (Etzkowitz, 2000). The emergence of the second academic evolution is reflected in the trend that increasingly scientists are examining their research for its technological and economic potential. Often encouraged by technology transfer offices and the requirements of government granting programs for the support of their research (Etzkowitz, 2000).
Appendix III: Underlying concepts of the concept of corporate entrepreneurship

Intrapreneurship

Pinchot (1985) labeled "Intrapreneurship … as entrepreneurship inside of the corporation.", which is inline with Knight (1987) which stated that "An intrapreneur is a employee who: ... introduces and manages an innovative project within the corporate environment, as if he or she were an independent entrepreneur" (Hisrich, 2001). Intrapreneurs are any of the “dreamers who do”. Those who take hands-on responsibility for creating innovation of any kind within an organization. They may be the creators or inventors but are always the dreamers who figure out how to turn an idea into a profitable reality (Macrae, 1982).

"The Macintosh team was what is commonly known as intrapreneurship; only a few years before the term was coined—a group of people going, in essence, back to the garage, but in a large company."

Steve Jobs – Time Magazine – 1985

Corporate venturing

Corporate venturing refers to the new-business-venturing dimension to pursue and enter new business related to the firm’s products and markets (Hisrich, 2001). The definition of corporate entrepreneurship implies that firms have characteristics of new business, however they are different from established business. Corporate venturing exploits new markets, or new product offerings, or both. However these venturing efforts may or may not lead to the formation of new organizational units that are distinct from existing organizational units in a structural sense (e.g. a new division) (Sharma & Chrisman, 1999). However some authors have proposed to separate corporate venturing in a distinct unit within the firm (Harrel, O’Reilly & Tushman, 2004, Mason & Rohner, 2002). These internal or external ventures are faster and better at exploring and exploiting new knowledge (Tushman & Anderson, 1990). Other differences between new business and established business include focus on value creation, exploitation of existing capabilities and operating excellence of established firms (Mason & Rohner, 2002).
Corporate venturing can be split into internal and external corporate venturing. External Corporate Venturing refers to activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organizational domain. These are firms that are the result of joint ventures, spin-offs, and venture capital initiatives, which all reside outside the domain of the existing organization (Sharma & Chrisman, 1999). Logically follows that internal corporate venturing refers to the corporate venturing activities that are the result of the creation organizational entities that reside within an existing organizational domain (Sharma & Chrisman, 1999).

**Strategic renewal**

Strategic renewal refers to the process of transformation of corporations through a renewal of their key ideas. This involves the creation of new wealth through new combinations of resources (Guth and Ginsberg, 1990). Zahra (1993, 1996) states that renewal has many facts like redefining the business concept, reorganization and the introduction of system wide changes in favor of innovation. Zahra argues that this renewal is achieved through the redefinition of a firm's mission through the creative redeployment of resources, leading to new combinations of products and technologies.

Most important is that these corporate entrepreneurial efforts result in significant strategic and structural changes. The activities of strategic renewal rise within an existing organization and are not treated as new business by the organization (Sharma & Chrisman, 1999). Wielemaker et al (2000) argue that many scholars have described many organizational forms conducive to strategic renewal, such as the virtual corporation (Davidow and Malone, 1992), the dynamic network corporation (Miles and Snow, 1986), the hypertext corporation (Nonaka and Takeuchi, 1995), the platform organization (Ciborra, 1996) and the Shamrock organization (Handy, 1995). Most of these examples highlighted a form found in a specific corporation, rather than descriptions of entrepreneurial forms in general (Wielemaker et al, 2000). Wielemaker instead proposes to use Volberda’s framework called Flexibility Audit andRedesign Model (Volberda, 1996). Based on two dimensions Volberda (1996) determines the organizational form. The first dimension is the repertoire of managerial capabilities that deal with the existence of a diverse range of management capabilities that facilitate renewal. These capabilities should consist of current capabilities and not yet activated capabilities. The emergence of
opportunities or threats requires management to have potential capabilities as a backup when renewal is necessary. The second dimension is concerned with the organization’s responsiveness, which is determined by the firm’s organization’s technology, structure and culture. This framework differs from previous work on corporate entrepreneurship by combining various models that have been based on findings in different firms and trajectories. The framework is of a general and open nature and therefore takes into account that renewal in multi-unit firms involved top-down and bottom-up initiatives, large and small-scale initiatives and various organizational sub-forms of renewal (Volberda, 1996).
Appendix IV: The concept of the entrepreneurial university versus the concept of academic entrepreneurship.

Important to note is that in the existing recent literature there is a division of two concepts regarding this topic: literature about the entrepreneurial university and literature regarding academic entrepreneurship. Both are strongly connected however there are some (minimal) differences. In this thesis the focus is on the first concept, however to give a complete overview of the literature and to describe the current state of the first concept it is important to highlight the concept of academic entrepreneurship as well. Therefore in this section the concept of academic entrepreneurship is highlighted.

Under the umbrella of the concept of academic entrepreneurship numerous activities have been inserted, which have in common that these activities are being performed by an actor who is dissatisfied with the current situation and is actively working towards changing it (Cantaragiu, 2012). There is a wide body of research conducted with unanimously accepted definitions, however the studies are hardly linked. Cantaragiu (2012) therefore suggested a definition of this concept to distinguish it from other forms of entrepreneurship such as social, scientific or commercial entrepreneurship. He suggested the following definition: academic entrepreneurship is a practice performed by academics with the intention to transfer knowledge between the university and the external environment in order to produce economic and social value both for external actors and for members of the academia, and in which at least a member of the scholars maintains a primary role (Cantaragiu, 2012). This definition clearly refers to the variety of ways in which academics go beyond the production of potentially useful knowledge (Henrekson et al, 2000). By undertaking a range of initiatives to facilitate and commercialize knowledge, academics try to ensure successful commercialization of their knowledge (Meyers et al, 2011). For further research in both directions, Cantaragiu, (2012) indicated that research should strive to better understand the dynamics between individual initiatives and institutional policies and to elucidate the means through which these two forces are allowed to combine instead of cancelling each other.

Academic entrepreneurship is more about academics putting knowledge to work by contributing to the economy, while the concept of the entrepreneurial university goes beyond the academic as the initiator, actor or the subject of putting knowledge to
Appendices

work. The concept of entrepreneurial university tries on a higher level to contribute to a more entrepreneurial behaving university. In this concept the initiator or actor is the university as an entity itself. The concept of the entrepreneurial university brings many stakeholders and systems into play regarding the institutional environment with its systems/processes, policies, functions and structures. Therefore it is not surprising this term has been adopted by policy makers to describe universities that effectively deliver on the third mission (Clark, 1998; Van Vught, 1999). To read more about the third mission, please read appendix II.
Appendix V: Clark’s five characteristics of the entrepreneurial university.

Clark (1998) identified the following five characteristics, which he referred to as “elements” of the entrepreneurial university;

<table>
<thead>
<tr>
<th>#</th>
<th>Explanation of characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>An “expanded developmental periphery”. This involves research transfer centers, joint ventures with industry, spin-offs, tailored educational and training programs for industry partners.</td>
</tr>
<tr>
<td>C2</td>
<td>A “diversified funding base”. Universities have three streams of income: funds regarding institutional support from government, funds regarding governmental research and all other sources lumped together as “third stream income”. Clark argues that instead clinging on the first stream of income, a shift is needed to all three together. By diversifying the income streams the university can move ahead on desired initiatives without waiting for system wide enactments that come slowly with standardized rules attached (OECD, 2011). This involves looking for alternative streams from local, regional and supranational public agencies, NGOs, revenues from student services, and alternative platforms such as e-learning, symposia and networking events.</td>
</tr>
<tr>
<td>C3</td>
<td>A “strengthened steering core” with decision-making authority and autonomy, professional and accountable (C3). This element embraces central managerial groups and academic departments. Internal decentralization is the main road to strengthened steering. Another important element regarding this characteristic is the dimension that stretches from highly personal leadership to highly collective or group-based leadership. Clark (OECD, 2012) states in later work that extremely personalized forms of leadership do not endure universities and cannot be a permanent feature in entrepreneurial universities. Instead strengthening particular line authority positions, for example those of the faculty deans, rectors and department chairs, should enhance the steering core (OECD, 2012).</td>
</tr>
<tr>
<td>C4</td>
<td>A “stimulated academic heartland”. This involves an environment in which purposeful scholarly work is recognized, encouraged and innovative,</td>
</tr>
</tbody>
</table>
collaborative research is pursued and remunerated according to its relevance.

| C5 | An “integrated entrepreneurial culture”. This is represented by a strong set of beliefs, principles and consistent practices, all of which “ought not to be treated independently of structures and procedures through which they are expressed, thus an institutional perspective is required”. |


Table 8: Clark’s five characteristics of the entrepreneurial university
Appendix VI: Etzkowitz’s five characteristics of the entrepreneurial university.

Etzkowitz (2000; 2004; 2012; Zhou and Etzkowitz, 2006) identified the following five characteristics of the entrepreneurial university:

<table>
<thead>
<tr>
<th>#</th>
<th>Explanation of characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>The “capitalization of knowledge”. The capitalization of knowledge becomes the basis for economic and social development and of an enhanced role of the university in society. Knowledge is created and transmitted for use as well as for disciplinary advance.</td>
</tr>
<tr>
<td>E2</td>
<td>“Managing interdependence with industry and government”. This clearly relates to Etzkowitz (2000 &amp; 2012) triple helix model. The entrepreneurial university interacts closely with the industry and government sphere. A university is not an ivory tower isolated from society (Etzkowitz, 2000).</td>
</tr>
<tr>
<td>E3</td>
<td>“Being nevertheless independent of any particular sphere”. Etzkowitz (2004) is here referring to the fact that the entrepreneurial university is a relatively independent institution. It is not dependent creature of another institutional sphere (E2). A university can become an entrepreneurial university if the university has some control over its strategic direction. To act entrepreneurial, a university needs a considerable degree of independence from the government and industry but also a high degree of interaction with government and industry.</td>
</tr>
<tr>
<td>E4</td>
<td>Being “hybrid”, by managing the tension between independence and interdependence. This involves that the resolution of the tensions between the principles of interdependence and dependence are an impetus to the creation of hybrid organizational formats to realize both objectives simultaneously.</td>
</tr>
<tr>
<td>E5</td>
<td>“Embodying reflexivity”. This involves continuous renewal of internal structures of the university as its relation to industrial and governmental changes, and of industry and government as their relationships to the university are revised.</td>
</tr>
</tbody>
</table>

Table 9: Etzkowitz's five characteristics of the entrepreneurial university
Appendix VII: Etzkowitz’s & Leydesdorfs 7 types of universities.

Etzkowitz & Leydesdorff (2000) propose that there will be a far greater variety across higher education institutions. Overall, they propose that seven types of universities will emerge (including the entrepreneurial university):

I. General universities combining teaching and research.

II. New hybrid universities. Combining the advantages of traditional “bricks and mortar” universities with the Open University models, by delivering the ability to educate at a distance. So called “Bricks and clicks” universities will emerge.

III. Specialized universities, particular teaching-only institutions.

IV. New private universities will emerge in Europe. Particularly in Central and Eastern Europe but also in countries like Germany where nine such institutions are being created (Pearson, 2000).

V. Networked university, either involving vertical integration of further education colleges with a university to form an integrated supply chain or horizontal integration of similar departments across several institutions working together and linked electronically.

VI. More mergers and acquisitions in the university landscape.

VII. Spread of the entrepreneurial university, predicted by Etzkowitz (1997). These institutions are giving considerable emphasis to the third function of contributing to the economy as well as to teaching and research.

(Etzkowitz et al, 2000)
## Appendix VIII: Universities on the leading edge of the concept of the entrepreneurial university

<table>
<thead>
<tr>
<th>University</th>
<th>Ch.</th>
<th>Elucidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT</td>
<td>S1</td>
<td>Top spinoff generator with specific aim at third mission. A number of organizational structures and practices facilitate commercialization of research (e.g. TLO, the Sloan School Entrepreneurship Center, the Deshpande Center for Technological Innovation, Entrepreneurship Development Programs, and inter-disciplinary Research Centers). Commercialization is considered an automatic and natural consequence of research activity (O’Shea et al, 2007).</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>Independent, coeducational, and privately endowed institution. It has a long history of partnership with the social and economic development of the state of Massachusetts. Clearly over a long period of time the university has developed informal internal and external networks between government and industry. Interesting to note is that partnerships with industry do not involve a federal component (O’Shea et al, 2007).</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>Just a few changes of the internal structure were identified, being entrepreneurial was assumedly present early in this university. Over time this university has a long tradition of industrial and military funding, which has led to commercially oriented innovations. Interesting to add is by sustaining faculty entrepreneurship in this university, policies supportive of commercialization have evolved. These very strict policies guide MIT to prevent conflict of interest for technology transfer, as well as they are applied to start-up activities. Faculties are for example required to report all outside consulting activities with start-ups (O’Shea et al, 2007).</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>To create the university spinoffs, the university is able to attract large financial resources to fund leading-edge science and engineering research, while in addition a large absolute amount of funding flows</td>
</tr>
<tr>
<td>Stanford University</td>
<td>S1</td>
<td>Stanford is fundamentally a research university (Lenoir, 2004) but focuses clearly on the third mission by creating a research base with commercial potential. Interesting to note that in the 1930’s the regional electronics industry was flourishing, fed by electronics programs at Stanford. Since this impetus, industry and university grew in tandem (Etzkowitz, 2002).</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>Lenoir (2004) summarizes clearly and concise the relationship between government and industry as follows: this university focuses</td>
</tr>
</tbody>
</table>
on attracting and retaining the scientific and engineering talent most capable of winning federally funded research grants and contracts and use those funds to support cutting-edge research that stimulates industrially relevant technology, which in turn reinforces the capability to do more and better research. Next, rather than exploiting the patent positions to specific firms to exclude access, the university served as a repository of economically useful knowledge that was made available to all of the firms in the region (Etzkowitz, 2002). Their invention disclosures and patented inventions brought in 595 million dollar from 1970 – 2003, while the total research costs were in 2002; 400 million dollar. Thus while it is successful in generating revenues from licensing, the sum of that total activity is relatively small in comparison with the research needs (Lenoir, 2004).

| S3 | The university took the collective entrepreneurial role by organizing the intellectual property generated in the university and in firms related to the university in a common project (Etzkowitz, 2002). Overall this university developed organizational mechanisms to move commercializable research across institutional borders (Lenoir, 2004). |
| S4 | From the work of Etkowitz (2002) and Lenoir (2004) conducted is that this university has not a diversified funding base. The primary, and almost exclusive source of its research budget is the government. In addition the past few years an increasing but relatively small amount of Stanford research has been funded from its own endowment and from revenues derived from patent and licenses. Surprisingly therefore very little direct financial support for research comes from industry. From a financial perspective, most of its revenues flows in from federal grants and contracts (Lenoir, 2004). Interesting to note is that Stanford also commercializes land or and property to bring income, it even has its own shopping center (Lenoir, 2004). |
| S5 | This university established research centers bringing together scientists and engineers to accomplish a research goal (Etzkowitz, |
This university has evolved a highly effective strategy for staying on the cutting edge of the research front (Lenoir, 2004). To stay in front of the wave, this university focuses on attracting and retaining the scientific and engineering talent most capable of winning federally funded research grants and contracts. Next there is an environment that encourages interdepartmental and cross-school collaborative work. These collaborations have been fundamental in producing startup companies focusing on convergent technologies (Lenoir, 2004).

This university embraces a culture that emphasizes entrepreneurial leadership. Scholars were expected to act more like an industrial research manager organizing a group of subordinate researchers to achieve a common end (Etzkowitz, 2002). Overall Lenoir (2004) states that on the one hand this university has evolved as an entrepreneurial, highly flexible institution that actively seeks to absorb new technological and scientific breakthrough areas and focuses elsewhere and turn them into scientific research areas worthy of federal research support.

To fully understand this case it is important to acknowledge that in 2010 the Aalto University was established following the merger of the Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki. “Without the merger, the original three would have continued as they were for hundred years”, was one of the interviewee’s reaction of Graham (2014). Before the merger big companies were expressing their concern that higher education was not globally competitive. Change was needed in order to sustain and to tackle the lack of talented people. A new university ecosystem was needed. To create this new university by merging three universities, government agreed to back industrial support by guaranteeing that every euro flowing in from industry would be supplemented with 2.5 euro from government. In total 700 million euro was gathered plus real estate made available for the
university site was acknowledged to be, “a massive investment for a country of this size”. This massive funding was also possible due to the business and government ecosystems the universities participated into. Serial entrepreneurs, government funding agencies and investors were located in this Helsinki area (Graham, 2014).

Currently the Aalto University is working to establish an even closer and more formalized partnership with Finnish industries in order to engage in dialogue with the sectors of working life it serves while accomplishing its missions as the scientific research university and the provider of basic and post-graduate education and also through its societal role and other forms of the third mission (Markkula & Lappalainen, 2009). The university clearly communicated a two-fold purpose to the outside world, on the one hand fostering innovations with practical relevance is flagged up, while on the other, ambitious academic research aimed at publications in international “top-tier” journals is accentuated (Aula & Tienari, 2011).

However, despite corporate demands and university’s third mission as a societal developer, scholars in many areas neglected their role as a detector of phenomena, thereby failing to interpret signals within industrial environments sufficiently to provide corporate operators with predictions, forecasts and guidelines helping companies to deal with future trends and innovations up to the level of radical innovations (Markkula & Lappalainen, 2009).

S2 Before 2010 very important were the close ties between big companies (e.g. Nokia) and university departments. Their educational curricula was therefore super concentrated how to work for big companies and students wanted to work in the public sector or big companies. One relatively small university departments was different however, the department Industrial Engineering and Strategy where hands-on, technology-driven entrepreneurship was the norm.

Overall, before 2010 Aalto was able to benefit from ongoing support from government for innovation and entrepreneurship. Later this
<p>| S3 | While the university benefited from the existing concentration of R&amp;D capacity and links with big companies it faced formidable cultural and structural problems in developing a vibrant ecosystem. To support the needed change of internal structures, the university’s senior management has been a vocal supporter of the entrepreneurship movement at Aalto from the earliest stages of its formation. Interesting to note that they supported without an explicit university policy on entrepreneurship. Currently Aalto is actively investigating strengthening its incentive schemes to align academic excellence with innovation and entrepreneurship activities (Graham, 2014). |
| S4 | Before the merger, there was a lack of venture capital. Finland struggled to achieve the critical mass of new ideas and new people to get the investors interested. Due to the government funds flowing in, income generation for the university has been, and remains, secondary to capacity building. The university is therefore focused on supporting regional startups instead of developing and securing IP or RoI (Graham, 2014). |
| S5 | Around the early 2000s the leading Finland’s universities became increasingly vocal in their calls for greater autonomy, to move away from a model where “university budgets were just state budgets and university presidents were just civil servants”. This helped them to create autonomy, which was followed by Aalto senior management strategy to “support but not direct” entrepreneurial activities within and outside the university. This was a vital factor that allowed the student-led movement, and its integration with the local entrepreneurial community, to develop organically while, at the same time, offering it strong support. This is seen as integral to the success of it’s current ecosystem whereby access to senior management would be unlikely in an |</p>
<table>
<thead>
<tr>
<th>Appendices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S6</strong> The location of the Aalto university is in the 4km² Otanieme region of Espoo, where around one half of the R&amp;D activities in Finland are undertaken in the 4km² Otaniemi region of Espoo. In this small region 25 research centers and higher education institutions were build on decades of investment by the Finnish government in the national innovation infrastructure (Graham, 2014). The aim of the merger was to form an institution that hosts world-class studying, teaching and research activities (Graham, 2014).</td>
</tr>
<tr>
<td><strong>S7</strong> Prior to 2008 the Finish national attitude towards entrepreneurship was even seen as hostile. Overall the finish culture is not supportive of risk-taking and entrepreneurship. Despite this national culture, an egalitarian grassroots movement led by uniquely talented individuals took place, which is impressive, but probably even more impressive is that it was almost entirely student-driven, bottom-up. This change in young people's attitude was directly attributable to the emergence of the Aalto University ecosystem. Very interesting to observe in this case, is the speed of the transition which was almost entirely student-driven (Graham, 2014; Aula &amp; Tienari, 2011).</td>
</tr>
<tr>
<td><strong>Chalmers University of Technology S1</strong> The institution started as a private industrial school in 1829 with a strong scientific orientation. In 1937 Chalmers was absorbed into the Swedish state-owned system but opted out in 1994 to become a private foundation and technical university but still receives public funding. The developmental periphery ranges from incubators to spin-off company, from special innovation courses, from industrial contact groups and a major science park. In the past two decades the university prioritized research that could support the revitalization of the Swedish innovation system and the creation of an infrastructure that could facilitated and support the commercialization of university based research. On the other side due to the fact that</td>
</tr>
</tbody>
</table>
traditionally this university was strongly funded with public money, there is/was a tension towards the third mission: between those who see research as a public good and those who focus only on the need to integrate university based knowledge production with the rest of the economy (Jacob et al, 2003).

**S2** Overall due to the privatization this university was much less dependent on government compared to state-owned universities in Sweden. However the cooperation with industry has been traditionally linked very strongly. In 2003 the university appointed a vice principal with the responsibility to co-ordinate university-industry relations. (Jacob et al, 2003).

**S3** Chalmers started activities to strengthen entrepreneurship and innovation with a chair in the Chalmers Innovation Centre (OECD, 2012). Very interesting to note is that Chalmers administrators and academics looked to US universities, particularly to Stanford and MIT, in order to legitimate it's early efforts to transform itself (Jacob et al, 2003).

**S4** Overall the funding from the Swedish public sector has traditionally been substantial (Jacob et al, 2003). In 1994 the Government provided Chalmers with a loan to start-up various spin-off activities. (OECD, 2012). Next Clark describes two features that developed the entrepreneurial university especially compared to other Swedish universities. He states that this was due to strong alumni relations and fundraising campaigns. This latter feature is two decades later still seen as a success (OECD, 2012). Another important event was the privatization of the university. By it’s privatization this institution was able to accumulate capital from the various entrepreneurial initiatives that had been part of the university’s landscape over the last two decades (Jacob et al, 2003). Interesting to note is that researchers in Sweden, like in most other Nordic countries, have sole ownership of any IP that may accrue from research in which they engage (Jacob, et al, 2003). Assumable this makes it more difficult for the university to create new money flows regarding selling patents.
Clark (1998) noted in early work that this university exhibited in 1995 a greater systematic capacity to steer itself than it had possessed fifteen years earlier. This was due to the fact that privatization was seen as a move that would afford Chalmers much longed for autonomy in its teaching and research but more importantly in developing its innovation infrastructure (Jacob et al, 2003).

Not much was written regarding this core characteristic regarding the university of Chalmers. However interesting to note is that the university created a two-sided market for entrepreneurial talent and inventions and let students and university inventors match up to commercialize university inventions (OECD, 2012).

Chalmers prides itself on being a university where individual initiative on the part of students and/or faculty is highly valued. This is also seen as one of the reasons that it was so easy to develop an entrepreneurial culture (Jacob et al, 2003). This can also be seen back in the amount of alumni who start their own business: 42% (Dahlstrand et al, 2010). Next the university builds on a learning entrepreneurial community of young graduates and promotes working with start-ups as a viable alternative career choice. On other hand Jacob et al (2003) state that there was argued that many members of faculty did not even possess the most rudimentary knowledge necessary for engaging in entrepreneurship.

This university is involved in entrepreneurial activities for over 30 years (Ranga et al, 2003) and made the transition towards an entrepreneurial university that refers to the increasing tendency to run the university as a quasi-business. Clearly the university links research, education and industry activities together to affect the whole knowledge system. It collaborates therefore with local SME’s as well as major international firms and benefits from regional structures like the laboratory for advanced research in
| S2 | The science and industry partnerships has increasingly gained visibility since 1980 due to the gradual shift from labor intensive industry and natural resource-based growth to innovation and knowledge-driven growth based on ideas, information and intellectual capital (Drucker, 1993). Alongside the importance of government as a third partner is more recently added to this mix. |
| S3 | Due to the scarce amount of available literature regarding this core characteristic in this university, it is not meaningful to elaborate on this characteristic. |
| S4 | Their TTO has grown to provide 24% of the universities R&D budget via contract research activities. A driving force for the university to forge broad alliances between university and industry was because of the increased competition for funds and search for alternative funding sources. Some pioneer research groups, led by a few academics with broader entrepreneurial experience acquired during their US doctoral or other training stages, created remaining until present the most productive university industry research groups within the university (Ranga et al, 2003). |
| S5 | Each faculty has its own board and develops its own strategy, no formal hierarchical structure whereby each professor is free to design his or her research agenda. The system relies on interdisciplinary research divisions and on the progressive inclusion of the TTO goals in research culture (OECD, 2012). From the start of the TTO (LRD) has received a large amount of budgetary and human resource management autonomy within the university itself (Debackre, 2000). |
| S6 | Since 1995 academics gained the right to retain profits from academic-knowledge based patents, licenses and other IP and next were allowed personal and financial involvement in university spin-offs. Interesting to observe is that researchers belonging to different departments at the university or even belonging to different faculties |
can decide to join forces and to integrate the commercial-industrial component of their R&D portfolio in a research division at the TTO. As a consequence, the research division concept introduces a de facto interdisciplinary matrix structure within the university, which does not happen without any tensions given the professional bureaucracies universities that are normally present according to Debackre (2000). There is a well-balanced system present to manage and monitor contract research in the area of industrial innovation (Debackre, 2000).

The findings from Ranga et al (2003) show a significant increase of publications produced that have stimulated academic entrepreneurial behavior. Their researchers have developed a record of applied publications without affecting their basic research publications and, rather than differentiating between applied and basic research publications, it is the combination of basic and applied publications of a specific academic group that consolidate the group’s R&D potential (Ranga et al, 2003).

Table 10: **Universities on the leading edge of the concept of the entrepreneurial university**
Appendices

Appendix IX: Best practices of corporate entrepreneurship

7.1.1.1 IBM

<table>
<thead>
<tr>
<th>Firm</th>
<th>Elucidation</th>
</tr>
</thead>
</table>
| IBM  | IBM was founded in 1911 by the merger of three companies. Under Watson Jr., IBM became the world’s dominant player in the fast growing IT industry, having their well known dark-suited salespeople a strong culture of corporate pride and loyalty and an implied lifetime employment. Their position was so dominant that during the 1960’s IBM became the target of an unsuccessful 13-year-long antitrust action by the US department. In 1990 IBM was the second most profitable firm and everybody wanted to work at IBM (Applegate et al, 2005).

Less fruitful was IBM’s future around 1991, their earnings dropped by a staggering 2.9 billion dollar. Even in 1993 their earnings decreased: a 16 billion dollar loss and 75.000 people were laid off. However in 1995 the firm was back in solid financial footing, however Compaq and Dell stole their market share in the mean time. IBM was a sleeping giant, which has lost his golden egg (Applegate et al, 2005).

A person vital in the process of leading IBM through this crisis was Gerstner, the CEO of the firm at that time. He was an executive with no technology background, insiders were therefore afraid that he came to break it up for sale and not to rescue the firm (Applegate, 2005). Next to cost cutting, globalizing and redesigning operations, killing sub brands, decreasing the sales organization, creating a customer focused strategy throughout the firm and shifts in product portfolio, Gerstner was the one who identified that managers had a difficult time to exploit growth opportunities in favor of IBM. Even innovation was focused on improving existing lines of business. Gerstner for example found out that funding for one of his key new-business initiatives in Life Sciences had been cancelled by line management in order to contain short-term costs, he “blew his stack.” (Harreld, O'Reilly & Tushman, 2009). The head of corporate Strategy found the similar pattern across the board. As Harreld, O’Reilly & Tushman et al (2009) stated that this had to do with the fact that
the majority of the IBM employees focused on selling current products and serving current customers, clearly a focused was needed on future products and serving future customers. IBM was focused on defending their existing leadership position instead of creating the next one. Harreld, O'Reilly & Tushman (2009) main point was that organizations need to be ambidextrous, which implicates that organizations need to both explore and exploit are more likely to adapt than organizations that can only exploit or explore. However another important learning point was stated.

To create a solution for this problem, Gerstner advocated dividing the firms's portfolio in three horizons, inline with the book: “The Alchemy of Growth”. Horizon 1 consisted of business that were mature and well established, as Horizon 2 business were on the rise and experiencing rapid growth while Horizon 3 business were emerging and represented as the “seeds of a company’s future strategy”, also referred as Emerging Business Opportunities (EBO). According to Gerstner each horizon required different leadership and governance and execution strategy. IBM was failing especially at Horizon 3, mainly due to the lack of experienced entrepreneurial leadership and processes caused most of these new IBM businesses to fail (Harreld, O'Reilly & Tushman, 2009). By creating this clear division throughout IBM with it’s subsequent horizons, IBM clearly wanted to behave more entrepreneurially. Especially the EBO businesses were able to pursue and behave in a more corporate entrepreneurial manner. Important key principles for the success of IBM's EBO were active & frequent senior level sponsorship, dedicated A-team leadership, disciplined mechanisms for cross firm alignment, resources fenced and monitored to prevent cuts, actions linked to critical milestones and quick start, quick stop if needed (Harreld, O'Reilly & Tushman, 2009).

Concluded is that Inline with the encompassing definition of entrepreneurship, IBM's EBO strategy was focused on the process of creating value by bringing together a unique combination of resources to exploit an opportunity (Schumpeter, 1934; Kirzner,1973). This strategy mastered IBM to get back to what set them apart. IBM is an innovation. IBM is at it's best when IBM creates value that our clients cannot get from anyone else (Gerstner, 2011).
3M was founded as the Minnesota Mining and Manufacturing Company back in 1902 and is best known of its innovative products. It's most successful product flexible sandpaper, still forms an important part of its product line but now comprises of over 60000 products that range from adhesive tapes to medical supplies. In 2013 the firm made a revenue of 29.6 billion dollar and employed over 88.000 people (secdatabase.com, 2014).

Already in 1920 3M tried to make innovation part of their corporate culture. Therefore 3M developed a policy that allowed internal researchers to spend up to 15 % of their time working on their own projects, also known as the “Bootlegging Policy” (3m.com, 2014). To help succeed these internal projects, 3M supports the projects with money for resources or to hire extra labor. To get an idea accepted for the Bootlegging Policy, the idea needs to be backed by a member of the main board. If the idea is accepted, an interdisciplinary team of engineers, marketing specialists and accountants are set-up to take the idea a step further. A famous example of this policy is the Post-It Note by Art Fyre in the 1980s. Art spotted a new market for the technology 3M developed.

3M’s culture can best be described as non-political, low ego, egalitarian and non-hierarchical as well as hardworking and self critical. Above all 3M is achievement orientated will often be rewarded with promotion (3m.com, 2014).

Today 3M faces many challenges, including sustaining their reputation for innovation. As the firm became larger and more complex, it was involved in different markets with different products and technologies and as a result had to deal with stiffer competition. Due to this competition it reached a pointed whereby the 20% policy was under severe pressure. Nowadays it is more an attitude rather than a reality. Nevertheless 3M has successfully practiced corporate entrepreneurship over a century (Burns, 2001).

| Google | Larry Page and Sergey Brin founded Google at Stanford University in 1995. They build a search engine, initially called Backrub, which used links to determine the importance of individual webpages. Later they renamed |
the search engine they built to Google, a mathematical term for a 1 followed by 100 zero’s (Google, 2014B). To illustrate their growth over the years, the firm announced in 2013 that the annual revenue of 2012 consisted of almost 60 billion (!) dollar and at the end of Quartile 4 2013 Google employed more than 47.000 employees (Google, 2014A).

In May 2009, Sergey Brin and Larry Page were trying to determine how to navigate Google through the recession. Their main problem was to maintain the firm’s culture of innovation in the face of stagnant profits. An important aim was to increase corporate entrepreneurship and innovation in their firm during a recession they have never experienced before (Finckle, 2012). As a result the firm had to fire employees for the first time in history. To make things worse, employees left for a variety of reasons: too much bureaucracy, low pay and benefits, high cost of living in the bay area and desire to start their own business (Finckle, 2012).

The recession shook Google awake, a new competitor was born, the recession itself. Google always believed that the best way to stay on top of the market and remain competitive over the long term is to promote, foster and invest in entrepreneurial innovation throughout the firm (Copeland, 2011). By upholding this strategy, Google dealt with the economic environment, however an important lesson was learnt. Important aspects of their entrepreneurial strategy are the flat organization structure, generous rewards and recognition for successful innovation and the 20 percent time policy. Google's flat organizational culture consisted of a minimum of management layers and communication channels were tried to keep as narrow as possible so people could act quickly (Finckle, 2012). Google’s own employees contributed to the flat organizational culture because Google tried to hire people that were able to manage themselves: “Our management philosophy amplified that quality employees who are motivated do not need to be managed.” (Copeland, 2011; Finckle, 2012). Another important aspect is Google’s generous rewards and recognition for successful innovation. Google employees earned a base salary that was on par with, or slightly lower than the industry average. However the financial upside could be much, much bigger for those that came up with a profit-pumping idea (Hamel & Breen, 2007; Finckle, 2012). The largest
Another important entrepreneurial effort that pursued Google’s entrepreneurial culture, is Google’s 20 percent time policy, which is similar to 3M’s “Bootlegging Policy”. The 20 percent time policy enabled employees to spend 20% of their time on whatever they were passionate about by promoting ideas to colleagues, assembling teams, exploring concepts and building prototypes (Fincke, 2012). If there was a winner, the team appealed to Google Product Council for funding and resources. Google, unlike IBM, did not apply preconceived criteria or hurdle rates for these projects. As long as the project appeared to have potential the interest in the project maintained. Google’s managers estimated that about 70% of these projects support Google’s core business, 20% represent emerging business ideas and 10% pursue speculative experiments (Copeland, 2011; Wolcott 2007; Steiber, 2013)

Wolcott (2007) described Google’s corporate Entrepreneurship model as the enabler model. The basic premise of the enabler model is that employees across an organization will be willing to develop new concepts if they are given adequate support. Inline with Wolcott, Copeland (2011) argues that vital for this strategy that it requires significant commitment, investment and participation from all functions and areas of the firm (Copeland, 2011).

Gerard Philips and his father Frederik founded the fundamentals of Philips in 1981. A few years later Gerard’s brother strengthened the firm. Philips was a great commercial talent and within a few years Philips belonged to the largest producers of light bulbs in the world. Stimulated by the Industrial Revolution in Europe, the firm started introducing its first innovations in the x-ray and radio technology. The list of inventions has only been growing focused to enrich people’s everyday lives (Philips.com, 2014). Currently Philips is organized in three main divisions, Philips Consumer Lifestyle, Philips Healthcare and Philips Lightning, and employs over 114,000 staff and reached a revenue over 25 billion euro in 2012.
More recently, conforming to IBM’s problem, was that Philips was also primarily focused on selling current products and serving current customers instead of finding new technologies that did not fall within the specified remit of the operating divisions. However Philips wanted to promote entrepreneurial-style innovation. Therefore Ad Huijser was appointed as Philip’s CTO with the quest to let Philips actively pursue new technologies outside of Philips current business field. He believed that sustainable firm growth was only achievable through moving into ‘really new areas’ and that to develop its own growth engine, Philips needed to enter new markets with new technologies that were new to the firm. Therefore Huijser decided to create and actively support an internal incubator. The aim of this incubator was to nurture those ideas and nascent technologies that had been developed by its employees but which otherwise would not be selected for commercialization. To become part of this incubator the potential ventures need to demonstrate the following entry selection criteria: the protect ability of the intellectual property governing the technology, the potential of the technology to create a 100 million market, the potential disruptiveness of the technology to an industry, the strategic alignment of the technology with Philips’ long-term corporate strategy and a motivated and capable team. Noticeable are the relative high similarities with IBM’s EBO selection criteria. From 2002 and mid-2007 20 proposals were made by project teams, and 11 achieved all criteria and were truly admitted (Ford et al, 2009).

Ford et al (2009) stated that while the incubator resembles a VC-type model, a far larger proportion of teams that approached the incubator managers looking to receive funding were successful than would have occurred if they approached venture capitalists. An important conclusion Ford et al (2009) took was that fluctuations in the business cycle for entrepreneurial ventures, not operating within a corporate context, have a major impact on their ability to rise funding and achieve growth. This ability of corporate incubators helped to protect corporate projects against financial setbacks. However this depends on the judicious combination of the resources of the larger established firm with the entrepreneurial verve of the new venture (Ford et al, 2009).
The Philips case highlighted a different model to stimulate corporate entrepreneurship by incorporating an incubator inside a large firm, which highlighted the financial profits of the corporate incubator.

| Xerox          | Xerox was originally founded in 1906 as the Haloid Photographic Company, which main business was to manufacture photographic paper and equipment. In 1938 Chester Carlson created an easier way to duplicate information on paper. Carlson was a physicist that actually invented a process of printing images using an electrically charged drum and dry powder “tone”. Ultimately, he revolutionized the way that information was shared and ultimately how office work gets done. He called his invention Xerography, of which the firm’s name is deducted (Xerox.com, 2014). This invention was commercialized in 1946 by Joseph C. Wilson. Currently Xerox is active in 180+ countries and employs 140,000 employees worldwide. In 2013 Xerox reached revenue of 21.5 billion dollar (Xerox.com, 2014).

The Xerox Corporation pursued an ambitious research agenda which was intended to support Xerox’s existing business through the creation of a more scientific understanding of its core technologies (Chesborough, 2003A). Therefore in 1970 Xerox established Xerox Palo Alto Research Center (XPARC). Their main mission in 1970 was “to create the architecture of information”. In this center researchers developed a new model based on each office worker having a desktop computer or what they called a “Workstation” (Von Burg & Kenney, 2002). In the next few years they developed the most important advances in personal computing since the semiconductor. An important advance was the development of the Graphical User Interface (GUI). This GUI consisted of a windowed environment, controlled by a mouse to reduce complexity (Chesborough, 2003A; Endogy, 2012).

From an organizational perspective XPARC clearly exhibited entrepreneurial elements. For example the XPARC business units were to a large degree independent, flexible and extremely productive (Endogy, 2012). However this case is often cited as an archetypal failure of corporate entrepreneurship (Holcombe, 2003; Savoia & Copeland, 2011;
Kenney & Von Burg, 1999). XPARC was a research driven firm, however the organization itself was not intended to generate sales revenue for Xerox, if only indirectly. Until the 80's Xerox did not realize that it's research teams, were not working on the same purpose as their parent (Endogy, 2012).

Next Xerox produced the technology and innovation but failed to capitalize on the entrepreneurial opportunity. An important factor was that as Xerox revealed their ideas to the world, other entrepreneurs made use of it and created their own ventures surrounding Xerox technologies and innovations. Xerox did not even recognize the market value of their innovation, but others did (Holcombe, 2003; Kenney & Von Burg, 1999). Some illustrating examples are the GUI and mouse Xerox developed (Holcombe, 2003; 2011, Etzkowitz, 2013; Kenney & Von Burg, 1999). Eventually, the mouse, developed by Xerox, was recognized by Steve Jobs as a potential input device and successfully popularized it. Next Xerox developed important pillars of the personal computers GUI, but Bill Gates at Microsoft built an operating system using Xerox’s ideas and became the richest man in the world (Holcombe, 2013).

Concluded can be that Xerox proved capable of producing innovative technologies. On the other side Xerox also proved incapable of capitalizing on the entrepreneurial opportunity, commercializing new technologies and lacked entrepreneurial insight. An important cause was that XPARC was solely a research driven firm which was not intended to generate direct sales for it’s parent firm.

| Polaroid | In 1926 Edwin H. Land leaves Harvard to pursue his work on light polarization. His work will be the base of the Polaroid Corporation, which will be founded later in 1937. Initially the main business focus was on Land’s invention on light-polarizing filters. In 1947 he became famous with its instant film camera’s, which eventually reached the market in 1948. From that point Polaroid focused on improving the instant camera and continued to be the firm’s flagship product line until the start of 2008 (Polaroid.com, 2014; Tripsas & Gavetti, 2000). Firm performance was exceptional, with an average annual profit growth of 17 percent between |
1948 and 1978. This period of strong performance culminated a clear set of firm capabilities and managerial beliefs, which had an intriguing impact on the firm itself and the upcoming years of innovation related to instant photography (Tripsas & Gavetti, 2000).

Polaroid was clearly a technology-driven firm. Land considered science to be an instrument for the development of products that satisfy deep human needs. Consistent with this philosophy, Polaroid management believed that the success came through long-term, large-scale research projects (Tripsas & Gavetti, 2000). Digital imaging was therefore viewed primarily as a technological opportunity, with the majority of digital imaging investment directed towards the development of new technical capabilities. This was also the reason why the firm continued to hold faith in the typical "razor" business model, while the digital photography market grew rapidly (Walrave & Gilsing, 2013). This business model was based on making the analog camera’s cheap in combination with expensive films.

Not due to the lack of technological skills, but due to management mistakes (Tripsas & Gavetti, 2000) and a non-entrepreneurial organizational structure the firm failed to respond successfully to new opportunities. An important factor that disabled Polaroid to keep up with their competition was due to the fact that managerial cognition influenced the evolution of capabilities and contributed to organizational inertia. From the literature no direct evidence can be found that Polaroid was clearly exhibiting entrepreneurial elements. However, clear points can be deducted from this intriguing case that are applicable to enterprises pursuing a corporate entrepreneurship strategy. Christensen en Overdorf (2000) suggests that already existing enterprises need to create a separate organization to develop radical innovations. This separation enables organizations to deviate from the often-unsuitable organizational culture of the parent firm. Next, Harreld, O’Reilly & Tushman (2009) states that firms need to become ambidextrous, which implicate that firms need to both explore and exploit. Clearly, Polaroid had difficulty to adapt to a radical technological change or to view in the eyes of an entrepreneur: exploiting the digital photography opportunity. From their insights I speculate that if the firm would have implemented a corporate
entrepreneurial strategy, whereby a separate and ambidextrous organization was created (as inline with the IBM and Google success cases), would have result in a more successful business case. This case clearly illustrates the importance of managerial cognitive representations in directing explorative search processes, capitalizing on entrepreneurial opportunities and the evolutionary trajectory of organizational capabilities.

| Table 11: Best practices of corporate entrepreneurship |
Appendix X: Organogram TU/e

Figure 9: Organogram TU/e
Appendix XI: An explanation of the most important stakeholders in the entrepreneurial ecosystem of the TU/e

Innovation, Technology, Entrepreneurship and Marketing group

This group is part of the department of Industrial Engineering & Innovation Sciences and contributes to research, educational and business program of this department whereby it focuses on New Product and Business Development Processes (ITEM-Eindhoven.nl, 2015).

Eindhoven Student Business Club

The aim of this club is to promote entrepreneurship among students and support their entrepreneurial endeavors by facilitating inspiring and informative lectures by successful entrepreneurs and network drink (ESBC, 2015).

Start-up Eindhoven

The business incubator of university whereby it aims to give starting entrepreneurs a soft landing in the market by providing everything you need to start and grow a business (Start-up Eindhoven, 2015). Important to note is that next to entrepreneurial students they aim at intrapreneurial students. The intrapreneurial activities are managed from Sure Innovation that offers high potential students the possibility to experience what it is like to work in the field that the students are educated in (Start-up Eindhoven, 2015).

Innovation Lab

The Technology Transfer Office of the university. The Innovation Lab is a department with a team of consultants, coaches and professors ready for staff, students and external parties to translate knowledge into business (TU/e 8, 2015).