Success Factors of Early-Stage University Spinoffs for Receiving Funding

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ABSTRACT

University Spin-offs, also known as USOs, are academic firms that are incubated in universities and other educational institutions with the purpose of commercializing their innovations into the industry. We examined the early development process of USOs and found evidence from academic articles to suggest that financial challenges often hindered further development into later stages. The answer was to acquire governmental funding to overcome these junctures. The purpose of this paper is to understand the relationship of USO characteristics and how they play roles in determining USO funding decisions. This was carried out with an analysis of grant proposals submitted by USOs to the Dutch Research Council (NWO). The dataset contained an evaluation of 242 university spin-offs from Dutch universities. Based on this dataset, a further analysis was undertaken by binary logistic regression analysis. The results showed that entrepreneurial competencies positively influence the outcome of receiving governmental funding, such as individual motivation and business model planning. We also found that commercialization of USO development had a desirable positive impact in receiving funding. But not all competencies were positive. Specifically, the ability of USOs to develop state-of-the-art technological solutions, outputted a negative relationship. Finally, this paper provides insights for academic entrepreneurship in universities and practical implications for upcoming academic entrepreneurs seeking funding.

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Keywords
Spin-offs, funding, entrepreneurship, academic, early-stage, commercialization

1. INTRODUCTION

University Spin-offs are at the forefront of maximizing the potential for new technologies to be brought from the academic world into the real world. The success of the USOs depends on the composition of entrepreneurial skills of its members, commercialization efforts, and the technologies implemented. We see that the relevance of this paper and the topic of University Spin-offs is correlated to economic development in both the regional and national levels. (Hayter et al., 2016) In the words of MIT president, L. Rafael Reif: "…MIT alumni have launched more than 30,000 active companies, creating 4.6 million jobs, and generating roughly 1.9 trillion in annual revenue." (Hayter et al., 2016). USOs also impact universities and society through important roles played by technology transfer offices (TTOs) which act as drivers of knowledge and intellectual property arising within the university. (Fernandez-Alles et al., 2019)

As previous research has shown, because USOs start off in the academic field, they often lack many key resources and capabilities needed to increase their chances of survival and growth (Diánez-González and Camelo-Ordaz, 2016; Knockaert et al., 2011; Mosey and Wright, 2007; Vohora et al., 2004) The most important resource for the USOs to acquire is the necessary funding to overcome the junctures ahead of them (Vohora et al., 2004). Without the funding provided by the NWO, the USOs will struggle to overcome the continuous cycle of junctures.

To understand what makes USO development successful we must analyze the factors outlined in previous literature. We already know that the process of a USO is in a very close proximity to academic environments, so many times the universities are the main drivers of USO development. Some spin-offs with high entrepreneurial orientation perform better if they are able to balance their level of proximity to universities (Soetanto & van Geenhuizen, 2019). Universities are trying to play key roles in providing guidance and facilitating the promising entrepreneurs (Rasmussen & Wright 2015), this is because many times the USO's creators lack the necessary business qualities themselves. We also see that universities that spend more money in intellectual property protection, development of technology transfer offices, and research availability then there is a positive number of spin-offs being created (Lockett & Wright, 2005). There are also some universities that have more credibility and better protection for USOs based on prestige (Colombo et al., 2019).

Other success factors are linked to individual and organizational competencies of the USOs (Gümüsay & Bohné, 2018). Entrepreneurial success factors relate to the management of tangible and intangible resources which directly translates to the performance of the firms. These resources include financial, human capital, organizational, and routine-based, social network and social capital, and technological resources (Gümüsay & Bohné, 2018). This can also be applied to how the USOs manage the funding received by the NWO. For example, two firms that receive the same funding but only one survives due to the proper management of financial resources.

There is much research that goes into academic entrepreneurship (Siegel & Wright, 2015) and what universities facilitate for the creation of USOs (Rasmussen & Wright, 2015) (Colombo et al., 2019), but lacking for which factors are required to acquire governmental funding. That is why in this paper we will go in depth into what exact determinants of USOs play roles to obtain the funding from the NWO. We propose the following research question: ***Which characteristics of university spinoffs are essential for early-stage spinoff success to acquire governmental funding?***

From a theoretical perspective, scientists and researchers can use this paper to build upon the ongoing discussion of entrepreneurial universities and exploring the understandings of academic entrepreneurs (Hayter et al., 2016). A further focus can be made on how academic entrepreneurs' competencies play roles in the development of USOs. Entrepreneurs can learn about the competencies that are essential to receive funding and positively score on the evaluation guidelines set by the NWO. With a better understanding they are more likely to get the funding they need but also the skills they need to survive in the long term. And finally, policy makers can use the findings to see how the USO evaluation methods and funding processes can be improved. The focus is to better understand the mechanisms in the evaluation procedures and prevent negative evaluation spillovers (Elhorst & Faems, 2021).

2. THEORETICAL FRAMEWORK

The definition of USOs that will be used for the purposes of this research paper is clearly defined in the paper by Soetanto & van Geenhuizen, 2019. The definition states that "University spin-offs are defined as independent ventures established by graduates or university staff, with the mission to bring novel university knowledge to the market (Rasmussen et al., 2011). With this definition in mind, we can determine that USOs are closely related with parent universities and that the role that universities play dictates the development cycle of university firms. And as seen in (Scuotto et al., 2019) we see the spillover effect that universities have on the high-technology industry through the operation of research-based firms. Thus, the importance of universities becomes bigger than just research, in fact, the whole industry is affected.

2.1 Overview of USO Development

The process of USO development and the is organized into five essential phases (Vohora et al., 2004). The paper outlines a framework consisting of the phases that the USOs encounter and in each of these phases they are presented with different challenges, or junctures, that can only be overcome with the right resources and capabilities. The five phases are: (1) research phase, (2) opportunity framing phase, (3) pre-organization phase, (4) re-orientation stage, (5) sustainable returns phase. And the corresponding junctures include: (1) opportunity recognition, (2) Entrepreneurial commitment, (3) venture credibility, and (4) venture sustainability (Vohora et al., 2004). Each of the phases and junctures are viewed as continuous cycles and must

be actively overcome therefore, they are not phases that are completed in a linear order.

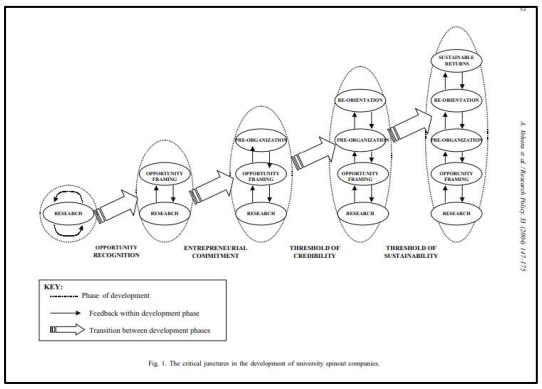

Fig. 1. The critical junctures in the development of university spinout companies.

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

2.1.1 Research Phase

The first phase of USO development establishes the fundamental foundation of the USO's development. We observe that "within this research phase valuable intellectual property is created, which then generates the potential opportunity for commercialization" (Vohora et al., 2004). We also see the USOs encounter their first "critical juncture" identified as opportunity recognition. Academic entrepreneurs must balance scientific methods and their solutions to the needs of the market. If they fail to do so, they won't be able to continue to the next phase.

2.1.2 Opportunity Framing Phase

After the research phase, the opportunity phase entails a transition between the recognized opportunity and the formative steps to creating a new USO venture mainly focused on the academic and the Technology Transfer Offices (Vohora et al., 2004). This "screening" process first involves evaluating the technology and to ensuring there is sufficient evidence that it actually works and shows sufficient promise for applications outside the laboratory. After the evaluation, attempts are made to "frame" the opportunity into commercialization (Vohora et al., 2004). Entrepreneurial commitment is the critical juncture faced in this phase of development. The academic entrepreneur is taking actions towards the events occurring in this phase.

2.1.3 Pre-Organization Phase

In next development phase the management team of the USO venture develops strategic plans which involves making decisions over what existing resources and capabilities to develop, what resources and knowledge to acquire now and in the future (Vohora et al., 2004). Now the third critical juncture surfaces, venture credibility, which is associated with the entrepreneurs' abilities to acquire resources that are needed for the venture to function (Vohora et al., 2004).

2.1.4 Re-Orientation Phase

The re-orientation phase presents the entrepreneurial teams challenges of continuously identifying, acquiring and integrating resources and then subsequently re-configuring them (Vohora et al., 2004). The critical juncture associated with this phase relates to venture sustainability, where the entrepreneurial team has the ability to create value from having developed the appropriate resources, capabilities and social capital (Vohora et al., 2004).

2.1.5 Sustainable Returns Phase

The last phase can be characterized by the USO attaining sustainable returns, in other words return on investment. By reaching this stage in the development phase, the USO will have overcome many of the early uncertainties and critical junctures.

2.2 Individual Variables

2.2.1 Entrepreneurial Competency

The first determinant that potentially plays a key role in USO development is entrepreneurial competency which can be defined as "higher-level, improvable characteristics entailing personality traits, skills, and knowledge [that utilize resources to the best of their ability] (Gümüsay & Bohné, 2018). We understand that the higher the levels the entrepreneurial skills of the individuals, the more likely that the life span of the USO is in better hands and will thus flourish. "Entrepreneurship theorists have long acknowledged that entrepreneurial competencies are linked to venture performance" (Chandler and Jansen, 1992; Man et al., 2002). Breaking down what we mean by entrepreneurial competencies, we will focus on mainly two core distinctions; academic entrepreneurs' motivations and business models. We understand that "motivation is the critical cornerstone for entrepreneurship activities to flourish…[and that] results indicate that extrinsic motivations relative to rewards do shape researchers' interest for entrepreneurship." (Mirabent et al., 2018). Thus, for our study, motivation of the academic entrepreneurs is critical for the USO to even form in the first place and have any traction. Without motivation the USO won't be able to overcome any of the junctures ahead (Vohora et al., 2004) nor receive the necessary funding. For the first hypothesis (H1A) we suggest that motivation is the key to acquiring funding.

H1A: There is a positive relationship between academic entrepreneurs' motivation and the acquisition of funding for university spinoffs.

For the second distinction, business models, we observe that when USOs plan to enter the industry, they require a well composed strategy to overcome challenges. "The market competitiveness of the USOs obviously has many challenges to be able to compete with the existing companies, analysis need to be done to get the right business step so the business strategy will be efficient" (Saputra et al., 2017). An efficient and well-balanced business model will convince the NWO that the USO has a clear plan consisting of what value they plan to bring into the market and how feasible their approach is. We suggest hypothesis (H1B) to go along with business models.

H1B: There is a positive relationship between academic entrepreneurs' business models and the acquisition of funding for university spinoffs.

2.2.2 Commercialization Competency

For the second determinant we will use commercialization which can be defined as "…commercialisation – or 'technology transfer' – may occur via academic entrepreneurship, that is the founding of a firm with the objective to commercially exploit a patented invention, or in some cases, a body of unpatented expertise (Shane, 2004). Universities are at the forefront of bridging the gap from academic knowledge to the industrial environment through Technology Transfer Offices (TTOs) and academic engagement. "Commercialisation clearly represents an important way for academic research to contribute to economy and society" (Perkmann et al., 2013). For the purposes of our research we focus on firms that have the objective of becoming commercialized because we believe that then they are more likely to seek funding and therefore acquire it.

H2: There is a positive relationship between a university spinoff's level of commercialization and its success to achieve funding.

2.2.3 Technology Competency

For the last determinant, technology competency, can be defined as the demand in the environment of the technology. Sometimes technology can be seen as not adding anything novel for customers or on the other extreme, too radical. That is why "technological and demand conditions contribute to determine both the emergence and the performance of spinoffs (Capone et al., 2019). It is essential that any new technology has the best fit in the society we live in today or can change it in a better way. "Technological regimes are technology-specific patterns in the ways firms learn and deal with the fundamental characteristics of the technological environment (Capone et al., 2019) And that technological environment has to be identified effectively so that the USO's technology fits." We have a two-part analysis to consider, the technological innovations and the customer awareness of the product. In the world "today, consumers are looking for more and more innovative and qualitative products and so companies seek to heavily invest in technological advancements to meet the needs of customers." (Mosconi et al., 2014). The customer focus of technology takes the perspective of USOs and how they need to provide a technology that fits the needs of the customers. If the technology is too complex and doesn't fit according to the customers, the USO will struggle to secure funding. In other words, the needs of the customers are not met with the technology provided by the USO. Technology and customer fit enact high importance whether the start-up will ever flourish, hence we suggest two corresponding hypotheses (H3A) and (H3B).

H3A: The higher ability of USO to develop state-of-the-art technological solution increase the likelihood of attaining governmental funding.

H3B: : The higher ability of USO to develop technological solutions matching customer tech needs, increases the likelihood to attain governmental funding

3. RESEARCH DESIGN

3.1. Subjects of Study

This study analyses 242 anonymized and aggregated university spin-off (USO) grant proposals submitted for evaluation in the Valorization 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 realizes 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, 2021). NWO 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, 2021). 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 organizations to contribute with their own knowledge agendas and questions to the programming, realization and co-funding of research" (NWO, 2021). Hence, Valorization 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 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, 2021).

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

3.2. Measurements

3.2.1 Independent Variables

The independent variables as already mentioned in section 2.2 Individual Variables, entrepreneurial, commercialization, and technology competencies, have positive and/or negative relationships on the encompassing dependent variable. For the purposes of our research we use the

ability of the USOs to get funding as the dependent variable. Going forward we will refer to these variables as competencies

To make results more extensive and accurate, for some of the competencies we implemented multiple items in the analysis. We identified the entrepreneurial and technology competencies as quite complex and can only benefit with more measurements in place. For example, the measurement analysis of entrepreneurial competency is broken into two items: the motivation of the personnel and the quality of the business model. By breaking down the competency into more parts we can specifically measure which aspects of entrepreneurship are more significant and have a positive or negative relationship.

Entrepreneurial Competency

As already illustrated in the previous section 3.2.1 Independent Variables, the entrepreneurial competency is being measured with two scales.

Motivation
-The ability of personal motivation and enthusiasm for the asset, which is measured by using an ordinal scale where this motivation is either well developed (1), not specified (0) or lacking motivation (-1).

Business Model
-The ability to produce a business model, which is measured in terms of the model's strength, lacking (-1) not present (0) or strong (1).

Commercialization Competency

Commercialization
-The ability to commercially exploit a patented invention, or in some cases technology transfer. It will be measured with an ordinal measurement (-1) negatively mentioned, (0) absent, or (1) positively mentioned

Technology Competency

For the purposes of the technology competency measurements, the competency is broken into technological innovations and customer focus. With technological innovations, the measurement focuses on the technology application itself, whereas the customer focus measures the connection of the needs of customers to the technology. By looking at both aspects of the spectrum, the advantages and/or pitfalls of competencies can be easily understood.

Technological Innovations
-The ability to develop state-of-the-art technology, which is measured by using an ordinal scale where this assessment is either well defined and advantageous (1) or not specified and negative (0)

Customer Focus
-The ability to assess the needs of the customers, which is measured by using an ordinal scale where this assessment is either well defined (1), not specified (0) or lacking need (-1).

3.2.2 Dependent Variable

All the independent variables are influenced by the dependent variable which we define as the success of the USOs. The success of USOs can further be defined as the acquisition of governmental funding from the NWO. The dependent variable can be measured as a dichotomous variable where there are two possible measurements, yes (1) or no (0). The yes (1) means that the USO got the funding and the no (0) means that the USO did not get the funding.

3.2.3 Control Variables

When it comes to research studies, control variables remain constant to maintain consistency in the results after the procedure is carried out. In terms of our control variables, we define the control variable as the USOs' NACE codes and the academic entrepreneurs' H-Indexes. The USO NACE codes are classified by the Economic Activities in the European Community which helps us put the USOs into a more controlled environment based on their industries. The industries laid out by the NACE codes range from (A) Agriculture, Forestry and Fishing to (U) Activities of Extraterritorial Organizations and Bodies. Since the industries are labeled from A-U we utilized a complimentary numbering of 1-21 to help with classification (EUROPA - Competition - List of NACE codes, n.d.). For the other control variable, academic entrepreneurs, we implemented the H-Index. The H-Index is a quantitative metric based on analysis of publication data of the academic entrepreneurs using publications and citations to provide "an estimate of the importance, significance, and broad impact of a scientist's cumulative research contributions."[Hirsch 2005] The H-Index allowed for the standardization of evaluation of the academic entrepreneurs on a scale measurement in our dataset.

3.3. Data Collection

To conduct a comprehensive analysis and test our 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 our independent variables, we used content analysis on the aggregated evaluation results regarding feasibility and valorization potential of selected USO proposals. To further enhance our research model, we retrieved information regarding the performance of business incubators and technology transfer offices of the leading Dutch technical universities from their websites and open-source reports. We also 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. We further matched the research fields of publications and USO

grant proposals with the NACE industry codes. (EUROPA - Competition - List of NACE codes, n.d.)

3.4. Analysis

In this section we will do an overview of the different research methods that will be utilized to measure the independent variables as discussed in section 3.2.1. First, I will discuss open, selective, and axial coding. All these subparts connect to the grounded theory; a method used to implement new theories based on data collected in order to compare and support or contradict existing theory (How To Do Open, Axial, and Selective Coding in Grounded Theory, n.d.). Open coding refers to the process of the initial phase of classifying data into labels with codes so that it becomes possible to compare the data. Axial coding is the next step where the data with the codes are coupled into categories. The final step is selective coding where all the categories previously created are made into one combined core category. This category builds the central premise of the research being done.

For the purposes of this research paper, we will make use of a binary logistic regression analysis. With the use of the dependent variable, discussed in section 3.2.2, we apply two possible values, did not acquire funding "0", and successfully acquired funding "1". The dependent variable is defined as a dichotomous variable. Then we can see the relationships that the dependent variable has with the independent variables.

4. RESULTS

In the following sections, we will discuss and compare our assumptions and hypotheses made in the theory sections with the results from the binary correlation analysis.

4.1 Coding Procedure

In the beginning of our methods, we had to code the raw data into usable measurements before we could undergo any type of analysis. The coding procedure was extensive with many parts. The parts that needed coding pertained to the: independent variables, dependent variables, and control variables.

For the first section, we were provided a large dataset that contained four scores, (USO Tech Score, Commercial Score, Business Planning Score, and Motivation & Commitment Score), overall scores, USO funding decision and comments made by the evaluation committee. (NWO 2021). After our independent variables were defined and the scales were in place, we processed the comments and scored the USOs from the dataset. Values in the coding process contained (-1) negative association, (0) no information, (1) positive correlation, and some with (2-3) strong positive correlation. The USO funding decision was already properly coded so it was just added into the dependent variable slot.

The next dataset that needed to be coded and implemented related to the NACE Industry codes and the Academic Entrepreneurs. The NACE codes provided by the Economic Activities in the European Community outputted such values as "C28" which weren't useful as measurement values. So, the procedure was two steps; first code all the USOs with the NACE codes and then number all the NACE codes with a simple 1-21 number scale following the letters A-U. Then the Academic Entrepreneurs variable was coded with the help of Web of Science. Statistics such as number of publications, number of citations, and H-Index were processed. In the end, the H-Index was used as the overall metric for coding in the analysis (Sarli, 2021). These variables would then be used as our control variables.

4.2 Descriptive Statistics

For the first analysis in SPSS, we utilized the descriptive table function to display the minimum, maximum, mean, standard deviation, variance, skewness, kurtosis, and range of our input. The input for Table 1 includes the dependent variable, USO funding decision, and the independent variables from section 3.2.1. The four variables, USO Tech Score, Commercial Score, Business Planning, and Motivation & Commitment, given in the dataset were also included to add more variability and for comparison.

4.3 Correlations and Regression Analysis

In the first part of our analysis, we tested the correlation coefficients of our independent variables in Table 1 in the appendix. Correlation coefficients are used in datasets to measure the strength of a relationship between two variables. The most common type of correlation coefficients in linear regression is Pearson's R (Logistic Regression | SPSS Annotated Output, 2021). Pearson's R indicates if a relationship is a strong positive relationship (1), no relationship (0), or a strong negative relationship (-1). For example, looking at Table 1, we see that the correlation between Technological Innovations and USO Funding Decision ($r = -0.100$) which indicates a slightly negative relationship.

The next part of our analysis concerns the binary logistic regression as can be seen in Table 2 in the appendix. The analysis consists of 7 models; models 1 was run with only the control variables in place, then models 2-6 included only one independent variable at a time, model 7 had all variables in place. The whole analysis also had the dependent variable of USO funding decision in place. With the analysis in place we have an overall look at the final Model 7. We observe that each of the independent variable that were significant on their own in Models 1-6 were also significant in Model 7, which means that our regression is robust. The Log likelihood is the lowest in Model 7 and the Nagelkerke R Square is the highest, meaning that our model is the most explanatory. (Logistic Regression | SPSS Annotated Output, 2021)

Finally, we can go over and confirm the assumptions of logistic regression (Assumptions of Logistic Regression, n.d.). The Assumption of Appropriate Outcome Structure states that the dependent variable must be binary. Our dependent variable, USO Funding Decision, is binary and ordinal (SPSS Output). Secondly, the Assumption of Observation Independence states that observations need to be independent of each other. We confirm

this by indicating that the dataset is entirely original. Thirdly, the Assumption of the Absence of Multicollinearity indicates that there must be little to no correlation between the independent variables themselves. We confirm this by looking at Table 1 and the correlation (Pearson's R) of all the variables. All the variables that were used further in the analysis (Variables 1-6) had low correlations to each other. Fourthly, the Assumption of Linearity of Independent Variable and Log Odds is tested in the binary logistic regression. Lastly the Assumption of a Large Sample Size is met with our sample size of 242.

4.4 Hypotheses

In Hypothesis 1A we proposed that there is a positive relationship between academic entrepreneurs' motivation and the acquisition of funding for university spinoffs. Table 2 in the appendix, shows that motivation has a positive significant impact on the outcome of acquiring funding ($B = 0.804$, $p < 0.01$). Hypothesis 1B stated that there is a positive relationship between academic entrepreneurs' business models and the acquisition of funding for university spinoffs. Table 2 shows that the business model is a weaker but still positive and significant relationship on receiving funding ($B = 0.542$, $P < 0.05$). The results show a positive significant relationship, and therefore the proposed hypotheses can be confirmed. Entrepreneurial competencies play positive roles and should be regarded to increase the outcomes of funding decisions.

In Hypothesis 2 we indicated that there is a positive relationship between a university spinoff's level of commercialization and its success to achieve funding. Table 2 results show a positive and significant relationship ($B = 0.562$, $p < 0.05$). With this information we can confirm Hypothesis 2 and state that commercialization positively influences the funding decision process.

In Hypothesis 3A we proposed that the higher ability of USO to develop state-of-the-art technological solution increase the likelihood of attaining governmental funding. From Table 2 we observe that this is not the case. The result is negative and not significant ($B = -0.244$, $p > 0.05$). Thus, we reject Hypothesis 3A. In Hypothesis 3B we proposed that the higher ability of USO to develop technological solutions matching customer tech needs, increases the likelihood to attain governmental funding. With Table 2 results we see that there is a moderately and significant outcome ($B = 0.504$, $p < 0.05$). With this result we can confirm that increasing the customer focus will have an overall positive impact on the ability to get funding.

5. DISCUSSION

Our findings have many implications for the development of early stage spinoff successes to secure funding. In this section, we will explain how our insights determine which characteristic are of significance and have an impact further than just proving hypotheses. We will discuss the theoretical implications, practical implications, and limitations & future research avenues.

5.1 Theoretical Implications

In the academic medium, our paper builds upon the understandings of the academic entrepreneurs' qualities, the pathway to commercialization, and the technologies implemented by the USOs. All our implications build towards an overall better understanding of what characteristics in USOs positively increase the likelihood of receiving funding. We can apply the knowledge that such competencies such as: entrepreneurial motivation, business planning, commercialization, and technological customer focus are subjects of focus when it comes to achieving funding. Since the development phase of USOs originates in universities, our theoretical implications align with what can be improved from the perspective of universities and corresponding research papers.

For the first paper we build upon (Gümüsay & Bohné, 2018) "Individual and Organizational Inhibitors to the Development of Entrepreneurial Competencies in Universities". We learned from this paper about what entrepreneurial competencies are, why they are important and how they develop. The findings of the paper mainly focus on the developments of the relational, structural, and cultural-cognitive inhibitors at both the individual and the organizational levels, and that both levels shape the development of entrepreneurial competencies (Gümüsay & Bohné, 2018). But the authors do not make any further progress to make any connections between entrepreneurial development and USOs attaining governmental funding. This is where our research strives as a benchmark of real data that the entrepreneurial competencies, partially based on the definitions outlined by (Gümüsay & Bohné, 2018), are significant and positively affecting the funding decisions of USOs grant proposals from the NWO. Therefore, the importance of developing entrepreneurial competencies is more important than just general development but also specifically in the funding decision stage.

Another paper of great significance pertains to (Perkmann et al., 2013) on "Academic Engagement and Commercialisation: A Review of the Literature on University–Industry Relations". The paper suggests that, "In fact, commercialization is often an outcome or follow-on activity, whether intended or unintended, of academic engagement. Working on common projects with industry may provide academics with insights into what ideas may be commercially valuable, and hence the opportunity to develop or co-develop inventions that can be patented, licensed or enable an academic spin-off" (Perkmann et al., 2013). The authors primarily highlighted the differences between academic engagement and commercialization and the developments toward university–industry knowledge transfer individuals and organizations. The focus of

the paper did not explore the development process of USOs and did not apply the concepts of academic engagement and commercialization to that of such stages as securing funding from the government. Our analysis and findings can provide a new pathway for (Perkmann et al., 2013) to extend further research towards the successful funding of USOs based on levels of academic engagement and commercialization characteristics in individuals and organizations.

5.2 Practical Implications

Our paper is a powerful tool for nascent academic entrepreneurs to understand what it takes to receive the funding for their university spin-offs. They can quickly see from the results of our analysis (Section 4) that such variables: motivation, business planning, commercialization, and customer focus are of positive significance in the pathway to successful USO development. And that "Technological Innovations" are of less importance, following the rejection of hypothesis 3A. This means that when these future business adventures want to embark on their own business venture, they can use the knowledge from this study to better equip themselves for the challenges and junctures to come (Vohora et al., 2004).

Policy makers and governing bodies, such as the NWO, can benefit from this study by uncovering which criteria should be of higher importance and how to improve evaluation metrics (Elhorst & Faems 2021). Our suggestion is to place a higher emphasis on entrepreneurial competencies and commercialization and less on technology. This can be done by the by the Valorisation Grant Programme by reworking the current metrics until all measurements being used are significant.

5.3 Limitations and Future Research

The first limitation of our research is the fact that our dataset only represents university start-ups located in the Netherlands. The way that the NWO works in the Netherlands is very specific to Dutch Universities This warrants that our findings might not be applicable to all countries. In order to extend our findings to other institutional environments, new students must be conducted in cross-country settings. The major contributions that our research can make is the key factors that USOs should develop to increase their success. Future research should be done to create a more widespread approach in which factors make USOs in the European region successful.

Secondly, for the purposes of our research, we decided to adopt a very narrow focus on the funding decision of early stage USOs. With such a specific view we were able to gather specific and measurable results to answer our research question, but it mainly stops there. The greatest advantage of a specific analysis is also the disadvantage in terms of overlooking and leaving out many other factors that could be crucial to the USO success. Much more research and development should be done in terms of survival and other key stages after receiving the funding.

Lastly, our dataset was founded upon the evaluation methods administered by the NWO. This means that if the NWO made any mistakes or made poor decision making while evaluating the USOs, we have no way of finding out nor providing an alternative dataset. For future implications it would be essential to double check the data and be in contact with the NWO during the research process. A step further would be to gather the data ourselves.

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Appendix

Table 1. Range, means, standard deviations and correlations of the variables (N = 242)

	Minimum	Maximum	Mean	S.D	Variance	Skewness	Kurtosis	Range	1	2	3	4	5	6	7	8	9	10
[1] USO Funding Decision	0	1	0.41	0.493	0.243	0.372	-1.877	1	1									
[2] Motivation	-1	1	0.31	0.624	0.389	-0.334	-0.655	2	0.274**	1								
[3] Business Model	-1	1	0.26	0.667	0.444	-0.359	-0.780	2	0.200**	0.121	1							
[4] Commercialization	-1	1	-0.21	0.75	0.563	0.359	-1.148	2	0.252**	0.155*	0.093	1						
[5] Technological Innovations	0	1	0.57	0.495	0.245	-0.303	-1.924	1	-0.100	-0.108	-0.060	-0.092	1					
[6] Customer Focus	-1	1	0.16	0.631	0.398	-0.136	-0.552	2	0.206**	0.097	0.128*	0.191**	-0.117	1				
[7] USO Tech Score	2.25	4.67	3.75	0.461	0.212	-0.849	0.637	2.42	0.404**	0.092	0.119	0.108	0.247**	0.015	1			
[8] USO Commercial Score	1.58	4.70	3.41	0.568	0.323	-0.614	0.351	3.12	0.594**	0.099	0.178**	0.212**	0.023	0.269**	0.595**	1		
[9] USO Business Plan Score	1.50	4.57	3.15	0.713	0.509	-0.246	-0.803	3.07	0.698**	0.242**	0.260**	0.143*	-0.154	0.192**	0.380**	0.622**	1	
[10] USO Motivation & Commitment	1.71	4.83	3.68	0.636	0.404	-0.705	0.377	3.12	0.631**	0.443**	0.186**	0.031	-0.099	0.202**	0.335**	0.486**	0.775**	1
N of cases 242																		

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

Table 2. Binary logistic regression results. Dependent variable: USO funding decision

	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	-0.181	0.265	-0.555	0.292	-0.314	0.275	-0.083	0.275	0.093	0.307	-0.310	0.275	-0.458	0.359
Motivation			0.961**	0.236									0.804**	0.250
Business Model					0.693*	0.215							0 .542*	0.227
Commercialization							0.724**	0.185					0.562*	0.198
Technological Innovations									-0.483	0.270			-0.244	0.298
Customer Focus											0.706**	0.221	0.504*	0.236
Industry	-0.30	0.022	-0.32	0.023	-0.042	0.02	-0.028	0.023	-0.034	0.022	-0.033	0.022	-0.045	0.025
Academic Entrepreneur	0.003	0.007	0.005	0.007	0.004	0.007	0.003	0.007	0.004	0.007	0.004	0.007	0.007	0.008
-2 Log likelihood	321.613		303.423		310.548		305.420		318.401		310.793		278.474	
Nagelkerke R Square	0.011		0.109		0.071		0.098		0.029		0.070		0.232	
N = 242														

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