Characteristics of Early-stage University Spin-offs that Benefit Governmental Funding Acquisition.

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ABSTRACT
The growing relevance of university spin-off development to successfully enable the technology transfer from academia to society has facilitated the emergence of this research topic. The path from the laboratory to a viable firm is difficult and complex, requiring the venture to successfully overcome many junctures and liabilities, one of these could be the governmental funding acquisition. This study examines the impact of concepts such as market knowledge, venture championing in the form of motivation, business networks, scientific-business based teams, and intellectual property rights (IPR) protection on governmental funding acquisition. Applying binomial logistic regression analysis on a unique dataset of 242 early-stage university spin-off proposals reveals that market knowledge, motivation and scientific-business diverse teams have a significant positive effect on governmental funding acquisition. These findings have implications for theory, such as approving existing notions, extending these concepts toward governmental funding acquisition, and expanding the list for additional research and validation. This study provides practitioners with unique insights, such as the knowledge of the intended market and consumers, motivation, and knowledge diverse teams are more advantageous and should be developed to the greatest extent possible before submitting the grant proposal. Finally, policy implications include providing additional support in the form of seminars and classes with mentors or specialists, in addition to financing.

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1. INTRODUCTION

University spin-offs (USOs) are *"(...) new ventures initiated within a university setting and based on technology derived from university research (...)."* (Rasmussen & Wright, 2015, p. 783) and have a huge potential to generate economic, as well as societal impact. Reason for this is that USOs apply the unique and often novel knowledge or asset from the university research into the business environment, combine theoretical and applied sciences, and foster economic growth (Ferri et al., 2018; Hayter, 2013), such as job creation or clustering of technologies (Pattnaik & Pandey, 2014). Furthermore, some USOs apply cutting-edge research to address global grand challenges, such as global warming or diseases, which is in line with the university's third mission (Compagnucci & Spigarelli, 2020).

Unfortunately, the transition from the researched technology in a university setting to a commercial business is complex and difficult, with spin-offs encountering a wide range of difficulties and liabilities in the first three years, such as managerial and financial challenges (van Geenhuizen & Soetanto, 2009; Soto-Simeone et al., 2020). Managerial obstacles arise often due to the lack of business expertise and entrepreneurial skills, and the similarity of expertise within the spin-off team (van Geenhuizen & Soetanto, 2009). Financial obstacles, such as a shortage of investment capital, as well as difficulties in obtaining them (Fisher et al., 2013; van Geenhuizen & Soetanto, 2009), hinder the spin-off from applying the researched technology to the business setting due to their novelty and high research and development costs (Fisher et al., 2013; van Geenhuizen & Soetanto, 2009). If these obstacles are not managed properly, the venture will not be able to move forward to the next development stage (Vohora et al., 2004), and the researched technology and prior efforts undertaken will be fruitless.

To overcome the obstacles and liabilities, the USO requires the right competencies and sufficient capital, which in the early stage of the venture is in shortage (van Geenhuizen & Soetanto, 2009; Soto-Simeone et al., 2020). Funding is crucial to employ personnel, apply research & development and acquire resources. Based on these organizational limitations and the high uncertainty of the technology's commercial potential, investors such as venture capitalists (VCs), might be averse to invest (Teixeira & Ferreira, 2018) due to their low legitimacy and lack of past achievements (Fisher et al., 2013). Governmental valorisation programs such as the Dutch Research Council (NWO), are not purely fixated to maximize their return on investment, as VCs do, but rather see the enormous societal impact of supporting promising early-stage USOs with capital (Ferri et al., 2018; Hayter, 2013; NWO, 2018; NWO, 2021b; Pattnaik & Pandey, 2014). These programs help USOs with a variety of initiatives that promote academic entrepreneurship to bridge the gap between research and the market (NWO, 2021c), before larger institutions invest in the USO. These programs assess the spin-off's technology or service based on a variety of criteria, and if it earns top ratings from a panel of scientists and industry experts, the spin-off obtains the necessary funds, either entirely or partially (NWO, 2021b).

Past studies have focused on broad success criteria of USOs, such as individual competencies (Rasmussen et al., 2011; Rasmussen & Wright, 2015), organizational hurdles to overcome (van Geenhuizen & Soetanto, 2009) and the different stages in which the USO must evolve (Vohora et al., 2004). However, there has been little discussion about the characteristics and competencies that are advantageous to obtain funding from a governmental initiative in the early stage of the venture. This paper will bridge this research gap by evaluating which early-stage characteristics, based on literature and grounded theory are beneficial and how to enhance USOs performance to overcome the funding gap and support the academic entrepreneur.

This leads to the research question of this study: *"Which early-stage university spin-off characteristics and competencies are beneficial to governmental funding acquisition?"*

This study adds new theoretical findings to the Vohora et al., (2004) framework and offers novel theoretical insights in general. Moreover, this paper will add to the competency framework by Rasmussen and colleagues (2011) and investigate if the entrepreneurial competencies of venture championing is favourable to governmental funding acquisition. Finally, this study will add to the research by Visintin and Pittino (2014) and evaluate if a scientific-business diverse team influences funding acquisition.

This study can be applied as a guiding paper to present potential academic entrepreneurs or young graduates with entrepreneurial tendencies, a list of valued early-stage characteristics for funding acquisition within a governmental valorisation programme. This study also explains which characteristics are more advantageous than others to prepare and focus on valued abilities and qualities to generate the greatest venture realisation. Finally, this practical information can enhance better resource allocation of the public funds and investigates the extent of double failure, which appears when one proposal receives money and fails to deliver on the expectation and promises, while another proposal did not receive that opportunity in the first place, which if avoided, results into more research transferred from academia to society.

The remainder of this paper is structured as follows, first, a general overview of the liabilities and development phases of USOs is presented on which different hypotheses are proposed. Section 3 elaborates the research design, subjects of this study, measurements, data collection and analysis in further detail. Followed by that, the results of this study are put forward and concluded with a discussion, implications on theory, practice and policy, and ends with the limitations of this study and a future research agenda.

2. THEORETICAL FRAMEWORK & HYPOTHESES DEVELOPMENT

The next sections give a review of the existing literature on the development, liabilities, and features of USOs on which hypotheses are developed.

2.1 General Overview of Academic Entrepreneurship and USO Development

Universities are an integral aspect of society's knowledge formation (Hunady et al., 2019). Universities prepare the labour force for the private and public sectors and develop new insights through research (Hunady et al., 2019) and teaching (Compagnucci & Spigarelli, 2020). In recent years, the term *"Third mission of universities"* has grown in importance (Compagnucci & Spigarelli, 2020), it emphasizes that the knowledge from university transferred to society should address social needs and industrial objectives (Compagnucci & Spigarelli, 2020), in addition to the two traditional roles which are teaching and performing research (Compagnucci & Spigarelli, 2020). One method to bring academic knowledge to the public is through university spin-offs (Hunady et al., 2019). As aforementioned, USOs are ventures based on university research, which bring their researched asset to the market with the potential to create employment and economic growth (Hayter, 2013; Rasmussen & Wright, 2015). USOs are in a

unique position to gain from academic and research knowledge (Hunady et al., 2019) and combine basic and applied sciences (Ferri et al., 2018). Despite the considerable effect, USOs face numerous liabilities that must be addressed and governed.

2.1.1 Liabilities of Early-stage USOs

There are several burdens identified by Soto-Simeone and colleagues (2020) that early-stage USOs must overcome to increase their likelihood of survival. These liabilities are based on the misalignment of internal organizational factors and industry conditions (Soto-Simeone et al., 2020). One of the burdens is the liability of newness (Stinchcombe, 1965), which arises because new innovative start-ups, such as USOs, lack specialized tools and skills to construct efficient procedures and build a strong structure to compete with developed companies that have already accumulated and established these structures (Gimenez-Fernandez et al., 2020; Soto-Simeone et al., 2020). Another burden recognized by literature is the liability of smallness (Gimenez-Fernandez et al., 2020; Soto-Simeone et al., 2020). This liability is based on the premise that small innovative start-ups, like USOs, lack the resources required to properly deploy the procedures and structures required to put their strategy into effect (Gimenez-Fernandez et al., 2020).

A further burden is the liability of legitimacy, which is dependent on the venture's degree of validity from various audiences to obtain required assets (Fisher et al., 2013; François & Philippart, 2017). To be perceived legitimate as an early-stage venture, "(...) its structures, practices, and behaviors must align with the prevailing institutions in the environment in which it operates (...)" (Fisher et al., 2013, p. 383), which can be communicated through narratives, management practices, claiming to be a part of a new or current category, as well as conformity to or misuse of the institutional system (Fisher et al., 2013). To be granted legitimacy, an identity is required (Fisher et al., 2013). The identity describes the meaning of the opportunity and the market being sought, the purpose of what the company stands for, and the entrepreneur's identity to make an entrepreneurial venture understandable to the external audience (Fisher et al., 2013). Furthermore, legitimacy must be obtained by a variety of stakeholders, each with their own set of demands (François & Philippart, 2017). As a result, USOs must adapt their identity to meet the various demands of the corresponding audience (Fisher et al., 2013). The corresponding audience depends on the USO's current development phase, such as in the early stages it is the university or government because they provide take-off grants, then suppliers for the supply of resources, customers for sales and income and eventually venture capitalists or stock exchange listings for greater amounts of capital (Fischer et al., 2013; Vohora et al., 2004).

When legitimacy is obtained, it cannot be held permanent and must be handled in such a manner that it can be sustained and restored if required (Fisher et al., 2013). As a result, it is important that the USO recognizes these liabilities and manages them cautiously to increase their likelihood of survival in multiple development stages.

2.1.2 USO Development Stages

USOs go through distinct phases when moving towards a sustainable business and to move from one phase to the next, USOs must overcome junctures (Vohora et al., 2004). To deal with these junctures, not only resources but also competencies are required (Vohora et al., 2004).

The framework begins with the research phase and focuses on the academic entrepreneur researching a novel technology and generating valuable knowledge and expertise into the studied field (Vohora et al., 2004). The opportunity framing phase is the second step, which involves evaluating and framing the researched asset for validity and commercial application (Vohora et al., 2004). The third phase is the pre-organization phase and focuses on strategic decision-making and resource collection (Vohora et al., 2004). The authors state that these decisions might have unintended repercussions later in the venture's life cycle, so they must be carefully considered. The re-orientation phase is the fourth step, which involves identifying, procuring, and implementing more value-adding resources, technologies, information, and expertise, which bring numerous strategic changes and adaptations (Vohora et al., 2004). The re-orientation phase aims to arrive at a state where the venture creates sustainable returns, which is the final stage of the framework (Vohora et al., 2004). This is also linked to the venture moving out of the university setting and towards a business identity with self-sufficiency (Vohora et al., 2004). Figure 1 displays the five phases with the corresponding junctures.

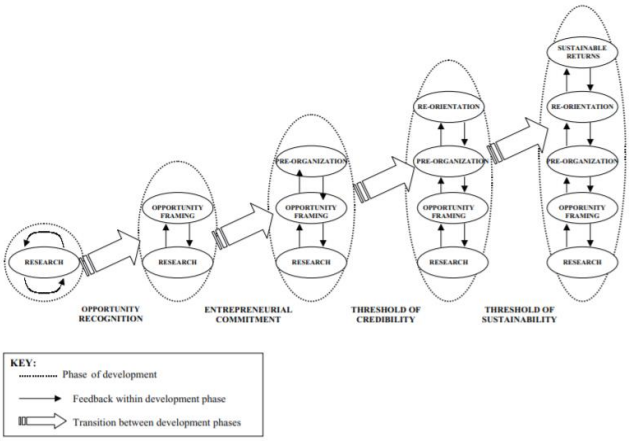

Figure 1. The critical junctures in the development of university spinout companies (Vohora et al., 2004).

2.2 The Role of Market Knowledge on USO Performance

According to Vohora et al. (2004), the first critical juncture to overcome is the opportunity recognition phase and entails the match of the researched asset with a market. The clear market definition includes the comprehension of the target market, as well as the needs of the customers. USOs who have defined these clearly in the early stage, show a higher success rate (Lawton-Smith & Baines, 2019), however, the research has tended to focus on successful market exploitation rather than funding acquisition and thus this study will apply that approach to governmental funding acquisition. The transfer of scientific knowledge into a practical business opportunity is crucial because the shift from the scientific environment to the industry is challenging (van Geenhuizen & Soetanto, 2009). This challenge requires new skills and knowledge, which are in the early stages often market-related, due to academics being less skilled at identifying commercial opportunities (Buratti et al., 2020; Poponi et al., 2017). Furthermore, providing great assessments of market knowledge might be a strong factor for coping and survival in a hostile environment (Buratti et al., 2020), which then ensures the funding jury that this USO can successfully transfer the knowledge to the public. In addition to that, if the USO provides a highly sophisticated technology with worldwide demand, this skill might help the USO boost its internationalization strategy (Buratti et al., 2020). Academics with prior industrial experience may have a better understanding

to position the venture within the market (Rasmussen et al., 2011), which has a positive effect on market comprehension (van Geenhuizen & Soetanto, 2009).

Having a thorough grasp of the market is advantageous since marketing, sales, and customer base tend to remain an issue for a long time (van Geenhuizen & Soetanto, 2009). Therefore, presenting assessments of markets and customers contributes to the easing of these challenges in the early stage and contributes to bridging the opportunity recognition gap (Vohora et al., 2004). This detailed assessment of the market is positively associated with funding acquisition because it assures the funding jury that this venture understands the target market which is required to successfully launch the researched asset and generate revenue as a venture. Following this argument, the first hypothesis is developed.

H_1 = *The degree of market knowledge of the USO has a positive association with funding acquisition.*

2.3 The Role of Venture Championing Through Motivation on USO Performance

The second threshold in the Vohora and colleagues (2004) framework is about entrepreneurial motivation and commitment. This juncture highlights the importance of persistent commitment and determined motivation, which is required to move the venture from a vision to a sustainable firm (Vohora et al., 2004). Personal dedication or the position of leadership required to support the venture start-up process are examples of championing competencies (Rasmussen et al., 2011). Early-stage USOs apply novel technologies (Hayter, 2013), which require the guidance and driving force of a dedicated venture champion to overcome the junctures and lead the team. Focusing on USOs, venture champions are not static but need to be adapted to the venture's development phase. In the early stage of the USO, during the research phase (Vohora et al., 2004), academic researchers can be the venture champion for internal university contribution, support, and credibility (Rasmussen et al., 2011), due to existing networks and scientific excellence of the academic. Later development stages require different skills and capabilities (Vohora et al., 2004), to receive credibility and support from external industry partners, customers, and investors (Fisher et al., 2013; Rasmussen et al., 2011), and thus require a more suitably venture champion.

Motivation and commitment are crucial because they provide meaning and energy behind the technological asset (Rasmussen et al., 2011), which can motivate investors to contribute to the venture which is needed to surpass the threshold of credibility (Vohora et al., 2004). Further characteristics include that venture champions apply transformational leadership styles to a greater extent than non-champions, as well as a greater variety of influence tactics (Sergeeva & Zanello, 2018), which are all beneficial to persuade another party to act in the interest of the venture champion. Since USOs encounter many liabilities and obstacles that take tremendous determination and persistence to advance towards a sustainable firm, venture championing is favourably associated with capital acquisition because the presence of this skill assures the funding jury that this USO is more likely to succeed in the long run. Following this argument, the second hypothesis is developed.

H_2 = *The degree of motivation in the USO team has a positive association with funding acquisition.*

2.4 The Role of Business Networks on USO Performance

Another threshold early-stage USOs face is to gain credibility, which is needed to gain the necessary resources (Fisher et al., 2013; François & Philippart, 2017; Rasmussen, 2011). Ties with industry partners provide credible interest in the new venture. These external partners can be reputable companies, launching customers, or university support in the form of technology transfer offices (TTOs). For example, from the Xeltis case (NWO, 2015), it can be noted that not only the great business plan was a factor in the decision why they received the funding, but also the collaborations with the University of Technology in Eindhoven had an impact on that decision (NWO, 2015). Furthermore, early-stage network ties are crucial because the firm does not create a network, but rather fits into an existing one (Guercini & Milanesi, 2017). Having these strong ties has a positive effect on gathering resources, knowledge, technology, and customers (Guercini & Milanesi, 2017; Poponi et al., 2017), therefore highlighting the importance for USOs to have early-stage interaction with other business actors. This acceptance within networks demonstrates the credibility of the USOs since established business actors are willing to interact and exchange physical, monetary, and organizational resources (Guercini & Milanesi, 2017).

The association of business networks on funding acquisition is positive because external investors or companies are more willing to invest or cooperate when the credibility of the USO is acceptable to the cooperating firm or business environment (François & Philippart, 2017; Rasmussen et al., 2011). Leveraging known industry partners helps to bridge the credibility gap for early-stage USOs, assures industry credibility, and is therefore favourably related to funding acquisition. Based on this reasoning, the third hypothesis is formed.

H_3 = *The degree of business networks of the USO has a positive association with funding acquisition.*

2.5 The Role of Scientific-business Based Teams on USO Performance

As aforementioned, the transfer from the research facility to the business environment is challenging and requires new insights and new expertise to make a promising start. Since the goal of the USO is to reach a sustainable firm in a business setting, essential business knowledge is required (Vohora et al., 2004). Because the efforts originate within a university context and are frequently undertaken by experts of their field, assurance can thus be rested that the scientific aspect of the founding team is well represented.

The new environment is different from the internal university setting because the business disciplines in the commercial setting are a completely different field of study, which require new techniques such as production process assessment, financial planning and business model generation (Visintin & Pittino, 2014), which are not usual techniques for scientifically trained personnel. Highlighting the need to require both scientific and business disciplines within the managerial founding team of the USO and the need for multi-disciplined people who possess this knowledge (Poponi et al., 2017). Furthermore, academic spin-offs with team-based leadership are more successful than their individual counterpart (Müller, 2006), highlighting the necessity of multiple people and better if, with different disciplines. Having great scientific and business educated and experienced members within the founding team results in better performance of business and scientific oriented tasks and are thus more likely

to face multi-disciplinary challenges. Since the funding jury evaluates both the research and the business aspect of the venture and having both sides well developed, having a scientific-business diverse team is positively associated with funding acquisition. Following this argument, the fourth hypothesis is developed.

H_4 = *The presence of both scientific and business competencies within the USO team has a positive association with funding acquisition.*

2.6 The Role of Intellectual Property Rights Protection on USO Performance

If the technological asset of the USO is unique and novel, intellectual property rights (IPR) protection is a necessity defence, to ensure first-mover advantages, because it can hinder the competition to apply that specific technology, or components thereof (Ferri et al., 2018; Teixeira & Ferreira, 2018). The resulting IPR protection also might set new standards within the business landscape (Teixeira & Ferreira, 2018), which can have positive effects on the prospective competitiveness of the USO.

Because of the novelty of the proposed asset and the early stage of the USO, this technology may be unrefined, but at the leading edge of technological potential (Teixeira & Ferreira, 2018). IPR protection acts as a safeguard, to ensure that the invested time, money and energy will not be lost. Furthermore, IPR protection is crucial for USOs in the early stages of development because research by Ferri and colleagues (2018), has shown that patents and trademarks have a positive effect on venture capital acquisition in later stages. IPR protection thus ensures a competitive position of the firm in a destined industry, in which the firm can reap returns and establish a sustainable position. The presence of a favourable IPR protection position ensures the funding jury that the USO is able to develop and apply the cutting-edge technology before and after the market launch, which enables first-mover advantages and great realisation of the venture. Based on this argumentation, the fifth hypothesis is developed.

H_5 = *The presence of IPR protection of the USO's asset has a positive association with funding acquisition.*

3. RESEARCH DESIGN

In the following section the subjects of this study, the measurements applied, data collection and analysis are explained in greater detail.

3.1 Subjects of the Study

This study analyses 242 anonymized and aggregated university spin-off (USO) grant proposals submitted for evaluation in the Valorisation Grant (VG) programme (between 2007 and 2014) managed by the Dutch Research Council (NWO). NWO is "(…) *one of the most important science funding bodies in the Netherlands and realises quality and innovation in science. Each year, NWO invests almost 1 billion euros in curiosity-driven research, research related to societal challenges and research infrastructure*" (NWO, 2021a, para. 1). NWO's mission is to advance world-class scientific research that is generating scientific and societal impact by means of excellent, curiosity-driven disciplinary, interdisciplinary, and multidisciplinary research (NWO, 2021a). NWO additionally selects and funds "(…) *the personnel and material cost for scientific research and knowledge exchange and impact activities of Dutch universities and public research institutes. NWO invites partners from industry, the government and societal organisations to contribute with their own knowledge agendas and questions to the programming, realisation and co-funding of research*" (NWO, 2021a, para. 4). Hence, the Valorisation Grant programme (now, Take-off) was one of the financing instruments targeted at academic entrepreneurs from Dutch research institutions to help further develop knowledge innovations within the high-tech domain into new activity and entrepreneurship. It may concern product, process, care, or service innovations in the broadest sense of the word (NWO, 2021c).

The VG has two phases: Phase 1 is the feasibility study with a maximum funding of 25,000 Euro that must be completed within 6 months. Projects that successfully complete Phase 1 could submit their applications for Phase 2 - the valorisation phase with a maximum subsidy amount of 200,000 Euro (NWO, 2014). Phase 2 projects which received the funding must be completed within two years, including an interim evaluation (NWO, 2014). In this study, we focus on USO proposals submitted to Phase 2 of the programme and therefore reflecting active preparation for the valorisation phase.

3.2 Measurements

3.2.1 Dependent Variable

The goal of this study is to find early-stage USO characteristics that are beneficial to funding acquisition. The dependent variable is the funding acquisition and is a dichotomous variable. Either the USO receives the funding (1), or the USO does not receive the funding (0).

3.2.2 Independent Variables

The dependent variable, as described above, can be influenced by independent variables. This influence on the dependent variable can be either positive or negative. Following all the hypotheses mentioned in section 2.2 to 2.6, an assessment of the effects of the independent variables is described below.

3.2.2.1 Market knowledge

Danneels' (2016) earlier study is used to measure the first independent variable. An ordinal scale is used to assess market knowledge:

- The ability to assess the selection and potential of (new) markets, which is measured by using an ordinal scale where this assessment is either done to a great extent (2), sufficiently assessed (1), neutral state (0) or lacking an assessment (-1).

3.2.2.2 Motivation

To define this independent variable, the definition of Rasmussen and Wright (2015, p. 792) is used: *"The ability to identify with the venture and to convince others to contribute to its development"*. The second independent variable is measured based on a previous study by Howell and colleagues (2005).

- The ability of personal motivation, commitment and enthusiasm for the asset, which is measured by using an ordinal scale where this motivation, commitment or enthusiasm is either well developed (1), neutral state (0) or lacking motivation, commitment and enthusiasm (-1).

3.2.2.3 Business Network

The measurement of the third independent variable is based on a study by Abbas and colleagues (2019). Business networks can be defined as relationships between firms that identify, develop or act upon opportunities of business (Abbas et al., 2019).

- The presence of a business partner in the form of either a: launching customer, business alliance or university,

is measured by using an ordinal scale where this partner is present (1), neutral state (0) or negatively involved (-1).

3.2.2.4 Scientific-business Based Teams

The fourth independent variable is measured according to an ordinal scale and based on research conducted by Visintin and Pittino, 2014:

- The presence of a scientific-business based team, which is measured by using an ordinal scale where the team is based out of both competencies (1), neutral state (0) or skewed (either scientific or business efforts are prioritized) (-1).

3.2.2.5 Intellectual Property Rights Protection

Based on a recent study by Ferri and colleagues (2018), the fifth independent variable is measured with an ordinal scale:

- The presence of a well-defined and established IP position (2), IP existent but needs improvement (1), neutral state (0) or difficult IP position (-1).

3.2.3 Control Variables

The term control variable refers to variables that are used to identify spurious associations (Sung, 2007). When determining if X is related to Y, it's crucial to see if the covariation between them remains after other factors' impacts on the relationship are removed (Sung, 2007). When a variable's impact on the other variables in the model is kept constant, it is said to be controlled (Sung, 2007). The type of industry is a categorical variable that will be controlled by categorizing USOs according to their NACE code, which is used to define industries in the European Union. The development trajectory of various industries may differ. In distribution, for example, USOs specializing in the information and communication industries might have an easier and cheaper distribution channel to all computers compared to USOs specialized in heavy machinery in the construction and manufacturing industry. This might give the first industry an advantage in spending the funds on other organizational departments compared to the latter. The same idea can be applied to the costs of producing one additional good, which for software is lower compared to heavy machinery equipment. Table 1 in the appendix shows the different industries derived from the dataset. The second control variable in this study is the academic's contribution as a researcher, which is measured based on the H-index. The H-index is a measure of a person's scientific research effort (Hirsch, 2005) it is used to prevent unwanted favouring of the proposal owing to the academic entrepreneur's scientific excellence, the relevance of their studies, and peer recognition, which might result in higher and biased proposal ratings over less renowned academic entrepreneurs.

3.3 Data Collection

To conduct a comprehensive analysis and test the proposed hypotheses, this study builds on a fully aggregated and anonymized research dataset provided to the author of this study. To construct a part of the independent variables, content analysis on the aggregated evaluation results regarding the feasibility and valorisation potential of selected USO proposals has been conducted. To further enhance the research model, information regarding the performance of business incubators and technology transfer offices of the leading Dutch technical universities from their websites and open-source reports has been retrieved. Scientometric information about the scientific output and its impact (i.e., the number of peer-reviewed publications, citations, citation networks) in the past 20 years by the leading Dutch technical universities have also been conducted. Finally, the research fields of publications and USO grant proposals with the NACE industry codes have been matched.

A literature review has been conducted using the online platforms: Web of Science, ScienceDirect and Scopus. Advanced search has been applied using booleans such as: *"AND"*, as well as field tags like *"TS"* and *"OO"*, to gather the most relevant literature. Keywords such as *"University Spin-off", "Academic", "Entrepreneurship", "Success factors", "performance", "competencies", "resources", "Binary logistic regression"* and additional topic-specific keywords have been used. The time variable was set to the recent five years to derive the current state of literature and research, if no recent and suited papers have been found, the period was widened. Additional literature has been provided by the supervisor of this study.

3.4 Analysis

To analyse the data, the software program MAXQDA was applied for grounded theory, Excel and SPSS were used for data input and processing. First, the data analysis technique applied is based on the grounded theory because the dataset of this study includes a transcript of comments on which new theory and insights can emerge (Pulla, 2016). The goal of grounded theory is to extract new concepts and hypotheses from the data without preconceived notions (Adolph et al., 2011). Grounded theory entails that the first step in content analysis is to break the dataset into discrete sections, called codes (Adolph et al., 2011; Pulla, 2016). Each section is a small piece of data from the dataset, and these are labelled together with the same meaning and properties (Adolph et al., 2011; Pulla, 2016). Finally, these grouped categories were bundled under one overarching category, which is the research question (Adolph et al., 2011).

Second, binomial logistic regression analysis (BLRA) is an S-shaped distribution function and applied to predict the funding acquisition which is either granted (1) or rejected (0), based on an array of independent variables (Abdulqader, 2017; Field, 2009). BLRA is the selected regression model because this method provides the best fitting function with a maximum likelihood compared to a linear regression model which does not capture this binary outcome and is better suited for a continuous dependent variable (Abdulqader, 2017). With the use of binomial logistic regression, there are some general assumptions: a) No significant variables are omitted; b) No extraneous variables are included; c) The explanatory variables are error-free measures; d) The observations are independent, and e) Errors are binomially distributed (Abdulqader, 2017; Midi et al., 2010). These presumptions will be checked in this research and elaborated further in the results section.

Third, from the original dataset of 242 proposals, a smaller subset of 103 proposals with data about survival was provided by the supervisor of this study. With this data, the number of funded USOs who have survived can be determined, i.e., the accuracy of the valorisation programme, as well as funded USOs who have not survived, i.e., double failure.

4. RESULTS

In this section, the findings of grounded theory are presented, followed by the results of the descriptive and binomial logistic regression models, accuracy analysis of the valorisation programme and concluded by validating the outcome.

4.1 Grounded Theory

The process of the data analysis started with applying grounded theory on the positive comments of the 242 USO grant proposals. This study is focused on beneficial early-stage criteria and thus puts the positive aspect of the comments in the centre of attention. The first step within the grounded theory is to split the comments into small pieces of code. The comments of the funding jury ranged from short and not very elaborated to broader and more detailed ones which covered more categories of the later elaborated axes. The number of codes in the first step resulted in 932 codes. These codes were then accumulated by similarity and category under 14 axes. Five of these axes are aligned with the hypotheses of this study and include Market knowledge which includes statements like "Good knowledge of the market" and observed 80 codes. The motivation includes statements like "Highly motivated team leaders" and sums up to 139 codes. Business networks include statements like "Strong commercial partner with experience with the product in the market" resulted in 109 codes. Scientific-business based team includes statements like "multidisciplinary team" and accumulated to 25 codes. Finally, IPR protection includes statements such as "Strong IP position worldwide" and accounted for 58 codes.

In addition to these axes, nine additional axes were created. The first one is called the *"X-factor"* and includes statements like: "The simplicity of this product appeals enormously" and "It is a beautiful product". This category aggregates all the impressions of the jury about the product and generally how the jury perceives the usability, appearance and simplicity of the technology. In total 40 codes were identified. The second category is about the presentation and includes statements like "Presentation, excitement, visuals, examples" and "This is a convincing presentation". This variable captures all the comments revolving around the presentation, the story, the visuals and the presentation style. In total 52 codes were identified. The third category is about future predictions or prognosis by the jury and includes statements like "Large market with a lot of future" and "Potential disruptive technology". This variable captures all the market, technology or venture related future prognosis; 46 codes have been identified. The fourth category is about the assessment of the team and includes statements like "Strong team" and "Robust, good team". This category is about the overall perception the jury has about the team. Together 51 codes have been identified.

The fifth category identified is about the presence of an external investor and includes statements like "Financing has already been found, which is an advantage" and "Already financed by external parties". This category includes all the statements of the jury mentioning that an external party is investing in the USO. In total 16 codes have been identified. The sixth category identified is about societal benefits including healthcare, environment and social criteria. Statements like: "Pharmaceutically relevant substances", "Responds to social problems" and "Strong reduction on CO2 removal costs, + 20%", cover the enhancement of society based on the USO's asset. These three subcategories accumulated to 37 codes. The seventh category focuses on the presence of knowledge within the team and includes statements such as "Good, prominent knowledge base." and "Long-term knowledge acquired". This category captures the presence of knowledge and development. 31 codes have been identified. The eighth category focuses on the proposed business plan of the USO and includes statements like "This is a well-developed business case with a clear strategy" and "Clear plan how to commercialize". For this category 72 codes have been identified. The ninth and final category focuses on the technology proposed by the USO and includes statements like "Good technology with many small-scale applications" and "Advanced technology. Already working". The final category includes all the statements concerning technological progress, diversification of applications and innovativeness. In total 176 instances have been identified.

All 14 axes are linked to the research question of this study: "*Which early-stage university spin-off characteristics and competencies of academics are beneficial to governmental funding acquisition?*" and focus on beneficial characteristics and competencies of the early-stage USOs. Table 2 and 3 in the appendix summarizes the findings, number of codes and distribution according to category.

4.2 Descriptive Statistics and Models

Table 4.1 shows the descriptive statistics of all variables applied in this study on funding acquisition, in addition to table 4.2, which shows the results of the binary logistic models. Complementary to table 4.1 and 4.2, table 5.1 and 5.2 from the appendix show the same binary logistic regression with the change of the dependent variable being survival. The results of table 5.2 show a positive, however non-significant regression between the independent variables and survival, except for IPR protection which resulted in a negative regression. Possible reasons will be provided in the discussion section. In the next paragraphs, table 4.1 and 4.2 will be elaborated in detail and a larger version of the tables is visible in the appendix.

The independent variables show a slight correlation with each other, with a maximum correlation coefficient of 0.274 which is below the threshold of 0.4. The variance inflation factor (VIF) is a method to determine whether the model exhibits multicollinearity, which means that the variables within the model are related to each other, causing an inflation of the standard errors of the coefficients and potentially making variables statistically insignificant when they should be significant (Akinwande et al., 2015). The VIF value of each independent variable is well below 2 and much closer to 1 as can be seen in table 6 in the appendix, a score of 1 indicates that there is no multicollinearity (Akinwande et al., 2015). Table 4.2 presents the result of the binary logistic regression with different models. Model 1 analyses the dependent variable in combination with the two control variables. Model 2 through model 6 show the influence of each independent variable on the dependent variable separately in addition to the two control variables. The reason for this is that if the variable has a significant impact isolated, it should also have the same effect in the full model, which makes the model generally more robust. Model 7 is a complete model that includes all independent variables and controls. The hypotheses are tested based on the full model and controlled by the industry and the H-index of the academic. The first control variable, industry, shows a weak, negative and insignificant impact, meaning that the type of industry does not play a role in governmental funding acquisition. The H-index also shows a weak and statistically insignificant but positive effect, indicating a similar reaction on funding acquisition compared to the type of industry.

The Omnibus Tests of Model Coefficients in table 7 from the appendix, is an assessment of the overall fit of the model (Boateng et al., 2019). The null hypothesis, in this case, is that the fitted model does not vary from the alternative hypothesis which states that the fitted model does differ (Boateng et al., 2019). Alpha is set to 0.05 throughout all the testing of significance and any value below alpha 0.05 indicates statistical significance and rejection of the null hypothesis. Model 7,

Table 4.1. Range, means, standard deviations and correlations of the variables (N = 242).

	Minimum	Maximum	Mean	S.D.	1	2	3	4	5	6	7	8
[1] USO funding decision	0	1	0.41	0.493	1							
[2] Market knowledge	-1	2	0.17	0.974	0.266**	1						
[3] Motivation	-1	1	0.31	0.624	0.274**	0.061	1					
[4] Network	-1	1	0.15	0.616	0.149*	0.066	0.06	1				
[5] Scientific-business based teams	-1	1	-0.14	0.602	0.223**	0.240**	0.105	0.148*	1			
[6] IPR protection	-1	2	-0.06	0.746	0.035	-0.042	-0.03	0.12	-0.038	1		
[7] Industry (Control)	0	19	8.49	6.21	-0.086	-0.037	-0.019	-0.077	-0.066	-0.083	1	
[8] H-index (Control)	0	92	24.76	19.063	0.012	-0.021	-0.066	0.064	-0.114	0.022	0.164*	1

*. Correlation is significant at the 0.05 level (2-tailed) ; **. Correlation is significant at the 0.01 level (2-tailed).

including all variables, is fitting significantly ($p < 0.0001$) better than the null model and therefore the null hypothesis is rejected (Boateng et al., 2019).

The model summary in table 8 from the appendix displays different pseudo R-square measurements to show how well model 8 fits the data (Boateng et al., 2019). The Nagelkerke R-square value ranges between -1 and 1, this measurement indicates that if the value is positive then as the predictor variable rises, so does the probability of the event occurring, and if the value is negative that means by increasing the predictor variable, the possibility of the result occurring decreases (Field, 2009). If a variable has a low R-value, it adds very little to the model (Field, 2009). The Cox & Snell R-square is another method of determining the significance of the model, however, compared to Nagelkerke R-square it does not have an upper bound (Field, 2009) and therefore the Nagelkerke R-square is preferred due to comparability among models. The Nagelkerke R-square value is 0.235 which means that the fitted model can explain or account for 23.5% of the variation in the dependent variable. The -2 log-likelihood is another measure for goodness of fit and fluctuates throughout the different models and is at the lowest value in the final model indicating a better fit of that model with the data.

The Hosmer and Lemeshow test represents a Chi-square test applied for testing the adequacy of the model fitting the data. Table 9 in the appendix resulted in an insignificant value of $p = 0.515$. In this measurement, statistical insignificance is an indicator of a good fit of the model to the data (Field, 2009). Table 7, 8 and 9 all point to the same conclusion that this model fits the data statistically significant.

Table 10 from the appendix shows that from the 242 USO proposals, 99 proposals were observed to be funded and 143 proposals not to be funded. The classification table of this model correctly classifies 121 proposals not getting funded and 51 proposals to be funded. It also wrongly predicted 22 proposals to get funded, even though they did not get funded, as well as wrongly predicted 48 proposals to not get funded even though they did get funded. Together this results in an overall accuracy of the model of 71.1%.

4.3 Hypotheses

Hypothesis one proposes that USOs who score high on market knowledge are positively associated with receiving funding. The coefficient value of market knowledge is positive, moderate ($B = 0.540$) and significant (p-value = 0.001) in model 7, table 4.2. Thus, hypothesis 1 is accepted.

The predicted probability to fall into either the funding or the non-funding group is expressed through the predicted change in log odds because the relationship of binomial logistic regression is non-linear. This coefficient ($B = 0.540$) describes for every 1 unit increase in market knowledge, an expected increase of 0.54 in the log-odds of funding acquisition, holding all other variables constant. For market knowledge, the odds ratio ($Exp(B) = 1.716$) is 1.716, which means that by increasing the independent variable by 1 unit, the factor of funding acquisition is around 1.72 times higher. If this value is equal to 1, there is no relationship between the independent variable and the dependent variable. If this value is greater than 1, that means there is a positive regression, therefore the event is likely to occur and if the value is between 0 and 1 that means that there is a negative regression, thus the event occurs less likely. In the 95% confidence interval, the lower value is 1.26 expressing a 1.26 times higher increase on the lower end and an upper value of 2.337 indicating a 2.34 times higher increase on the upper end of the distribution. Table 11 in the appendix displays all coefficient details including the 95% confidence interval.

Hypothesis two proposes that USOs who score high on motivation are positively associated with receiving funding. The coefficient value of motivation is positive and strong ($B = 0.993$) and statistically significant (p-value < 0.0001). Thus, hypothesis 2 is accepted. This coefficient ($B = 0.993$) describes for every 1 unit increase in motivation, an expected increase of almost 1 in the log-odds of funding acquisition, holding all other variables constant. For motivation, the odds ratio ($Exp(B) = 2.7$) is 2.7, which means that by increasing the independent variable by 1 unit, the factor of funding acquisition is 2.7 times higher. In the 95% confidence interval, the lower value is 1.646 expressing a 1.65 times higher increase on the lower side and an upper value of 4.431 indicating a 4.43 times higher increase on the upper side of the 95% confidence interval.

Hypothesis three proposes that USOs who have higher network capabilities are positively associated with receiving funding. The coefficient value of networking is positive and moderate ($B = 0.320$) but insignificant (p-value = 0.185). Thus, hypothesis 3 is rejected.

Hypothesis four proposes that scientific-business based USOs are positively associated with acquiring funding. The coefficient value of scientific-business balance is positive and moderate ($B = 0.532$) and significant (p-value = 0.037). Thus, hypothesis 4 is accepted. This coefficient ($B = 0.532$) describes for every 1 unit increase in scientific-business balance, an expected increase of 0.53 in the log-odds of funding acquisition, holding all other variables constant. For scientific-business balance, the odds ratio ($Exp(B) = 1.703$) is 1.703, which means that by increasing the independent variable by 1 unit, the factor of funding acquisition is 1.7 times higher. In the 95% confidence interval, the lower value is 1.033 and an upper value of 2.807 indicating a 2.8 times higher increase on the upper end.

Hypothesis five proposes that USOs who score high on intellectual property rights protection are positively associated with acquiring funding. The coefficient value of IPR protection is positive, weak ($B = 0.156$) and insignificant (p-value = 0.428). Thus, hypothesis 5 is rejected.

Table 4.2. Binary Logistic regression results. Dependent variable: USO funding decision (N = 242).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.
Constant	-0.189	0.262	-0.336	0.275	-0.574*	0.29	-0.273	0.268	-0.185	0.272	-0.188	0.263	-0.721*	0.309
Market knowledge			0.579**	0.144									0.540**	0.158
Motivation					0.990**	0.237							0.993**	0.253
Network							0.482*	0.221					0.32	0.241
Scientific-business based teams									0.793**	0.236			0.532*	0.255
IPR protection											0.076	0.177	0.156	0.197
Industry (Control)	-0.03	0.022	-0.029	0.022	-0.032	0.023	-0.026	0.022	-0.027	0.022	-0.029	0.022	-0.029	0.024
H-index (Control)	0.003	0.007	0.003	0.007	0.005	0.007	0.002	0.007	0.006	0.007	0.003	0.007	0.007	0.008
-2 Log likelihood	325.483		308.203		306.123		320.592		313.33		325.299		281.165	
Nagelkerke R Square	0.011		0.103		0.114		0.038		0.076		0.012		0.235	

* p < 0.05 ; ** p < 0.01 ; Hosmer and Lemeshow is not significant (p > 0.05).

4.4 Accuracy of the Valorisation Programme

From the dataset of 242 USO proposals, 103 were provided with additional data about the existence of the USO after the valorisation programme. From these 103 proposals, 36 proposals got funded (1) and thus 67 proposals did not receive the funding (0). 24 of the 36 proposals (66,67%) were funded and survived on the market, which is the accuracy of the valorisation programme. 12 of the 36 proposals (33,33%) were funded yet did not survive on the market, i.e., double failure occurred to one out of three proposals who got funded. Of the 67 proposals, 28 did not receive funding but survived after the valorisation programme and the remaining 39 did not receive funding and ceased to exist. Table 12 in the appendix shows the full distribution of the proposals and their accuracy.

4.5 Data Validation

There are a few assumptions that must be fulfilled to validate the data when applying binary logistic regression analysis. In this study, these assumptions have been checked and applied.

4.5.1 Assumption of Appropriate Outcome Structure

The outcome variable i.e., the dependent variable, which is the funding decision by the valorisation programme must be purely binary (Abdulqader, 2017). The classification table in the appendix confirms the outcome being purely binary, either funded (1) or not funded (0).

4.5.2 Assumption of Observation Independence

The dataset applied in this study consists of independent and unique observations without duplicates and excluding time series (Abdulqader, 2017). The independence of observation is fulfilled based on the study's design and data collection, which is elaborated in section 3.1 Subjects of the Study and 3.3 data collection.

4.5.3 Assumption of the Absence of Multicollinearity

Table 6 shows the VIF values, which for all variables are very close to 1, assuring that multicollinearity is absent within this model. If the VIF value would be greater than 5, that specific variable would be highly correlated with other variables and thus falsely represent the results (Akinwade et al., 2015). In case that would occur, that specific redundant variable should be removed from the model and another trial started assuring that multicollinearity is absent.

4.5.4 Assumption of Linearity of Independent Variables and Log-Odds

Based on the outcome of binary logistic regression, probabilities cannot be applied due to their linear representation. Therefore, the probabilities of the independent variables have to be transformed into odds and log-odds, which are not restricted to the range of 0 to 1 (Tranmer & Elliot, 2008). This assumption is met because the results are measured and assessed in odds and log-odds.

4.5.5 Assumption of a Large Sample Size

This study benefits from a unique dataset of 242 early-stage USO proposals. Binomial logistic regression requires a large sample, around a minimum of 50 cases for each explanatory variable is required (Abdulqader, 2017). Based on 5 independent variables and accounting for the rareness of the sample, this assumption is almost completely fulfilled.

5. DISCUSSION AND CONCLUSIONS

The successful establishment and knowledge transfer from the university to the market is of great importance to the founders of USOs, researchers in the field of academic entrepreneurship and governmental valorisation programmes. These new ventures are established oftentimes on cutting-edge researched technologies and have the potential to innovate productivity and enhance living standards (Ferri et al., 2018; Hayter, 2013). As a result, identifying beneficial early-stage USO characteristics is critical for enhancing funding acquisition and the growth of these ventures early in the development stage (Vohora et al., 2004). To create a clear focus on this issue, the following research question has been established: *"Which early-stage university spin-off characteristics and competencies are beneficial to governmental funding acquisition?"*

The USO development framework by Vohora and colleagues (2004), has been applied as a basis on which several hypotheses are created to test if the required competencies of the first two development stages (hypothesis 1 and 2) are beneficial to pass the critical threshold of credibility, which in this study, is the funding by the governmental valorisation programme. A further method to pass the threshold of credibility was hypothesized with business networks (hypothesis 3). Finally, two further hypotheses based on literature and grounded theory have been developed to examine the impact of scientific-business diverse teams (hypothesis 4) and a further hypothesis about the positive association of IPR protection (hypothesis 5).

The first hypothesis proposed that USOs with a greater level of market knowledge are positively associated to obtain funding is verified. This follows the notion of Lawton-Smith & Baines (2019), that comprehension of the target market, as well as the needs of the customers, are of great importance to early-stage USOs success while extending the idea to governmental funding acquisition instead of market exploitation. In addition to that, this assumption confirms the importance of market knowledge in the early stage of the USO which is part of the applicability of the asset to the destined market (Vohora et al., 2004). Interestingly, the impact of market knowledge has a statistically insignificant, weak but positive effect on survival (table 5.2, model 7) under the condition of this early-stage dataset. The reason for this is not clear since there can be many fluctuating variables based on the

development stage of USOs (Vohora et al., 2004). A possible explanation might be the assessment of market knowledge in this study, which can be interpreted as a precursor to the operational activities of closing a deal with a customer, which occurs more frequently after the firm has reached a higher development stage. Adjusting this measurement to fit more closely with the tasks to ensure survival on the market, could have led to a stronger and statistically significant result.

Another important finding is the confirmation of hypothesis 2, stating that USOs with a higher degree of motivation are positively associated to acquire funding. A possible explanation might be the power of influence tactics, and persuasion of the jury (Sergeeva & Zanello, 2018), which could be achieved through great motivation, expressing promises and expectations of the USO and its founder or founders. Another possibility includes the importance of motivating reasons and the commitment of the venture champion towards the venture (Rasmussen et al., 2011). USOs by default face the challenge of transferring a novel researched asset from the university to the market (Hayter, 2013), facing multiple junctures and tough conditions (Vohora et al., 2004). This requires enthusiastic and committed members to face these challenges and overcome them during the USO start-up process (Rasmussen et al., 2011). Motivation continues to have a positive and moderate influence on survival yet is statistically insignificant. A possible explanation might be the required motivation to push through later junctures such as the threshold of credibility and sustainability (Vohora et al., 2004). Furthermore, when acquiring larger sums of capital from institutions such as VCs, which on the one hand demand some sort of already established legitimacy attributable to state financing, as well as a higher level of dedication and motivation (Teixeira & Ferreira, 2018).

The third hypothesis is rejected, which states that USOs with business partners are positively associated to acquire funding. Even though partners can help to achieve legitimacy and overcome this liability to gather resources (Fisher et al., 2013; François & Philippart, 2017), the results do not statistically confirm that, therefore further research to close this gap is highly recommended. A possible explanation might be the requirement of direct legitimacy to the funding jury instead of indirectly through third parties (launching customers, suppliers or universities), even though these third parties might be important for the USO (François & Philippart, 2017). This direct legitimacy could be achieved through other concepts such as great presentations, excellent technological showcases or a detailed business plan. Relating business networks to survival, again a positive, moderate but statistically insignificant effect has been observed. The degree to which business partners have been evaluated in this study could be tailored to the variable of survival, removing university support and including new types of business cooperation such as joint ventures or collaborative research to capture the association more accurately.

The fourth hypothesis is accepted, stating that USOs with a scientific-business based team are positively associated with funding acquisition. This confirms the notion of USOs who have to master scientific expertise with business knowledge to transition successfully from the university to the market (Poponi et al., 2017; Vohora et al., 2004). Scientific-business diverse teams remains an important concept (Visintin and Pittino, 2014) and now approved and extended to the early stage of the USO. Putting scientific-business based teams in relation to survival, a moderately positive yet insignificant result was found. A possible explanation for this might be the continued demand for both knowledge domains, to further develop and refine the asset in combination with the successful exploitation of the asset on the market.

One unanticipated finding was the rejection of hypothesis 5, stating that USOs with beneficial IPR protection are positively associated with funding acquisition. A possible explanation might be the difficulty and inexperience of the academics with IPR protection, which also require large sums of capital to successfully protect the asset, which the early-stage USO is in shortage of (van Geenhuizen & Soetanto, 2009). Another option is that because IPR protection is so vital to the jury, a very excellent implementation resulted in funding acquisition, which only a few proposals could satisfy. Connecting IPR protection to survival, the model shows a weak, negative and insignificant association. As a result, the impact of IPR protection reduces the likelihood of survival. This discrepancy may be due to the choice of knowledge protection method, this could be a trade secret, which is inexpensive but ensures no legal protection. Another possibility could be again the high costs associated with IPR protection, which might be better spent on marketing, the refinement and development of the asset or acquisition of goods and services. To fully comprehend the association, an investigation of other external factors is recommended.

Concerning the control variables, both the industry and the H-index could not be determined statistically significant, additional testing should be conducted before any further conclusions are drawn.

5.1 Implications on Theory

Several implications on theory and the literature of academic entrepreneurship can be drawn. The first implication is the statistically significant applicability of the first two competencies in the Vohora and colleagues (2004) framework on funding acquisition. This goes in line with the notion that the first two junctures have to be successfully passed before the third threshold of credibility can be tackled, which in this context is governmental funding acquisition. This finding makes the framework relevant and applicable to the current context.

In addition to that, the results of hypothesis 2 confirm that the venture championing competency by Rasmussen and colleagues (2011), in the form of motivation and commitment, to be a statistically relevant indicator to governmental funding. Successfully extending the original applicability from credibility towards funding acquisition. Applying the concept of credibility in the form of business partners to the funding decision has shown a non-significant effect, requiring a reassessment of this concept for governmental funding acquisition and thus current limited application. Finally, the results confirm that scientific-business based teams are significantly positively associated with funding acquisition, thus accepting the concept of Visintin and Pittino (2014). Extending the contribution of the authors from general USO performance towards the governmental funding acquisition.

5.2 Implications for Practitioners and Policy

The findings of this study have several important implications for (future) practitioners. According to these findings and the context of the data, three of the five independent variables have been confirmed. Market knowledge, motivation, and scientific-business based teams should be emphasized. More specifically, that includes the extensive evaluation of the market, customers and competitors which should be well known and studied. In addition, strong motivation can influence the behaviour of third parties to act in the interest of the venture. In the context of

governmental funding acquisition, this implies demonstrating strong motivation of the asset, which could be accomplished through a compelling narrative about the benefits the asset can achieve. Finally, presenting expertise from both knowledge domains and generally having an expertise diverse team has resulted in higher odds of funding acquisition. Since the venture is born within the university setting, scientific expertise can thus be assured, additional help should be sought from skilled business personnel with a focus on marketing, product development or financial business planning, depending on the limitations of the venture.

When it comes to the variable of business networks, it resulted in a moderate, positive strength to funding acquisition, yet from this dataset arose statistical insignificant. Business partners can provide legitimacy and the supply of resources or knowledge to the USO. Transferring this idea to governmental funding acquisition implies that business partners are important, however not to the same extent as the above mentioned first three concepts. The same caution should be applied to IPR protection, which may ensure exclusive exploitation of the asset and thus benefit the commercialization process. For governmental funding acquisition, this implies that the better the asset can be protected on the IPR protection level the better, however, it should not be treated as a standalone feature and instead a good addition to the overall proposal.

The implications for practitioners can be summarized as: *The primary focus should be applied on great market knowledge, high motivation and a knowledge diverse team. Additionally, to improve the odds of funding add the presence of complementary business partners, as well as a defensible IPR protection position.*

Directing the implications to the policy level, table 12 in the appendix shows that of the 103 proposals, 36 have been funded, from which 24 of them have survived, leading to an accuracy of 66,67%. Therefore, two out of three proposals have received funding and realised the venture. That number on its own is not very impressive because adding the survived column of both the funded and non-funded, the sum of which equals 52, which then is almost a 50/50 chance between funded and non-funded, which makes the impact of funding on survival almost as significant as a coin toss. Due to the small sample size, final implications should be made with caution, additionally, there might be a slew of other factors influencing success and survival, such as funding outside of the government program or orders from the launching customer. Extending this thought, perhaps USOs require more than just funding and instead require knowledge and training from experienced consultants or mentors. A reasonable approach to tackle this issue could be to implement more emphasis on classes with mentors or business development consultants to measure the odds of being funded and then one step later, the truly relevant metric of survival rates compared to the previous year. Of course, there are more benefits to being funded, such as easing the supply of goods and hiring of personnel, which might have benefitted the funded and survived group to be able to survive.

On the other hand, there is the issue of double failure, USOs who received funding and did not accomplish to survive. Based on this sample, 12 out of 36, or one out of three proposals did receive funding, yet ceased to exist with the funding being spent without any contributing effect. Unfortunately, there was no additional information given about the reason why the USO ceased to exist since there could be many possible reasons, such as over-promising and under-delivering, inadequate spending of the funding or wrong estimations about the market.

The policy implications can be summarized as: *For the next valorisation grand round, study the effect of additional sessions and training by business development consultants or previous valorisation grant winners on the likelihood of being funded and on the likelihood of survival on the market. This additional information may enhance proposals, therefore increasing the likelihood of knowledge transfer from academia to society and thus a more efficient use of the valorisation grand budget.*

5.3 Limitations and Future Research Agenda

The development of USOs is complex, covering multiple knowledge domains with numerous variables influencing the outcome of the venture. As a result, many significant constraints will be discussed in the last section before concluding with a future research agenda.

First, focusing on the origin of data, which is specifically and only on Dutch proposals from Dutch universities or medical centres, with a Dutch funding jury and valorisation programme and Dutch regulations governing them all. Based on this homogenous environment, comparing the results with other nations is challenging due to different regulations, the weight of criteria and the development of local universities. Second, identifying the true potential of a proposal based on a few short comments of the funding jury is challenging and could distort the real picture of the proposal, especially if these few comments have led to funding acquisition. The same limitation can be applied to the negative feedback of the funding jury, which may not represent the full picture of the proposal. This might be avoided by adopting a defined form of criteria that the jury must fill out based on predetermined characteristics as well as extra personal comments. This technique ensures at least a fair comparison of the proposals and may provide a better understanding by third parties such as researchers. Third, binomial logistic regression analysis on a larger sample size would show a more accurate model but due to the uniqueness of the data, that option was not given. In addition to that, a larger sample for the survival data would have shown a more concrete picture of the survival rate and to an extent the occurrence of double failure.

Further research on the topic of beneficial early-stage competencies needs to be undertaken before the association and discussion about early-stage characteristics and funding acquisition is more rich, diverse and robust. As a future research agenda, it might be relevant to investigate the weaker and insignificant variables of this study. Such as focusing on what type of business partners are more relevant than others and if IPR protection can be included in the list of beneficial characteristics. Further approval of the accepted hypothesis is also required. In addition to this, table 3 in the appendix suggests more variables for future research that might have an impact on funding acquisition, such as the impact of personal future expectations, evaluation of the technology, degree of business proposals and the presence of a contribution to society. Future studies on these topics are recommended.

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8. APPENDIX

Table 1. Control variable industry.

Number	Industry	Frequency
1	A - Agriculture, forestry and fishing	6
3	C - Manufacturing	66
4	D - Electricity, gas, steam and air conditioning supply	10
5	E - Water supply; sewerage; waste managment and remediation activities	9
6	F - Construction	5
7	G - Wholesale and retail trade; repair of motor vehicles and motorcycles	6
8	H - Transporting and storage	2
9	I - Accommodation and food service activities	1
10	J - Information and communication	22
13	M - Professional, scientific and technical activities	27
14	N - Administrative and support service activities	5
15	O - Public administration and defence; compulsory social security	5
16	P - Education	3
17	Q - Human health and social work activities	51
18	R - Arts, entertainment and recreation	1
19	S - Other services activities	1
0	Z - No Info	22
	Sum:	242

Table 2. Results after applying grounded theory based on the hypotheses.

Hypothesis	Category	Number of codes
1	Market knowledge	80
2	Motivation	139
3	Business network	109
4	Scientific-business based team	25
5	Intellectual property protection	58
Total:		411

Table 3. Additional findings from grounded theory.

Number	Category	Number of codes
6	X factor	40
7	Presentation	52
8	Future predictions	46
9	Team	51
10	Investor	16
11	Societal benefit	37
12	Knowledge	31
13	Business plan	72
14	Technology	176
Total:		521

Table 4.1. Range, Means, Standard deviations and correlations of the variables (N = 242).

	Minimum	Maximum	Mean	S.D.	1	2	3	4	5	6	7	8
[1] USO funding decision	0	1	0.41	0.493	1							
[2] Market knowledge	-1	2	0.17	0.974	0.266**	1						
[3] Motivation	-1	1	0.31	0.624	0.274**	0.061	1					
[4] Network	-1	1	0.15	0.616	0.149*	0.066	0.06	1				
[5] Scientific-business based teams	-1	1	-0.14	0.602	0.223**	0.240**	0.105	0.148*	1			
[6] IPR protection	-1	2	-0.06	0.746	0.035	-0.042	-0.03	0.12	-0.038	1		
[7] Industry (Control)	0	19	8.49	6.21	-0.086	-0.037	-0.019	-0.077	-0.066	-0.083	1	
[8] H-index (Control)	0	92	24.76	19.063	0.012	-0.021	-0.066	0.064	-0.114	0.022	0.164*	1

*. Correlation is significant at the 0.05 level (2-tailed) ; **. Correlation is significant at the 0.01 level (2-tailed).

Table 4.2. Binary Logistic regression results. Dependent variable: USO funding decision (N = 242).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.
Constant	-0.189	0.262	-0.336	0.275	-0.574*	0.29	-0.273	0.268	-0.185	0.272	-0.188	0.263	-0.721*	0.309
Market knowledge			0.579**	0.144									0.540**	0.158
Motivation					0.990**	0.237							0.993**	0.253
Network							0.482*	0.221					0.32	0.241
Scientific-business based teams									0.793**	0.236			0.532*	0.255
IPR protection											0.076	0.177	0.156	0.197
Industry (Control)	-0.03	0.022	-0.029	0.022	-0.032	0.023	-0.026	0.022	-0.027	0.022	-0.029	0.022	-0.029	0.024
H-index (Control)	0.003	0.007	0.003	0.007	0.005	0.007	0.002	0.007	0.006	0.007	0.003	0.007	0.007	0.008
-2 Log likelihood	325.483		308.203		306.123		320.592		313.33		325.299		281.165	
Nagelkerke R Square	0.011		0.103		0.114		0.038		0.076		0.012		0.235	

* $p < 0.05$; ** $p < 0.01$; Hosmer and Lemeshow is not significant ($p > 0.05$).

Table 5.1. Range, means, standard deviations and correlations of the variables (N = 103).

	Minimum	Maximum	Mean	S.D.	1	2	3	4	5	6	7	8
[1] USO survival	0	1	0.5	0.502	1							
[2] Market knowledge	-1	2	0.19	0.908	0.127	1						
[3] Motivation	-1	1	0.25	0.589	0.194*	-0.019	1					
[4] Network	-1	1	0.12	0.548	0.176	0.151	0.242*	1				
[5] Scientific-business based team	-1	1	-0.16	0.538	0.148	0.102	0.094	0.162	1			
[6] IPR protection	-1	2	-0.14	0.715	-0.08	-0.17	0.012	0.116	-0.004	1		
[7] Industry (Control)	0	19	8.5	6.223	-0.031	-0.028	-0.042	-0.121	0.079	-0.108	1	
[8] H-index (Control)	0	92	21.11	18.141	0.146	0.03	-0.071	-0.121	-0.018	-0.056	0.145	1

*. Correlation is significant at the 0.05 level (2-tailed)

Table 5.2. Binary Logistic regression results. Dependent variable: USO survival (N = 103).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.	B	s.e.
Constant	-0.199	0.39	-0.257	0.396	-0.451	0.42	-0.402	0.413	-0.082	0.403	-0.2	0.391	-0.512	0.453
Market knowledge			0.278	0.224									0.211	0.244
Motivation					0.742*	0.362							0.65	0.38
Network							0.752	0.392					0.554	0.418
Scientific-business based team									0.611	0.389			0.454	0.415
IPR protection											-0.228	0.285	-0.255	0.304
Industry (Control)	-0.017	0.033	-0.016	0.033	-0.016	0.033	-0.011	0.033	-0.022	0.033	-0.02	0.033	-0.019	0.035
H-index (Control)	0.017	0.011	0.017	0.012	0.02	0.012	0.02	0.012	0.018	0.011	0.017	0.011	0.022	0.012
-2 Log likelihood	140.283		138.725		135.818		136.385		137.717		139.638		130.154	
Nagelkerke R Square	0.032		0.051		0.087		0.08		0.064		0.04		0.154	

* $p < 0.05$; Hosmer and Lemeshow is not significant ($p > 0.05$).

Table 6. Variance Inflation Factor (VIF).[a]

Model		Collinearity Statistics VIF
1	(Constant)	
	Market knowledge	1.066
	Motivation	1.019
	scientific-business balance	1.108
	Network	1.055
	IP position	1.027
	Control industry	1.044
	Control H-index	1.052

a. Dependent Variable: USO funding decision (0=decline; 1=funding)

Table 7. Omnibus Tests of Model Coefficients.

		Chi-square	df	Sig.
Step 1	Step	46.273	7	.000
	Block	46.273	7	.000
	Model	46.273	7	.000

Table 8. Model Summary.

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	281.165[a]	.174	.235

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 9. Hosmer and Lemeshow Test.

Step	Chi-square	df	Sig.
1	7.203	8	.515

Table 10. Classification Table.[a]

Observed			Predicted		
			0	1	Percentage Correct
Step 1	USO funding decision (0=decline; 1=funding)	0	121	22	84.6
		1	48	51	51.5
	Overall Percentage				71.1

a. The cut value is .500

Table 11. Variables in the Equation.

		B	S.E.	Wald	df	Sig.
Step 1[a]	Control industry	-.029	.024	1.451	1	.228
	Control H-index	.007	.008	.716	1	.397
	IP position	.156	.197	.628	1	.428
	Market knowledge	.540	.158	11.739	1	.001
	Motivation	.993	.253	15.458	1	.000
	scientific-business balance	.532	.255	4.357	1	.037
	Network	.320	.241	1.758	1	.185
	Constant	-.721	.309	5.437	1	.020

Table 11. Variables in the Equation (Continued).

			95% C.I. for EXP(B)	
		Exp(B)	Lower	Upper
Step 1[a]	Control industry	.971	.927	1.018
	Control H-index	1.007	.991	1.022
	IP position	1.169	.795	1.718
	Market knowledge	1.716	1.260	2.337
	Motivation	2.700	1.646	4.431
	scientific-business balance	1.703	1.033	2.807
	Network	1.377	.858	2.208
	Constant	.486		

a. Variable(s) entered on step 1: Control industry, Control H-index, IP position , Market knowledge, Motivation , scientific-business balance , Network .

Table 12. Distribution and accuracy of the valorisation programme (N = 103).

	Survived	Exited	Sum
Funded	24	12	36
Not funded	28	39	67
Sum	52	51	N = 103