

An Investigation of the Importance of Patents in Academic Entrepreneurship

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ABSTRACT:

University spinouts – commercial developments out of university research – for many years have been growing in importance in academic research. Current literature mainly focuses on the development of university inventions that have formal intellectual property (IP) protection in form of a patent. This study via a single case study approach qualitatively investigates the commercialisation process of an unpatented Maastricht University invention. Focus of the study is the importance of IP protection in form of a patent. The mere existence of a patent – so reveals this research – does not seem to primarily influence measurable business outcomes. Since the research was designed as an exploratory, qualitative single case study with additional interviews, the aforementioned results need to be tested on a larger scale.

KEYWORDS: spinout, academic entrepreneurship, patent, IP protection, (L26, O32, O34).

Introduction and Research Question

Previous studies have revealed that the capitalisation of academic research is getting more common, due to potentially high profits (Markman, Phan, Balkin, & Gianiodis, 2005). Current studies focus mainly on the commercialisation of scientific inventions that are protected by patents (e.g.: Abreu & Grinevich, 2013; Shane, 2004). This study investigates first, IP protection and second, as suggested by Fini, Lacetera and Shane (2010) the effects of non-formal IP protection only on business development. The single case investigated in this study is the commercialisation process of a Maastricht University (UM) invention.

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The case study

The undertaken investigations were designed as a single case study in the field of medical technology (MedTech). The product is an artificial vestibular system (AVS) in form of a belt that brings spatial coordination to people who lack the feeling of balance. The developing professor behind the invention is an otorhinolaryngologist and a well-known specialist in the field of balance and the vestibular system. He supports several research projects especially in the field of vestibular difficulties. One of his research ideas is an external artificial vestibular system (AVS) in form of a belt developed for people with a bilateral vestibular loss. The idea of a belt to train spatial orientation based on vibrotactile feedback is not new, already since 2003 BalanceTek holds a patent for a similar type of balance prosthesis in the United States of America (USA).

Maastricht Instruments (later referred to as technology transfer office, TTO) is a company owned by the UM Holding with the goal of commercialising on scientific inventions of UM. Besides investigating licensing opportunities for products developed by UM with already existing companies, the TTO also intends to support the development of new companies founded around the new inventions. Throughout the research process – collaboration over eleven months – the TTO supported the business case creation via a business developer, who served as a collaboration partner, and also a range of consultants. To facilitate support for the business case creation process there was also collaboration with the regional development agency (RDA), which additionally offered a support program to cover training and business case development costs.

Research Question and its Relevance

The development of university spinouts is a topic of growing academic interest (e.g.: Abreu & Grinevich, 2013; Chatterjee & Rossi-Hansberg, 2012; Fini et al., 2010; Grimaldi, Kenney, Siegel, & Wright, 2011; Malik & Mahmood, 2012; Perkmann et al., 2013; Shane, 2004). Core focus of the paper is to find out whether and to what extent IP protection in form of a patent is important for business success. The following research question evolved:

'How does the absence of IP protection in form of a patent influence the commercialisation of scientific inventions out of university research (academic entrepreneurship)?' In order to develop an academic theory, the research in this study is designed as a single case study based on observations, focus groups, interviews in the case (researchers, technicians, business developers at Maastricht Instruments (MI), manager of another spinout of Maastricht University which was founded in 2011, Xilloc Medical, 2014) and additional interviews

that support the theory development but are not directly linked to the case (medical specialists, managers of non-MI spinouts). Before the collection and analysis of field research data, the existing literature related to AE and patenting was reviewed in order to set a context into which the study can be placed. The study due to its scope ignores the question of who should own the IP, since the variety of ownership and contractual structures is too manifold to be covered in the small-scale size of this research.

Objectives and Structure

The research is organised in three objectives. First, the literature was analysed with regard to different forms of capitalisation of academic research. The focus lays on university spinouts. Second, the study focuses on the importance of IP protection in form of patents. Emphasis has been put on the lack of patent-protection and its influence on success. Third and last objective of this study was the development of recommendations for the continuation of the case, as much as for the future of AE research with regards to patenting.

Literature Review

“Universities are pressured to show tangible returns for the research grants they receive” (Baldini, 2010, p. 872). The purpose of research, however, should be an “abstract desire for truth” (1918, p. 526) which stands in contrast to the solution of a society problem which is the basement for the commercial exploration of a product (Pittaway, 2012). As a consequence, the potential creation of revenues and profits out of research results is based on a range of tensions, which have to be overcome. Revenues can be generated via patenting, licensing and spinout creation. Whereas patents and licenses keep the ownership of IP in-house, the creation of a new business can also mean that the rights of the IP move from the university to the spinout (McAdam, Miller, McAdam, & Teague, 2012; Wright, Clarysse, Mustar, & Lockett, 2007). Patenting only means that the way something functions is protected. It does not mean that the patent is used and that any revenue is generated with it. “Licensing has traditionally been the dominant route for the commercialisation of public sector IP” (Lockett, Siegel, Wright, & Ensley, 2005, p. 982). It implies, that the right to exploit IP – whether protected by a patent or not – is given to a company which makes use of the research results and somehow shares its profit with the university (Shane, 2004). The alternative to licensing is the

entrepreneurial approach, namely the creation of university spinouts or AE. The development of spinouts has increasingly been supported by governments in Asia, the USA and Europe (Baldini, 2010; Kroll & Liefner, 2008; Moray & Clarysse, 2005; Wright et al., 2007; Yang, Chang, & Chen, 2006).

Academic entrepreneurship (AE) and its stakeholders

Given there is still is no common definition for AE, AE in the context of this study needs to be defined. It is the creation of university spinoffs which are new businesses founded to commercially exploit IP, which was developed at an academic establishment (e.g.: Di Gregorio & Shane, 2003; Djokovic & Souitaris, 2006; Roberts, 1991; van Geenhuizen & Soetanto, 2009). Here spinouts based on research with or without IP protection in form of a patent and with or without the initial researcher to be part of the business are included.



Figure 1: Stakeholders in academic entrepreneurship

(no main source, Friedman & Miles, 2006; Lockett et al., 2005; Malik & Mahmood, 2012; McAdam et al., 2012; Meyers & Pruthi, 2011; Roberts, 1991; Shane, 2004)

In AE there is a range of stakeholders as visualised in figure 2.1. Given the increased economic interest in the commercial exploitation of university research (Lockett et al., 2005), technology transfer offices (TTO) are getting more and more common (Algieri, Aquino, & Succurro, 2013; Hülsbeck, Lehmann, & Starnecker, 2013; Markman et al., 2005), a unit that is enhanced by university leadership (Meyers & Pruthi, 2011). These come not only with advantages for the entrepreneur, as they as additional intermediary also need to be financed resulting in an increased economic interest of the university. This

interest though by definition stands in conflict with academic goals as there is an on-going “tension between encouraging entrepreneurship and encouraging and rewarding pure academic activities” (Philpott, Dooley, O’Reilly, & Lupton, 2011). This conflict resulted in the stakeholders to be structured in business and technical specialists from an internal and an external perspective. The stakeholders from figure 2.1 were grouped as presented in figure 2.2. The allocation of the subjects to the groups is neither exhaustive nor mutually exclusive (e.g. other spinout managers could also be classified as internal; the customer, the potentially most important stakeholder (Meyers & Pruthi, 2011) is totally missing in the visualisation). The entrepreneur (the chief executive officer (CEO) of the new company) as one of the core stakeholders (e.g.: Malik & Mahmood, 2012; Meyers & Pruthi, 2011; Shane, 2004) is placed in the middle, because he links all other stakeholders together

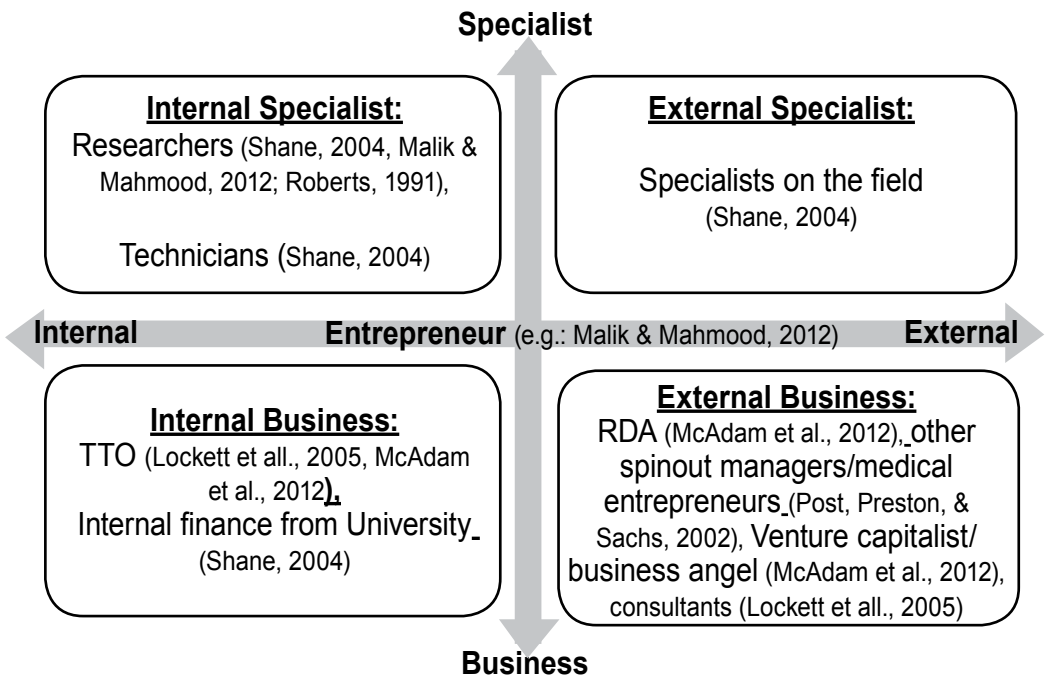


Figure 2.: Stakeholder analysis matrix

(no main source, stakeholders from: Lockett et al., 2005; Malik & Mahmood, 2012; McAdam et al., 2012; Post, Preston, & Sachs, 2002; Roberts, 1991; Shane, 2004)

Knowing the many stakeholders there are, stakeholder salience should be investigated based on three stakeholder's "relationship attributes: power, legitimacy and urgency" (Mitchell, Agle, & Wood, 1997, p. 853). Applying this framework to the stakeholders shown in figure 2. The competition is a latent stakeholder, the research team, specialists and consultants are expectant stakeholders and the TTO, the RDA, financiers and customers are highly salient stakeholders. Management should especially focus on highly salient stakeholders as they can really influence the business.

Patents and their importance

Patents are defined as: "a government authority or licence conferring a right or title for a set period, especially the sole right to exclude others from making, using, or selling an invention" (Oxford Dictionaries, 2014). In the context of AE research primarily looks at IP protection in the form of patents (Shane, 2004). However, other forms of IP protection such as trademarks and copyrights also exist (Bradley, Hayter, & Link, 2013). It seems that there is a development of IP management more towards handling it as a strategy rather than a purely protective approach in terms of patenting (Smith & Hansen, 2002). Further, the company owning the patent is also in charge of supervising the market for patent violations. This can be a particularly costly duty since all the knowledge behind the IP is publicly disclosed at the moment of patent application (Markman, Gianiodis, & Phan, 2009). In case a patent is not granted, the disclosure of information to the competition can be a severe cost to the company that developed the invention. For general entrepreneurship and other businesses not acting in straight connection to academia, Smith and Hansen (2002) explain that IP can also be protected by non-disclosure. However, Shane (2004, p. 259) finds out in research interviews with MIT spinoff managers, that patents are perceived as the key business success factor – thus this study is an attempt to fill this knowledge gap. The authors further state that "it takes real aggressive, competitive IP management [...] to succeed" (Shane, 2004, p. 259). From an economical perspective, a patent can be compared to an investment and the decision for it to an investment decision with a clear business case (Smith & Hansen, 2002). For now, the research about AE without patents is very limited. This study explores how important the existence and use of a patent is in the context of AE and thus tries to closing this subject-related gap.

Research Design and Methodology

The primary research that is used to evaluate the importance of patents as IP protection tools at the example of the AVS is explained in this section. This qualitative study is an exploratory one. Knowing that the field of entrepreneurship is a fairly new academic field (Pittaway, 2012), it is still necessary to develop theory which can be tested in future more quantitative research. A spinout development process has been accompanied over a period of eleven months. The research cannot be classified as longitudinal, though it has some longitudinal elements.

Research techniques in use

To fully explore the case and as academia sees entrepreneurship as “too dynamic and complex to be captured by a single method” (Neergaard & Ulhøi, 2007), some of the many methodological varieties that exist within qualitative research have been applied (Saunders, Lewis, & Thornhill, 2012), meaning that triangulation was used (Bøllingtoft, 2007). This latitude of qualitative research (Yin, 2011) allowed for different angles of analysis and objectification of the multiple realities of human cognition (Saunders et al., 2012). Phenomenology (Goulding, 2005) permitted the full exploration of IP protection importance.

Due to the research setting and the limited time frame for the study, it was not possible to give all research subjects equal importance. Particularly more observation effort has been put into the collaboration with and the research of subjects of primary importance for the commercialisation of the product. The consequently more thorough understanding of those allowed differentiating between personal opinions and right answers with regards to the duties they perform. The use of observation and focus groups primarily resulted in discussions, in which the researcher took more the role of a moderator, rather than asking specific questions. For the mostly unstructured interviews discussion areas were predefined to ensure that follow up questions were topic-related (Yin, 2011).

Internal, related and external perspectives

To minimize sways by the researchers prolonged collaboration with the TTO, not only the internal perspective from within the study, but also the external perspective has been investigated. In group three and four of Table 3.1 internal does not mean that the subjects come from within the university or the TTO, but that they closely monitored the development of the AVS business case

over a prolonged period of time and thus can form a neutral but case-specific opinion. The salience of the different stakeholder has been a factor of choice according to which research subjects have been investigated. Specialists around the case – especially other academic entrepreneurs – were met to get a better understanding of the research results. As some of the examined subjects were in between internal and external, a third category – related – has been introduced. In order to avoid any influence of the subjects by the researcher, unbiased wording was used in all communications (Saunders et al., 2012). A mix of recording and detailed notes taking has been used which allowed for focusing on aspects such as body language (Maylor & Blackmon, 2005; Saunders et al., 2012; Yin, 2011).

To structure the study in the best possible way, the many investigated subjects were grouped as visualised in table 3.1, which was developed out of figure 2.2. Whereas the figure only differentiates between Internal and External, and business experts and medical or technical specialists, the table is more detailed being based on the specific setup of the case. As explained above Internal and External was adapted to Internal, Related and External allowing for a better categorisation of the subjects. To facilitate the reader's understanding of the subject all codes are structured like table 3.1. The codes start with Internal (I), Related (R) or External (E), and go on with the first letter of the respective group and then are counted through. A hyphen after the I, R or E prevents confusing the coding with other abbreviations. In order to give the many subjects and events a more systematic grouping the business has also been classified in other categories. Table 3.1 shows all subjects that have been actively involved in the study and have contributed to the academic development of the paper.

Table 3.: Grouping of Research Subjects Results

	Internal	Related	External
1. Specialists	Researcher (I-S1) Assistant of Main Researcher (I-S2) Technician in Research Study (I-S3)	Professors and technical specialists in a focus group (R-S)	2 craniosacral specialists (E-S1a-b) and 2 physiotherapists (E-S1c-d) in a focus group Osteopath (E-S2) Orthopaedist (E-S3) Otorhinolaryngologic practitioner (E-S4)
2. Business side	Business developer TTO Longitudinal observation (I-B1) TTO Manager (I-B2)	investment bank Advisor (R-B)	Kamer van Koophandel (E-B1) RDA (E-B2)
3. Academic Entrepreneur	Business developer that takes a current product further (I-AE)	–	2 CEOs of med. companies based on software (see, E-AE1-2) 7 CEOs of med. companies not based on software (see table 4.4, E-AE3-9) Operations manager of a med. company (E-AE5a)
4. Finance	Informal Angel Investor who almost invested (I-F1) Financial specialist (I-F2)	Interregio Conference, Limburg, Netherlands (R-F1) European Venture Contest, Aarhus, Denmark (R-F2)	Venture Capital Senior Manager (E-F1) Med. Consulting company: Senior Consultant (E-F2) Angel Investor and CEO (E-F3)
5. Lawyer, specialization Patent Law			

This section is designed to present the results of the investigations. The respondents and consequently the following sections were grouped as visualised in table 3.1.

Specialists

A broad range of specialists including the researcher who developed the product, as much as companies in the field and completely independent specialists in the medical field. They were investigated as much in interviews as in focus groups (see Table 3.1). Even when getting specific questions about patenting none of them apart from the researcher that developed the product cared about whether the product did have a patent or not so. All specialists were primarily interested by the medical validity of the product. Depending on whether the specialists were working in research or commercially the price of the product for the final patient was an issue of importance.

Business development

Internal Business focus

Internal subjects are part of the TTO. For the investigations of the business partner at the TTO, two research techniques have been used: interviews and observation. The business developer (I-B1) was observed and interviewed in a mostly unstructured way at several points in time. Next to that an unstructured interview with a manager of the TTO (I-B2) has been undertaken. I-B1, no matter what happened was all the time extremely positive about the development of the AVS. When a consultant (I-C2) expressed his disbelief in the product, collaboration with the consultant was not continued, rather than revising the own opinion. When specialists (E-S1a-d, E-S2, E-S3) considered the product not to be competitive their opinions were considered as “interesting”. At a later point in time, one possible investor (I-F1) assessed his network of potential partners for commercialising the invention. When several of his possible partners independently explained him, that the market of bilateral vestibular loss is very small, and that the product cannot be applied e.g. in fall-prevention, the investor – so explained I-B1 – wasn’t matching the product. Even though I-B1 had a business background, he was persuaded by scalability assumptions that according to a consultant (I-C3) have proven wrong in business many times (I-B1: “We sold five belts, thus, there is a market to sell it to”). However, all statements by I-B1 are to be considered relative to his own statement of being an intrapreneur rather than an entrepreneur and the fact that he is employed, and so – as explained I-F2 at a later stage – needs to have the opinion of the business that employs him (the TTO).

The unstructured interview with a higher manager of the TTO (I-B2) has revealed the conditions of the TTO for the technology takeover of the AVS. Comparing these conditions to conditions other academic entrepreneurs knew

from other universities (I-AE, R-AE1) the earning expectations of the TTO at university where the AVS has been developed were much higher than the earning expectations of other universities. According to I-B2 “the TTO is a totally separate non-academic unit which is a profit-oriented business”.

Related Business focused subjects

In the category related, there is one advisor from an investment bank (R-B) whom was met with several times. Topic of conversation was more the global business perspective than financial aspects; therefore, he was categorised as one of the business-focused subjects. The subject knows the AVS and influences its development (either in form of advice or future funding), wherefore the group related was chosen. An unstructured interview with a consultant from an investment bank (R-B) revealed that the existence of a patent influences funding only to a limited extent. If the product is easy to copy then patenting is good, if the product is very elaborated, though, patenting is a danger. As patent information has to be disclosed the general public – including competitors – gets access to years of research at no risk and no cost.

External Business focused subjects

The category external includes a meeting with the chamber of commerce (E-B1) for general information and the attitude of the RDA (E-B2) regarding the development of new technology driven businesses in the region. These subjects are neither influenced by the commercialisation plans nor monetarily involved in the AVS development.

Consultant Chamber of Commerce (E-B1): “*Be the decision taker, be sure to own the majority of the business!*” The exploration of entrepreneurial opportunities around the AVS involved contacting the chamber of commerce. Their advice though, did not match the meaning of success in this study. Here success is defined as quantifiable business accomplishments; the above recommendations were linked to the realisation of the entrepreneur as such. E-B1 agrees with previous subjects on the importance of patents to depend on the product.

Representative of the RDA (E-B2): “The business plan is what counts for us. If it is valid, then we deliver support!” One of the subjects in the study (E-B2) represented the RDA. E-B2 generally agreed with the consultant from the investment bank (R-B) regarding the importance of patents. Both subjects (E-B2 and R-B) mentioned this independently and explained that patents are only marginally – if at all – affecting collaboration with a new business. Like many

others, E-B2 mentions market size and the entrepreneurial team to affect the success of AE.

Academic entrepreneurs

Internal academic entrepreneurs

One entrepreneur working on a product from the same TTO (I-AE): “*The importance of patenting depends on your product.*” There is only one subject that falls into this group, which is an entrepreneur that currently brings an invention from the same TTO to the market (I-AE). The invention he works on is not patented either, wherefore the comparison of the two cases seems interesting from an academic perspective. I-AE considers two aspects to be of crucial importance for his business: the widespread network of the TTO and the non-disclosure of his algorithms. The device this entrepreneur is bringing to the market is a movement monitoring system. He explains that only the network of the TTO makes the commercialisation possible. Patenting – so he says – would rather harm his product because the disclosure of his algorithms would have negative consequences.

Related academic entrepreneurs

Two CEOs can be categorised as related to the AVS. One is the founder manager of a previous successful spinout of the same TTO (R-AE1) and the other one is the CEO of a competing MedTech company (R-AE2). The second company’s CEO knows the AVS fairly well and is involved in decisions about future funding programs such as the one that was received for the AVS; R-AE1 was also part of the program.

Previous spinout manager: “*You have to love something about it, no matter if that’s the product, the figures, the selling, you have to live it, to breath it!*” R-AE1 emphasised that the all-deciding factor is not the patent but the enthusiasm of the entrepreneur. He explains that if the entrepreneur is not a charismatic driver then the company cannot succeed. This, so he emphasizes, is the most crucial aspect. Patents, according to him, “are only necessary to catch investors, nothing else”. They are important but primarily as a management strategy rather than as a tool for protection.

R-AE2 was talked to after holding a presentation about his own company. His company focuses primarily on research for laboratory technology and sells to large companies who commercialise on his inventions. R-AE2 explained the importance of patents, stating – similar to other subjects – that it is a balance act between keeping information in-house and disclosing it. Furthermore, he

justifies that it is a much bigger challenge to monitor the market and competition whilst doing research. Researching or patenting a solution to a problem which, by the time the solution is found, does not exist anymore – so he concludes – does not make sense.

External academic entrepreneurs

Overall nine CEOs and one operations manager of nine different medical companies were communicated with especially focussing on the importance of IP protection in medical entrepreneurship. Full comparison cannot be made, because the input of the different respondents varied significantly in length and completeness. All of the selected businesses developed out of previous research at academic institutions. The major point for deciding whether or not the involvement of a patent was advantageous – several of the subjects clarified – were whether algorithms were involved, and whether the product was software-based or not. Therefore, the study differentiates between software-based respondents (E-AE1 and E-AE2) and not software-based respondents (E-AE3 to E-AE9). The CEOs of the two software-based devices emphasised different aspects that influence the success of a new company – one did put the focus on the market's needs (E-AE1) and the other on the representation and sales capabilities of the entrepreneur (E-AE2). Still, they agreed on one aspect – the patent to be a danger to business. Revealing the algorithms behind their software – so both describe independently – is rather harming the business development of their products. Whereas the opinions of the CEOs of companies with software-based products were fairly similar, the opinions on patenting in non-software-based businesses were widespread. According to E-AE4 all his companies have patents, which makes it possible to get investors. He makes clear that patents are necessary to catch investors. E-AE5a elaborates on patenting that in his company most products successfully combine several patented parts wherefore the entire products become unique. For E-AE7 the lack of patenting turns out to be a problem: “Our device is too simple to be patented and that is why we don't get investors.” The simplicity of the device and the lack of the patent – so clarifies E-AE7 – make the device so easy to be copied that investors don't want to go for the risk. This entrepreneur questions the free market as a consequence: most of the products – also the successful ones – do not have relevant patents and many still succeed. This refers to R-AE1s statement about patents to be important to get investors. R-AE1 does have a patent, however, his patent is not linked at all to the unique selling point (USP) of his firm. As for success influencing factors E-AE5 repeats the opinion of

R-AE1 to a certain point. He agrees with R-AE1 that belief in the product and the enthusiasm of the entrepreneur is decisive. Further E-AE5 – who, several years ago, was about to shut business – concludes that it is crucial to continue even in phases, which do not look promising. The most detailed conversation and advisement happened with E-AE9 who took much more time to discuss the AVS. E-AE9 has a special connection to the AVS given he worked as a business development manager at the TTO of the AVS. He is here classified as external because his opinion is absolutely neutral. At his time at the TTO, the AVS was already under development, however E-AE9 only knew about the existence of the product. E-AE9 by today is an entrepreneur in a team of three and as he explains, they bring it all together, management, market and technical knowledge. As for patents the opinion of E-AE9 was relatively rigorous. He explains that a patent is only useful if it can be defended and in case it is expected to earn substantial returns. Even though a patent secures knowledge that is unique it is neither a protection a defence, nor a prove of unique technology. Positives of a patent are, the freedom to operate and consequently it makes the company an interesting partner because the company is not only based on public knowledge.

Finance

This section includes subjects that were interviewed at several points in time and also conversations at a national and an international finance event.

Internal finance

I-F1: *“Only when fully being part of the story it is possible to develop a really unbiased entrepreneurial opinion”* One of the investors (I-F1) can be categorised in the group of internal finance because he went into making research to find out more about the AVS. His investigations of an entire network of specialists, consultants and business people revealed, that it is better to stop any further investments in the business creation process around the AVS, as long as medical validation studies are not completed. With this validation – he justifies – the AVS can be a success. Knowing that the market for this product is uncommonly specific, it is very small and hence difficult to reach. Due to the extremely limited size – so he explains – only a very broad international approach by a large company can work out. Small new companies according to him could not handle the necessary commercial representation of the device. As for the importance of patenting I-F1 explains that patenting is only important from the perspective of the investors. I-F1, himself a business angel,

explains that investors are by definition limited in their knowledge. A patent gives investors the feeling of exclusivity, which as a consequence raises their assumption that the product definitely can be commercially explored. Other than for this reason a patent is not necessary because for most companies it is not possible to cover the follow-up costs of a patent. For new companies patenting only attracts investors. With patent or without, if there is a management team that covers the companies needs as much from a specialist as from a business perspective and if the product really solves a problem, then commercial success is very likely. The accountant (I-F2) made rather general statements due to limited case-specific knowledge. He specifically elaborates on the massive follow up costs of patents. Next to paying very high patent fees the market needs to be continuously monitored whether competitors try to abuse the knowledge of one's patent. The monitoring as such is very costly and then one also needs to have the financial buffer zone to pay for the legal costs until the case is won. Considering all the costs it might – especially for new and small businesses like the potential company for the AVS – be a good decision to take the risk and not patent the product. Patenting for a new business should only be an option if it is very likely to succeed large scale, which is unlikely for the AVS, due to the small market size.

Related finance

In related finance no people can be mentioned, yet the collaboration with the TTO and the RDA have made it possible for the researcher to participate in two events: the Interregio Conference Limburg (R-F1) and the European Venture Contest Healthtech Denmark (R-F2). R-F1 was a regional event where entrepreneurs could present their inventions. At the event several inventions were presented by entrepreneurs, which were about to bring the respective products to the market. Business angels, investment companies, local journalists and managers of businesses in the healthcare industry formed the audience. At the event the presentation of the AVS caught the interest of several potentially collaborating companies and also I-F1, a major regional business angel, whose opinion was elaborated upon in section 4.5.1. The European Venture Contest Healthtech (R-F2) is one of the biggest MedTech events in Europe. Roughly thirty relatively new companies pass the complex participation-application procedures every year; this year amongst these, the AVS. The researcher-entrepreneur presented the AVS at the event to an audience of international – primarily European CEOs, venture capitalists, business angels and consultants which evaluated the investment pitches of the presenting businesses. The – at

the time – planning was criticised because of a lacking non-medical approach towards the product. The missing long-term perspective was also not considered positive. Furthermore, the medical validation was and is missing, which makes long-term business planning for the AVS deceitful.

External finance

E-F1: *“Taking decisions is about facts – but in entrepreneurship and investment this is also a lot about feelings!”* Three subjects fit in the group of external finance, namely a senior venture capital manager (E-F1), a senior medical consultant (E-F2) and a CEO and Angel Investor (E-F3). At R-F2 in Denmark the Researcher Entrepreneur got to know E-F1 and E-F2. Both subjects were talked with independently about the AVS and also the importance of patents in AE. Both independently commented on patents, no matter what they protect to be good in attracting investors. However, there was certain disagreement about their success importance. Whereas the Consultant (E-F2) explicitly commented upon the patent not to be of crucial importance in case the product had any algorithms involved. The venture capitalist (E-F1) did not comment on the patent at all – even though several questions about it were asked. E-F3 was a contact made via I-B2. E-F3 – himself an entrepreneur in several businesses emphasised in particular on the importance of the focus of the entrepreneur. Different to I-F1 this investor did not give patents a major importance, but primarily saw them as major cost.

The patent lawyer

Granted the many differing opinions on the importance of patents a patent lawyer was consulted to explain why and when patenting is relevant or helpful and what is important about it. Given his legal perspective there was no business focus in the questions other than the questioning about the business consequences of any suggested legal actions. His statements were not contradicting any of the previously mentioned comments or opinions by other subjects, though rather explained the reasons. According to the patent lawyer it is not the existence of a patent but no matter what is patented depends on the quality of the patent which is decisive. A very good patent would be one that patents a whole process, a very bad one, one that protects a certain shape of a part. The lawyer elaborates that there are many complicated ways to fight for one's right on the patent, however either one of them is very costly. The lawyer comments as I-F1 beforehand that patents are more useful to the big players rather than small new companies.

Discussion & Conclusion

This section serves as a sum up of the results and as a comparison of these with the literature and already existing theory. The chapter is divided into two sections: 1. Importance of a patent, 2. Conclusions and Recommendations. The first of the two sections combines the knowledge presented in figure 2.4 with the results, which were illustrated in the previous chapter. The second section closes chapter with key conclusions and key recommendations for academic entrepreneurship, the investigated case study as much as the continuation of academic research.

The importance of a patent

This study revealed that at the base there are mainly two options for IP in academic research: To fully disclose it and to patent it, or not to disclose it and to keep it exclusive to a limited few. The majority of respondents (R-B, E-B1, E-B2, I-AE, I-C1a, I-C1b, I-C2, R-C2, E-C1, E-AE9) explained that patenting necessities cannot be generalised but are product dependent. In accordance with the literature (Shane, 2004), it was explained that patenting could be an advantage (R-B, E-B2, E-AE9, I-C2, E-C2, E-C3, I-F1), but it was not mentioned a single time in the study, that patenting is the paramount success influence. The only specific case – two subjects mentioned independently – in which patenting definitely is preferential is, if the product is very simple (I-B1, E-AE4). If patenting is definitely the way to go, then a good way to choose might be to combine several patented parts to become a unique combination (E-AE5a, E-AE9). Other than the patent lawyer, no-one thought that the inexistence of a patent might have strong negative effects on the business performance of the company; in fact some perceived patenting as unnecessary (E-AE1, I-C3), several subjects independently explained that patenting is a danger due to the disclosure of information (I-AE, E-AE1, E-AE2, E-AE3, E-AE9, I-F2); a fact that seems especially to be valid in software-based companies (I-AE, E-AE1, E-AE2). In fact, several times entrepreneurs and consultants alike linked the question of patenting linked to the product being based on software or not. Some respondents explained that patenting is not important (I-C3, R-C, E-F3) and can be hindering business (I-B1, I-B2, I-C3). This is the case, because focus moves away from value-creating activities to market monitoring for infringements; competition can also be good for business. Whether the opinions of I-B1 and I-B2 in this respect are truly own opinions, or if their comments are linked to the fact that the AVS does not have a patent

is unknown. Good or bad, it is found – just like Shane (2004) explained – that patenting comes at its price. Next to high-end fees for the patenting authorities (I-C1b, R-C2, I-F2) there are also large follow-up costs associated with monitoring the market (E-AE9, I-C1b, I-C2, I-C3, E-C2, I-F2). It seems to only make sense to patent simple inventions because the costs linked to monitoring and protecting a complex patent often outrage the potential earnings that can be achieved via the patent. Be that as it may, patents do have a plus; they are a proof of unique technology, grant freedom to operate (E-AE9) and serve for getting investors (R-AE1, E-AE4, E-A7, I-F1, R-F2, E-F1, E-F2). Apparently, patents are so important to investors, that one of the interrogated entrepreneurs R-AE1 even chose to go for a patent, which does not protect his USP. The positive consequences of patenting – so revealed the discussion with the patent lawyer – depend solely on the patent quality. It cannot be generalised what the best choice is, but it seems that in most cases the disadvantages of patenting outweigh its advantages. Only if the patent is of high quality and protects the upmost range of options it can be of advantage. Nevertheless, also high-quality patents come with challenges.

Table 5.: Patenting evaluated

Advantages of the patent	Disadvantages of the patent
IP protection	High costs for patenting
Attractive to investors	High costs for following up on patent
Good for very simple products	Information disclosure can be risky
Freedom to operate	Can be hindering business
Proof of unique technology	Does not protect, just gives legal means
Consequently: Not the paramount success determinant	

This study has proven that current AE research does not treat inventions, which do not enjoy the protection by a patent with the necessary care. It was found that patents, trademarks and copyright exist, but that in fact only patenting is understood as an IP protection tool. In AE there are two main choices for treating IP: pure non-disclosure of information and the management strategy

of a product (as mentioned by I-AE, E-AE9) including key opinion leaders as a form of protecting IP. Patenting means full disclosure of the idea.

Conclusion & Recommendations

This study clearly reveals at the example of the AVS and especially the surrounding interviews that practitioners do not see patenting as an absolute necessity for success. Nevertheless, patents do play an important role also in the field of AE because they influence the decision-making of a highly salient stakeholder: the investor. This study makes recommendations for the field of AE, the particular case of the AVS and for future research.

The General Importance of Patenting in Academic Entrepreneurship

This study reveals that patents are not decisive for success; IP protection is a strategy. Patents come at a high price and with major follow-up costs; only high-quality patents are of advantage, but the IP disclosure associated with patenting can be risky, especially for software-based products. Patenting for protection seems to only make sense for very simple products or for products that are exploited on a large scale by large companies, as they are a legal defense tool against large competitors. Small companies mostly do not have the monetary breath to fight for their rights against large competitors. The options always are: patenting or not disclosing information – the later might be a good choice if algorithms are involved. To protect business, it always makes sense to create a system that only works when several matching parts from the same company come together. From an expenses point of view, the costs for patenting only make sense if large revenues and earnings are expected. In AE patents seem to be of minor importance as a protection tool, however, they grant freedom to operate and so make the starting business an interesting partner, not only from an investor's perspective. It cannot be said in general that university spinouts have to have patents, this always depends on the product.

The Importance of Patenting in the Investigated Single Case Study

The study clearly shows that the lack of a patent is not a disadvantage in the case of the AVS however small the market might be. Continuation of the commercialisation is possible – whether the best option is a new company, however, is not sure. Recommendations of I-F1 seem to lead to the conclusion that the AVS is particularly interesting for larger companies who can easily tap the larger scale marketing channels and who are interested in a license deal. All in all, development is still necessary prior to commercialisation.

Currently medical validation is still pending, pursuant to I-R1, it is just about to be received; an inalienable necessity for exploiting the medical market. Nevertheless, a cooperative angel investor who especially aims for helping people which are suffering from bilateral vestibular loss might bring this product further and could be key in case of the creation of a new spinout. For commercialisation primarily focusing on quantifiable return, licensing might be the best option.

Limitations and Future Research Recommendations

This study is an exploratory research study based on a single case study only focusing on patents. Therefore, several limitations evolved.

1. *Key success factors in Academic Entrepreneurship:* The key result of this study is, that a patent does not belong to the core success influencing factors in AE. A separate study about what the key success factors in AE actually are is necessary.
2. *Not generalizable results – test results in future research:* The conclusions about the importance of patenting drawn from this research project are not fully generalizable to AE as a whole, but only to a theoretical proposition. Yet, Shane (2004)'s reasoning for patenting to be a key success determinant is put in question. Nevertheless, the importance of patenting must be tested in future quantitative research.
3. *Make maximum use of provided data:* This research had – particularly due to limitations in pages – simplify very detailed data to extremely simplified coding and could not analyse the data to its best. Future research of a similar scope might choose to make use of less data, but explore it in more detail.
4. *Geographical limitation to mainly the Netherlands and Europe – test validity at other locations:* This study investigated a single case in the Netherlands. Throughout the case Dutchmen and Germans were consulted. Some international opinions were recorded at the European venture contest in Denmark, but this still is very limited. To generalise the results to a broader geographic area, cases across a wide geographical spread have to be investigated.
5. *Involve end-users in research:* Here no discussions with the end-users of the AVS or other medical products were held. The patient of the medical might – as much as the investor – be influenced by the existence of a patent. This is an aspect that should be covered in future investigations.

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