# European Academic Spin-Offs: Exploring the Barriers to Long-Term Success

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**Abstract:** An academic spin-off (ASO) is an enterprise that is founded by researchers or students associated with a university or research institution. ASOs typically commercialize new technologies, products, or services that are based on results of academic research. However, ASOs often face barriers to long-term success. These barriers severely limit the economic and social impact of the research and innovation from ASOs, as well as discourage future researchers from starting their own ASOs. Furthermore, barriers can vary depending on the region and the industry and increase the complexity of this issue. So far very little research has been done to examine the barriers to ASOs in general or in specific industries and regions. Thus, the research question emerges as to what the general barriers to long-term success for ASOs in Europe are. To increase the understanding of the spin-off creation process, we conduct a systematic literature review of existing literature about ASOs and their barriers in general. Previous approaches already classify barriers into micro, meso, and macro levels. Other models exist that examine the spinning-off process with respect to a temporal level. In order to combine both dimensions, the frameworks mentioned above were merged in the first step and expanded with current research in the second step with a particular focus on barriers to long term success. Barriers for ASOs need to be addressed more in depth in order to fully realize their potential and to expand upon the existing literature of the general barriers of ASOs in Europe. Exploring these barriers yielded first results which include a limited access to funding and resources, lack of understanding of the creation of a business model, furthermore a lack of infrastructure and difficulty in establishing and sustaining a network with industry partners. Addressing these barriers will require targeted policies, funding, and training programs that enhance entrepreneurial skills and promote collaboration between ASOs and industry partners. Our findings provide insights that can help to improve the success rate of ASOs in Europe and encourage the development of innovative solutions to address societal challenges.

**Keywords:** Academic Spin-Off, Europe, Innovation, Entrepreneurship, Literature Review

## 1. Introduction

Universities are undergoing a transformation from being purely research and educational institutions to becoming "Entrepreneurial Universities". This phenomenon is also referred to as the "third mission," which means that universities are dedicating themselves to the transfer of knowledge to the productive sector and industry **(F. Visintin und D. Pittino 2014)**. To accomplish this task, various forms of transferring knowledge have emerged over the years. Knowledge in form of technology can be transferred by licensing processes, publications, and industry research and development agreements and also in form of academic spin-offs (ASOs), also known as university spin-offs (USO) (Mihali et al. 2022). An ASO is a new company established through the exploitation of a core technology or technology-based idea generated within a university, where the founding member(s) may or may not be affiliated with the academic institution (Smilor et al. 1990; Nicos Nicolaou und Birley 2003).

ASOs are seen as drivers of innovation, which have a positive impact on the economy (Block et al. 2017; F. Visintin and D. Pittino 2014; Berbegal-Mirabent et al. 2015). Benneworth und Charles (2005) have summarized additional valuable impacts of spin-offs, including the promotion of entrepreneurship, network building, regional economic development, the creation of technology clusters, and job creation. In general there is still a lack in research about specific survival factors (Mihali et al. 2022), despite the fact that research on ASOs continues to grow, and literature reviews have already been conducted to cluster specific topics such as barriers, drivers, and success factors (Hossinger et al. 2020) or to categorize them into different levels **(F. Miranda et al. 2018)**. Hossinger et al. (2020) also noted in his literature review, that the results have been somewhat controversial and fragmented. This is due to the nature of certain samples, timeframes, or contexts. Different research designs and definitions have also undermined the consistency of the results, thereby affecting the fulfilment of their objectives.

Until yet research does not consider both, a temporal and a contextual dimension, and it has been repeatedly suggested that further research is needed to better understand ASOs. Therefore, this paper will primarily focus on the barriers of ASOs by consolidating existing research findings and identifying opportunities for future research areas. Existing theoretical frameworks in the area of contextual dimensions and in the area of temporal dimensions were combined to a new framework. Currently, the SCOPUS database has been reviewed, and

relevant articles have been analysed within this new framework. The search query yielded 92 articles, of which 26 were deemed relevant.

## 2. Theoretical Framework

### 2.1 Definition Academic Spin-off

The concept of academic entrepreneurship refers to the establishment of new ventures that aim to commercialize knowledge, technology, or research outcomes developed within a university setting. According to Pirnay et al. (2003) academic entrepreneurship involves utilizing internal and external opportunities innovatively to generate economic resources for personal profit or to support academic units and institutions. Additionally, it aims to create platforms for social and political change within academia. (van Looy et al. 2011, S. 554) defines it as "Entrepreneurial universities are institutions which are characterized by greater involvement in economic and social development, more intense commercialization of research results, patent and licensing activities, the institutionalization of spin-off activities, and managerial and attitudinal changes among academics with respect to collaborative projects with industry (van Looy et al. 2011, S. 554)**.**

Motivated academics play a crucial role in the development of academic entrepreneurship. These individuals go beyond their traditional roles in teaching and research to pursue entrepreneurial activities. Understanding the motivations driving academics to become academic entrepreneurs is essential for government officials and university administrators to develop effective policies that provide sufficient incentives for academics to engage in entrepreneurial activities (Hossinger et al. 2020).

Etzkowitz und Viale (2010) define academic entrepreneurs as experts in specific scientific fields who possess a divergent awareness of the commercial potential of both fundamental research and business problems. University spin-off (USO) companies emerge from this process and are characterized by their utilization of the founders' research outcomes while maintaining a connection to the originating academic institution.

Academic entrepreneurship represents a fusion of academic expertise and entrepreneurial activities, aiming to commercialize research outcomes and generate societal impact. Understanding not only the success factors but also what hinders ASOs are critical for fostering a culture of innovation and knowledge transfer within universities.

### 2.2 Dimensions and Stages

Many authors have recently been engaged in identifying the influences that have positive or negative effects on ASOs aspects (Hossinger et al. 2020).

F. Miranda et al. (2018) identified three main research areas in the field of academic entrepreneurship: individual characteristics, organizations, and institutional context, depending on the unit of analysis. When the analysis focuses on the individual faculty member, the main area is referred to as "individual"; when the emphasis is on the university spin-off (USO) itself, the area is labeled as "organization"; and in cases where the analysis pertains to the national or regional context in which the USO is situated, and the economic and social impacts that the USO could have on them, the area is referred to as "institutional context". These areas also relate to the framework of Hossinger et al. (2020).

Hossinger et al. (2020) summarized success factors, drivers, and barriers of ASO creation in a literature review. In their framework three dimensions or levels to categorize every influence and to easily identify patterns and recurring themes are used. The micro-level refers to individual aspects of the ASO founding process, such as the behaviour and decisions of individual founders or their interactions with other actors. The meso-level looks at the founding process from an organizational perspective by analysing the interactions and dynamics between different organizations, groups or communities involved in the formation of ASOs. The macro-level, on the other hand, focuses on the overall social framework and structures that influence the ASOs founding process, such as political or economic legal.

With particular focus on barriers, they list the following:

| **Micro (Individual academic)** | **Meso (University)** | **Macro (Regional and national contexts)** |
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| Lack of entrepreneurial capabilities, knowledge and resources | Lack of entrepreneurial culture | Limited availability of federal and private funding sources |
| Lack of applicability of knowledge | Bureaucracy | Complicated and time-consuming application and granting processes for state subsidies |
| Team or governance conflicts | Management style | Country- and regional-specific differences |
| Fear of failure | Lack of incubation services | |
| Aversion to risk and stress | | |
| Attitude towards science: 'Publish or perish' | | |

Hossinger et al. (2020) Conceptual framework

In the context of a temporal dimension, Ndonzuau et al. (2002) investigated successful spin-offs to better understand the process of academic spin-offs. Their study revealed four phases:

- Stage 1: to generate business ideas from research.
- Stage 2: to finalize new venture projects out of ideas.
- Stage 3: to launch spin-off firms from projects.
- Stage 4: to strengthen the creation of economic value by spin-off firms.

Each of the four stages within this spin-off process fulfils a distinct functional role. In the initial phase, ideas are generated and evaluated in terms of their potential for commercialization. The subsequent phase involves rigorous examination of these ideas, leading to the transformation of the most promising ones into tangible entrepreneurial projects. In the third phase, the superior projects materialize through the establishment of new spin-off companies. Finally, in the fourth phase, the economic value generated by these nascent firms is consolidated and enhanced. Every phase can be seen as a selection process. Not every idea funnel into a successful spin-off creation and commercialisation.

## 3. Method

To answer our research question and gain deeper insights into the barriers facing ASOs in Europe, we conducted a systematic literature review. This methodological approach enabled us to identify, analyse and synthesize relevant research papers addressing this topic.

A literature review is essential for scientific research as it shows the current state of knowledge, identifies research gaps, and develops new hypotheses or theories. It enables relevant literature to be analysed and summarized to reveal weaknesses and inconsistencies (Xiao und Watson 2019).

### 3.1 Article research

Our literature search includes two scholarly databases, namely "Scopus" and "EBSCO Business Source Premier", whereas this actual work in progress paper includes only first results from Scopus. By using a systematic search strategy based on keywords and search terms, we were able to generate an extensive list of potentially relevant articles. For Scopus we used the following keywords and search terms:

*(Academic OR university) AND (spin-off* OR spinout* OR spinoff* OR spin-in* OR spinin* OR startup* OR start-up*) AND europe* AND (barrier* OR obstacle* OR challenge* OR success* OR driver*)*

With this initial input, we received a total of 179 results. We then further narrowed the results by focusing on English-language articles and book chapters published between the years 2000 and 2023. After the refinement, we were left with 92 results from the Scopus database. For the systematic literature review, we also used EBSCO Business Source Premier in addition to the previous database. By including this additional database, we were able to expand our access to relevant literature and identify potentially new articles. Combining the results from both databases allowed us to get a comprehensive overview of the existing literature and to identify the most relevant sources for our research question. For the EBSCO Business Source Premier database, we used the following keywords and search terms:

(Academic OR university) AND (spin-off* OR spinout* OR spinoff* OR spin-in* OR spinin* OR startup* OR start-up*) AND (barrier* OR obstacle* OR challenge* OR success* OR driver*)

This initial input does not include the term "AND Europe" since we received a lot of results unrelated to our research question. To limit the results to Europe, we used the geographical filters provided by EBSCO. Furthermore, we used the advanced search options from EBSCO:

- Peer Reviewed
- Published Date: 2000-2023
- Publication Type: Academic Journal
- Publication: Article

After the refinements, we got a total of 153 results. Together with the 92 results from the Scopus database, we found a total of 245 results for our literature review. This body of literature should be sufficient to conduct a systematic literature review and examine the barriers for ASOs in Europe.

## 3.2 Paper selection

For the selection of the relevant papers, careful paper selection was carried out using certain criteria. These criteria were developed to ensure that the selected papers meet the requirements of our research question and provide high-quality information on the barriers facing academic spin-offs (ASOs) in Europe.

The following criteria were considered in the paper selection process:

- Timeliness: Do the title, abstract or keywords of the paper show that it is based on current research in academic spin-offs in Europe?
- Focus: Does the paper focus specifically on academic spin-offs in Europe, or is it too broad or too narrow for our research question?
- Relevance: Do the paper's title, abstract, and keywords suggest that it directly addresses our research question or is highly relevant to our topic?
- Approach: Does the paper use an appropriate approach or methodology for our research question based on the information in the title, abstract or keywords?
- Perspective: Does the paper offer a unique or valuable perspective on the research topic that offers new insights or a fresh perspective on our research question?

Our criteria were chronologically examined, beginning with an assessment based on the title, abstract, and keywords. In cases where further examination was necessary, the entire paper was thoroughly read to make a final decision, whether to include it into our shortlist. Papers failing to satisfy at least one criterion were excluded from the shortlist for the literature review. This thorough process guarantees the inclusion of solely high-quality and pertinent papers in the final literature review.

We applied our paper selection criteria to the 92 results that we received from the Scopus database. By doing so, 26 papers were identified that demonstrate relevance to our stated criteria of timeliness, focus, relevance, approach, and perspective. By doing so, we successfully identified 26 papers that demonstrated relevance to our predetermined criteria of timeliness, focus, relevance, approach, and perspective. These 26 selected papers will serve as a solid foundation for our systematic literature review. Afterwards, each of the identified papers underwent careful examination, enabling us to analyse and categorize the barriers faced by ASOs in Europe, using our established framework. This comprehensive analysis will provide valuable insights into the barriers encountered by ASOs, facilitating the grouping of similar barriers and organizing them into distinct categories for an organised presentation of the findings. The objective is to assemble a list of these barriers and explain the dimensions and stages of the spin-off creation process where these barriers may manifest. The content of each paper was audited to ascertain its potential contribution to addressing our research question.

## 3.3 Established theoretical framework

By integrating the three dimensions proposed by Hossinger et al. (2020) and the four stages outlined by Ndonzuau et al. (2002), we can enhance the structure and analysis of our research findings. The inclusion of micro, meso, and macro levels enables a comprehensive examination of the barriers encountered by European academic spin-offs (ASOs) from multiple perspectives, considering the interactions among actors, organizations, and the broader ecosystem. Furthermore, the incorporation of the four phases of the spin-off formation process provides insights into the specific stages where barriers may arise. This novel framework facilitates the

identification of patterns and recurring themes within our results, thereby offering a comprehensive understanding of the barriers faced by European ASOs.

# 4. Results

## 4.1 Stage 1: generate business ideas from research

According to (Ndonzuau et al. 2002) the first stage aims to generate business ideas, proposals and offers for commercial exploitation within the scientific community. For most universities, commercial exploitation of their research requires radical changes in the traditional way they have exploited their results. Commercial exploitation implies the convergence of two opposing concepts of science. The scientific concept, which sees science as an end in itself, and the economic concept, which sees science more as a means to achieve other ends, particularly financial gain. The challenge is to reconcile these two opposing concepts (Ndonzuau et al. 2002).

### *4.1.1 Mikro-Level*

Generating business ideas from research can be challenging due to various barriers on an individual level. (Toledano et al. 2022) state that academic entrepreneurs may experience ethical dilemmas in the commercialization of knowledge and technology through ASOs without clear guidance. Academic entrepreneurs' attachment to academia and university life can at times conflict with their entrepreneurial activities, particularly when research and business interests diverge. Serving the public interest, a typical goal of academic activity, can collide with the commercialization of knowledge and technology through ASOs, leaving academic entrepreneurs with ethical dilemmas without clear guidance. The current literature also points to the pressure that academic entrepreneurs can face to reconcile scientific knowledge with commercially viable knowledge (Toledano et al. 2022).

Researchers in Eastern Europe, particularly Poland, show different patterns of academic entrepreneurship. Locally productive researchers are more likely to engage in academic entrepreneurship than cosmopolitan researchers who follow an international academic career because they have less time for entrepreneurial activities. Focusing on an academic career, especially on an international level, requires more time and reduces the likelihood of approaching an entrepreneurial career path (Luczaj 2022).

(Seguí-Mas et al. 2018) were able to identify management problems are a key obstacle to setting up academic spin-offs. Since academics do not automatically have strong management skills, knowledge transfer via spin-offs is more complex compared to licenses or patents, where management tasks can be delegated to the licensee or buyer. Therefore, (Seguí-Mas et al. 2018) recommend universities to specifically train potential academic entrepreneurs in management skills to promote successful knowledge transfer via ASOs. Furthermore, (Vega-Gomez et al. 2018) argues that individual characteristics such as academic experience, entrepreneurial personality, self-confidence, creativity, conscious benefit of entrepreneurship, promotion of the societal role of universities, gender and scientific productivity influence the possibility of founding an ASO and the entrepreneurial orientation of the researcher.

The results of a survey of academics from 50 universities and 16 out of 17 Spanish regions show that personal and economic benefit is the main motivator for Spanish academics to establish an ASO. This condition determines nearly 28% of a researcher's preference structure. Failure by academics to see the prospect of personal and financial benefits can hamper their motivation to start an ASO. The mikro level therefore plays a important role in overcoming this potential barrier to entrepreneurial motivation (Vega-Gomez et al. 2018).

In summary, various barriers at the mikro-level can complicate the establishment of ASOs in Europe. Management problems (Seguí-Mas et al. 2018), lack of time resources due to focusing on an academic career (Luczaj 2022), and ethical dilemmas related to the commercialization of knowledge and technology (Toledano et al. 2022) are some of the obstacles to be overcome. Individual factors such as academic seniority, entrepreneurial personality, and perceived benefits of entrepreneurship also play a role (Vega-Gomez et al. 2018).

### *4.1.2 Meso-Level*

van Geenhuizen und Soetanto (2009) state that a constraining culture at the university can develop when universities do not provide sufficient resources and incentives for academics to balance the process of inception

and early growth. This constraining culture can create a barrier for employees to get fully involved in the spin-off (van Geenhuizen und Soetanto 2009). Organizational culture has been identified as a major barrier for starting ASOs. This includes different goals and timelines, as well as language and communication styles, which can negatively impact the formation of ASOs. Administrative problems such as bureaucracy and insufficient working time have also been identified as barriers to academic entrepreneurship. Furthermore, an organizational lack of knowledge about ASOs and their formation has been identified as a barrier. Especially academics with little to no experience are affected by this lack of knowledge from their organization or university (Davey und Galan-Muros 2020). In order for academics to be actively involved, particularly with regard to the important step of disclosing inventions, there must be a strong research system and appropriate incentives implemented by the universities (Heher 2006).

To support the development of ASOs, universities adopt strategies such as integration into the university's vision and mission and fostering an entrepreneurial culture. Resources and incentives are provided to facilitate implementation. However, the lack of provision of resources and incentives can be a barrier, as can the lack of integration into the university's vision and mission and the failure to promote entrepreneurial behavior among university stakeholders (Davey und Galan-Muros 2020). The support measures for entrepreneurial activities in academia strongly depend on the entrepreneurial culture of the university and ultimately the committed resources in form of university incubators or founding centers, as (Piontek und Wyrwich 2017) note. Both researchers and students are affected by the culture of universities and their commitment to promoting entrepreneurial activities. The more students participate in entrepreneurship courses, the greater the opportunity for new start-ups and academic spin-offs. Interview partners stated that students with compulsory courses are more likely to be found in the incubator than those with optional courses (Piontek und Wyrwich 2017).

#### *4.1.3 Makro-Level*

Although academic entrepreneurship in theory allows for the transfer of unique skills, academic engagement in entrepreneurial activities is rather limited in most countries. The European higher education system is largely based on Humboldt's idea of a university, which is opposed to a utilitarian approach. It is therefore not surprising that the level of academic entrepreneurship in Europe is comparatively low (Luczaj 2022).

In Ukraine, too little emphasis has been placed on strengthening innovative entrepreneurship at universities, especially in start-ups and ASOs. The commercialization of research results is crucial to transform theoretical knowledge into innovative products. However, social, economic and political conditions make it difficult to develop an environment for ASOs. Measures such as legal protection of research results and technology transfer are needed to address these barriers and increase innovation productivity. Bureaucratic hurdles and a lack of institutional management between science and business are further barriers that have to be overcome (Novikova et al. 2018).

Commercialization of scientific research results is not sufficiently supported by academic institutions in Poland and Slovakia, although higher education law in Poland and law in Slovakia encourage entrepreneurial activities. Institutions are not yet adequately prepared for commercialization pressures, and resources and programs to support researchers in this area are lacking. In addition, the government continues to focus mainly on funding basic research and less on application-oriented research that can be used by industry. These barriers hinder the development of business ideas from research and ultimately the formation of ASOs (Luczaj 2022).

### 4.2 Stage 2: to finalize new venture projects out of ideas

#### *4.2.1 Mikro-Level*

#### *4.2.2 Meso-Level*

#### *4.2.3 Makro-Level*

### 4.3 Stage 3: to launch spin-off firms from projects

*4.3.1 Mikro-Level*

*4.3.2 Meso-Level*

*4.3.3 Makro-Level*

### 4.4 Stage 4: to strengthen the creation of economic value by spin-off firms.

*4.4.1 Mikro-Level*

*4.4.2 Meso-Level*

*4.4.3 Makro-Level*

## 5. Discussion and Implementation

Our research, despite its extensive systematic literature review, has several limitations. First, the survey is limited to English-language literature, thereby excluding potentially relevant work in other languages. Second, the "Scopus" and "EBSCO Business Source Premier" databases used may not be complete and may have overlooked important studies. Third, we limited our search to the period between 2000 and 2023, potentially excluding previous significant work. Finally, our investigation relates exclusively to Europe and therefore cannot be generalized to ASOs in other regions of the world. Further research that overcomes these limitations could provide a more complete picture of the challenges facing ASOs.

## 6. Conclusion

Generating business ideas from research results is a significant challenge at the micro, meso and macro levels in Europe. At the micro level, individual factors such as managerial skills, time resources and ethical dilemmas influence the ability of scientists to set up ASOs. Scientists who dedicate themselves intensively to their academic careers, especially at an international level, often have less time for entrepreneurial activities. In addition, ethical dilemmas can arise when research interests and commercial interests diverge. At the meso level, institutional factors are proving to be substantial challenges. A restrictive university culture that lacks resources and incentives to set up ASOs can hamper the active participation of scholars. Administrative hurdles and a lack of knowledge about ASOs and their formation process can also limit the formation of spin-offs. To overcome these obstacles, universities should actively implement strategies to promote an entrepreneurial culture and provide sufficient resources and incentives. At the macro level, social, economic and political conditions pose an obstacle to the development of ASOs. In **eastern European** countries like Ukraine, too little emphasis is placed on strengthening innovative entrepreneurship at universities. Bureaucratic hurdles and a lack of institutional management between science and business represent additional barriers that need to be overcome. The commercialization of research results and the emergence of ASOs in Europe are therefore facing crucial challenges. However, these obstacles can be overcome through targeted action at all levels. It is important to provide strategies and resources that support both scientific research and entrepreneurship. In this way, research results can be effectively converted into practical business applications and contribute to economic development.

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