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Estimating the Population Size of Academic Spin-Offs: Challenges and Opportunities

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Abstract:

Purpose: *Firstly, this paper aims to systematize the factors involved in estimating the academic spin-off (ASO) population size, which relate to the definition of ASO. Secondly, it proposes to use equity links to develop a method to measure a part of the ASO population in Poland with its testing and critical analysis.*
Design/Methodology/Approach: *The study utilizes an original methodology for surveying ASO population size in Poland, focusing on identifying and assessing the formal connections (equity links) between university Special Purpose Vehicles (SPVs) and ASOs.*
Findings: *The study led to the creation of a comprehensive database of ASOs in Poland, confirming the significant analytical potential of the equity -ties-based approach. This methodology expands and organizes the available knowledge on ASO scale and characteristics within the Polish economy. A noted limitation is the exclusion of ASOs without equity ties to universities.*
Practical Implications: *This equity -ties-based approach provides a reliable framework for continuous ASO monitoring, enabling policymakers and academic institutions to assess the impact of support programs and foster academic entrepreneurship more strategically.*
Originality/Value: *The developed database provided a range of information presented on such a scale for the first time. It confirms that foundations have been established for conducting quantitative research that could serve as a basis for more specialized considerations and analyses of the phenomenon at both national and international levels, as well as for studying a range of micro and macroeconomic phenomena. Moreover it has been highlighted how various choices regarding definitions can increase or decrease the number of entities classified as ASOs, which facilitates comparisons of ASO population size results obtained in different studies.*

Keywords: *Academic spin-off, knowledge commercialization, academic entrepreneurship, university, academic spin-off population.*

JEL Classification: *K10, M31.*
Paper type: *Research article.*

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1. Introduction

Academic Spin-Offs (ASO)s are seen as an important mechanism for the commercialization of scientific knowledge. Consequently, they have attracted research interest over several decades (O'Shea, Chugh, and Allen, 2008; Miranda, Chamorro, and Rubio, 2017; Mathisen and Rasmussen, 2019). Scholarly attention to ASOs began to surge in the 1990s, as they were increasingly recognized for their impact on economic growth (Roberts, 1991; Gompers, Lerner, and Scharfstein, 2005; Caputo, Charles, and Fiorentino, 2022).

Over the following years,considerations were supported by examples of a number of fast-growing spin-offs established at the world's top universities as in the United States - MIT (Shane, 2004) and Stanford (Autio, 1997) and Oxford in Europe (Smith and Ho, 2006). At the same time, researchers have questioned whether research should solely focus on top institutions and what is the situation outside them? Researchers have pointed out the conicity of expanding research and analysis to "non-elite" academic centers and implementing international comparative studies (Wright, Clarysse, Mostar, and Locket, 2007; Migliorini, Serarols, and Bikfalvi, 2010).

The current perception of ASOs is significantly broader, and there is an awareness of the fact that they form a diverse and complex collective in terms of the founding team, size, growth rate, or degree of novelty of the technology used.

However, the widening perception of ASOs is accompanied by considerable fluidity in the boundaries of defining the concept and, moreover, by variability in the criteria for belonging to the sector. This situation makes it difficult to address the topic holistically, so that studies dealing with the issue of the size of the ASO population at country level are very rare.

This paper addresses this gap with two objectives. Firstly, to organize the factors involved in estimating ASO population size, especially around ASO definitions. Secondly, a proposal to use equity links to develop a method to measure a part of the ASO population in Poland with its testing and critical analysis.

2. Literature Review

2.1 Defining an Academic Spin-Off: Discussion and Approaches Used

The term "academic spin-off" (*academic spin-off, university spin-off*) has gained a permanent place in the literature. In its broadest sense, it refers to an enterprise that has its roots in an academic or research institution. They play the role of the parent organization, that is, the organization from which comes the knowledge and people that make up the new entity and its future competitive position.

Based on an analysis of the approaches used in the literature (e.g., Pirnay, Surlemont, and Nlemvo, 2003; Fryges and Wright, 2014; Głodek, 2018), it can be pointed out that the concept of ASO is associated with three or four criteria occurring together (Figure 1):

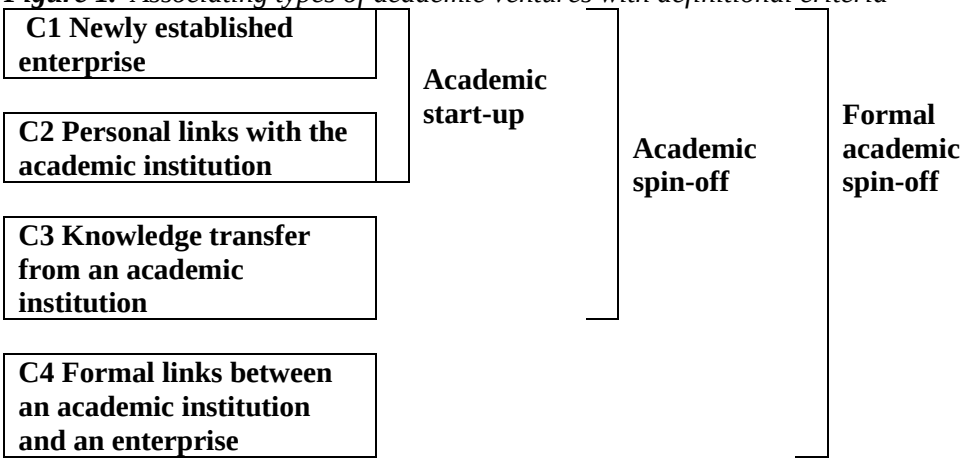
- Criterion 1: Creation of a new enterprise.
- Criterion 2: Personal ties to the parent organization, through the person (individual) founding, co-founding or participating in the management of the new entity.
- Criterion 3: The occurrence of knowledge transfer from the parent organization, which in this case is the research unit.

The above criteria are recognized by the vast majority of authors however, the list is often supplemented with an additional fourth factor, which is interpreted in different ways:

- Criterion 4: Existence of a formal relationship, such as equity or contractual ties, between the parent institution and the start-up.

It is also important to recognize that each of these factors is associated with a range of approaches, generalizations, and, at times, imprecise definitions. These varying elements considerably impact the ability to accurately estimate the scale of the ASO phenomenon.

Figure 1. *Associating types of academic ventures with definitional criteria*



Source: *Own study.*

Criterion one (C1), which requires the establishment of a new business entity, is relatively straightforward and generally undisputed.

However, second criterion (C2) - focusing on personal ties to the parent organization - already contains an element that can seriously differentiate the estimated number of

companies. It concerns the group of parent organizations. While it is widely accepted that universities belong in this group, debate arises when considering whether other types of institutions should also be included, such as scientific research organizations that are not universities, technical schools, or private educational institutions (Steffensen, Rogers, and Speakman, 2000; Clarysse, Heirman, and Degroof, 2000).

In the case of Poland, the landscape includes various institutions such as the Polish Academy of Sciences, state research institutes or scientific institutes, including those affiliated with the Łukasiewicz Research Network (Zachłowski, 2018). An additional number of scientific institutions operate at medical entities such as the Polish Mother's Health Institute.

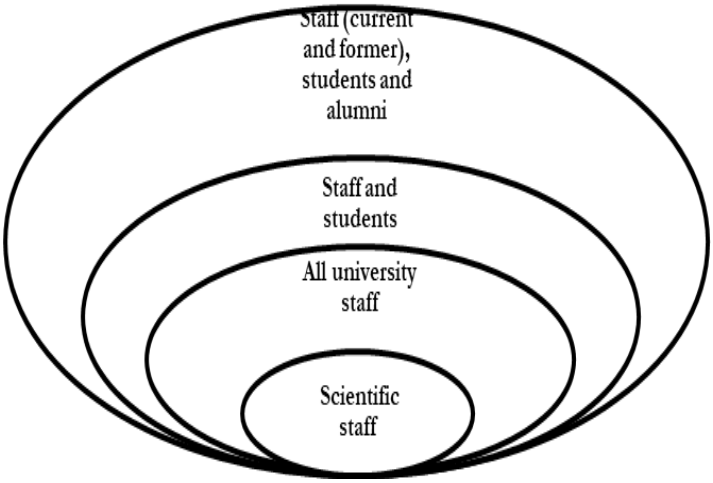
Extending the examination of criterion two (C2), there is ample scope for varied definitions based on the status of the person(s) establishing the new company, within the parent organization (Albert, Fournier, and Stéphane, 1991; Nicolaou and Birley, 2003; Fryges and Wright, 2014; Schaeffer and Matt, 2016). This criterion can be further analyzed along two key dimensions.. The first relates to the position of the founding person(s), and the second to the issue of continuity of the founder's relationship with the organization.

In the first case, the position of the founder serves as the key differentiator. It is generally accepted that a university research employee as a founder embodies the characteristics expected of an ASO founder. However, other professional categories within the university context can also expand the scope of ASOs, including (i) technical staff, such as laboratory technicians or supervisors, (ii) doctoral candidates, and (iii) students.

For simplicity or perhaps referring to the essence of ASO, some publications omit detailed categorization of founders, instead focusing solely on the knowledge transfer aspect (Criterion 3). Nevertheless, there is a perspective that closely integrates ASOs into the stream of academic entrepreneurship, also accepting new companies founded by any group affiliated with the university (Schaeffer and Matt, 2016).

In the second case, we are talking about (i) an ongoing or (ii) a terminated relationship with the university. Both situations, as well as hybrids, are encountered in ASOs. This may result in the inclusion (or not) of former university employees, doctoral students or former students among the potential founders of ASOs. In particular, including graduate students in the defining criterion may increase the number of entities at least several times. Nevertheless, Hayter, Lubynsky and Maroulis (2017), among others, analyze ASOs understood as companies founded by university graduates.

Figure 2. *Potential founder groups of academic ventures and their impact on ASOs categorization*



Source: *Own study.*

The third criterion (C3) refers to the transfer of knowledge from the parent organization to the new enterprise. It involves utilizing various forms of scientific knowledge to establish and develop the new enterprise.

The first area of discussion concerns the form of knowledge transfer,, and in particular the absence or existence of a legal form. Formal mechanisms, such as license agreements or patent sales, offer clear authority and legal boundaries for using the knowledge, defining ownership and permissions precisely. The second area of discussion focuses on the degree to which transferred scientific knowledge is actually utilized within the new venture.

This aspect highlights the need to selectively identify companies where university-based knowledge serves as a foundational element, as not all enterprises founded by academic professionals leverage knowledge from the parent institution. Many such ventures may be classified as "academic start-ups" (Figure 1) rather than spin-offs, as their core activities do not fundamentally rely on university-originated knowledge (Glodek, 2018).

In the case of the fourth criterion (C4) regarding the existence of a formal relationship with the parent organization, there is considerable diversity of interpretation. It relates largely to the discussion of how much of a spin-off (or spin-out) is an intended venture by the parent organization. Intended, that is, one that was created with the knowledge, consent, and in some cases with the support of the parent organization.

In the literature, opinions differ on the importance of including this criterion within ASO definitions, as it often serves more to distinguish among types of spin-offs

rather than as a defining element. A number of publications do not take it into account (Miranda, Chamorro, and Rubio, 2018), assuming that it serves to classify the types of spin-offs internally, rather than defining them as a separate category.

Others assume a distinction between two categories of entities - spin-off and spin-out (Wright, Clarysse, Lockett, and Binks, 2006). Some sources even combine the terms, in the form - spin-off/spin-out companies (Makowiec, 2012).

Based on the type of formal relationship, three distinct types of affiliations between ASOs and their parent universities can be identified:

1. ASO with equity participation of the university - refers to the situation in which there are capital ties of the company with the parent organization.

2. ASO tied by a contractual relationship with the university - in this category, the ASO and the university are linked through the form of a contract, for example, the transfer of intellectual property rights. These agreements may cover aspects such as the transfer of intellectual property rights, permission to use the university's logo, or the formal designation of the ASO as an official spin-off. In each of these cases, the agreements regulate some element of the relationship between the two entities.

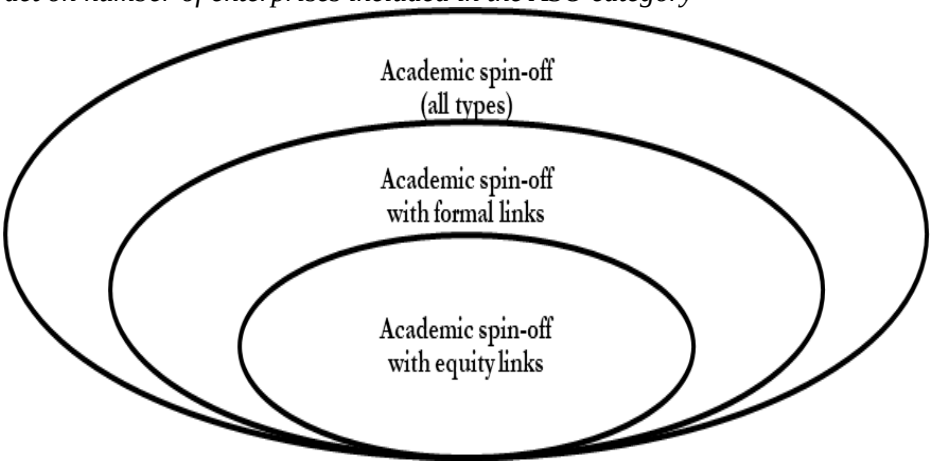
3. ASO without formal ties with the university - refers to the situation where ASO operates independently. The university may offer informal support through advising or networking opportunities (Berbegal-Mirabent, Ribeiro-Soriano, and Sánchez García, 2015), remain indifferent, or even show reluctance towards the spin-off's establishment.

The size and structure of ASO populations, particularly regarding their formal ties to universities, are often shaped by the legal regulations governing their establishment. As Bengtsson's (2017) analysis indicates, the structural differences in the population development of the different types of ASOs in the three Scandinavian countries can be linked temporally to the modification of national regulations. The author sees this aspect as the reason for the different trajectories of the sector's development in Sweden, and Denmark and Norway in recent years.

The focus on spin-off companies with capital ties to their parent universities is supported by current legislation (Law, 2011; 2018) and the critical role of the knowledge source in their formation (Lockett and Wright, 2005).

For researchers, this approach will have an additional important practical dimension. Identification of the ASO population according to the criterion of capital connection significantly facilitates the search for entities, and often also the acquisition of data on their basic economic characteristics.

Figure 3. *Types of links between academic ventures and universities, and their impact on number of enterprises included in the ASO category*



Source: *Own study.*

2.2 ASOs Population Estimation – International Comparison

In the United States, AUTM has collected data regarding university spin-off activity since 1994. Based on data provided by AUTM, Avnimelech and Feldmann (2015) estimate that approximately 9,992 spin-offs were established by around 300 leading U.S. academic institutions from 1980 to 2012. Notably, AUTM data focuses exclusively on formal spin-offs—those with documented affiliations to universities (Miner *et al.,* 2012). Although more recent comprehensive statistics for the entire market are not available, AUTM data continues to be utilized for specific sub-analyses (Martínez-Ardila *et al.,* 2023).

Since 2011, an annual report in the UK has monitored trends within the ASO population, identifying approximately 1,880 entities, of which 1,317 remain active (Whorwood, 2014). These reports focus on formally recognized academic spin-offs, defined as ventures that utilize intellectual property (IP) developed through university research and maintain formal connections to their parent institutions through equity stakes or licensing agreements.

The Italian study by Bolzani *et al.* (2014a) compiled a database of ASOs formed between 1978 and 2013, identifying 1,010 entities. Unfortunately, the authors did not provide explicit criteria for defining academic spin-offs. Their approach was largely pragmatic,, the authors used 18 different databases - mainly university databases, but also personal databases. In a related academic publication, Bolzani *et al.* relied on a refined database of 935 Italian ASOs created between 2000 and 2013. In this study, the definition aligns with Fini *et al.* (2009) specifying that an ASO (1) need to be affiliated with a university, evidenced by the institution holding equity in the company, which relates to definition related to formal links.

Moreover they consider personal links – as ASO is considered when one of the employees (either faculty or technicians), or even research collaborators of the institution is a shareholder of the company (Bolzani *et al.,* 2014b). This inclusion of personal links as a defining factor is relatively unique within the ASO literature. Unfortunately, a similarly extensive analysis of the Italian ASO sector post-2014 is not available, highlighting a gap in the recent literature.

Bengtsson's (2017) analysis of ASO data in the Nordic countries—Denmark, Norway, and Sweden—highlights the availability of university-level data on ASOs. However, there are differences in the definition of ASO due to legislation. Norwegian and Danish statistics are based on equity relationships and licensing agreements, while in Sweden a licensing or spin-off agreement does not necessarily include a contract with the university, as the research knowledge is owned by the academic researcher.

In this case, ASOs are identified by statistics when a university holding company receives shares as part of the investment process or in exchange for consulting support. Thus, the ways in which ASOs are identified are similar, although due to the conditions they do not give fully comparable results.

In Polish scientific literature, there has been a discussion on ASOs population size since the late 1990s. Most of the literature focused on the identification and description of individual cases of ASOs (Tamowicz, 2006; Weresa 2007; Kubiński and Safin, 2011) or qualitative analysis of groups of identified entities (Głodek, 2018). Some research extends to ASO identification within broader, quantitatively surveyed populations, including academics (Banerski *et al.*, 2009), regional companies (PSDB and EPRD, 2013), and micro-enterprises (Korpysa, 2017).

However, the only approximation of the size of the ASO population in Poland was indicated by Głodek (2018), who, using the estimates in the Banerski et al. report (2009) indicating that a percentage of 3 that 3-4% of scientific employees engage in entrepreneurial activities. Using current employment figures in the sector (Rzymek, 2023), a level of 4% would indicate around 3,350 entities, and assuming a level of 3% would yield a result of around 2,500.

2.3 Equity Links as One of the Methods to Identify the ASO Population in the Polish Context

Estimating the population of ASOs in Poland has historically faced challenges, as highlighted in previous analyses. As the analyses presented in the previous section show, this is not an exceptional situation. Unlike many other countries, Poland has not traditionally used equity links as a criterion for ASO identification. This absence is partly due to the limited presence of equity-linked ASOs in the early 2000s, making this criterion less relevant.

However, legal reforms introduced in 2011 mandated that universities hold shares in newly established enterprises involved in indirect commercialization (Act, 2011). This shift led to the formation of university special purpose vehicles (SPVs), facilitating the university's formal involvement in spin-offs. In 2012, extensive public support for the creation of SPVs was launched in the form of the SPIN-TECH programme. As a result of the program's implementation, by July 2016, the SPV created under the program had participated in the establishment of 68 ASOs (NCRD, 2016).

Although the development of the market for university SPV has been rather slow, over the years more Polish universities have decided to launch them. A key milestone was the establishment of the *Porozumienie Spółek Celowych* (PSC) in 2014, a collaborative forum for SPVs nationwide. By early 2024, PSC had grown to include 34 entities across Poland, indicating continued expansion and institutional support for academic commercialization through spin-offs (PSC, 2024).

3. Methodology

The development of the research methodology followed five primary stages: (i) conceptual operationalization, (ii) compiling a list of SPV, (iii) determining and characterizing equity linkages, (iv) measuring data, and (v) verifying the efficacy of the methodology.

Initially, based on a literature review and prior research findings, we defined academic spin-offs (ASOs) based on multiple criteria (Figure 3). In terms of the fourth criterion regarding equity linkages, we considered it solely as a means of identifying a segment of the ASO population. In our view, this criterion alone lacks the weight and significance to serve as a defining characteristic of ASOs. To align with our research objectives, we focused exclusively on public universities, which perform the majority of scientific research and employ most of the research workforce in Poland, making them the primary source of ASO activity (Mirosław *et al.*, 2022).

The second step in the methodology involves the identification of SPVs. Since 2011, the establishment of ASOs through these entities has been regulated, with new legal frameworks mandating universities to hold equity in new enterprises that commercialize university-generated knowledge (Act, 2011).

Identification begins with the list of public academic universities under the oversight of relevant. Subsequently, we verify whether the entity has an SPV using data from the internet, including university websites. Where confirmation of an SPV’s existence was uncertain, we contacted universities. It is important to note that in Poland, SPVs typically take the form of capital companies, although in the past, especially before 2011, these functions were sometimes assigned to other types of entities, including university foundations.

After finalizing the SPV list, we proceed to identify ASOs through a manual scan, using tools to investigate equity linkages. Available tools for this purpose include the *Fundacja Moje Państwo* platform (https://rejestr.io/), *Transparent Data sp. z o.o.* (https://przeswietl.pl/), and *ISI Emerging Market Group Limited* (https://www.emis.com/pl).

The objective was to identify connections between SPVs and other enterprises. To enhance the reliability of the research, it is recommended to use multiple tools and cross-verify their results. This method has inherent limitations. Formal database searches can only identify equity linkages when an investor's shareholding exceeds 10%, and they reflect only the current status and will not include ASOs in the form of joint-stock companies.

After compiling the initial ASO database, additional steps are necessary to ensure no entities are missed. In building the further dataset, contacting industry organizations or the universities directly was helpful. We established contact with the PSC. Our collaboration provided valuable additional data.

To ensure the completeness of the data, we contacted the university as a final step. This action can be used as feedback at the data completion stage. At this stage, two critical elements must be examined: first, the assessment of the correctness of identified ASOs and the completion of the database with any missing data; second, in some cases, it is impossible to independently determine the level of shareholding, and the entity may provide the necessary information.

Before initiating coding begins, criteria for verification, acceptance, and exclusion of ASOs for the target study was established. In adopting this approach, it is important to consider the risks of data duplication due to compiling data from various sources. This is possible, for instance, in cases where more than one SPV holds shares in an ASO.

The final evaluation step involves verifying that each entity aligns with the established ASO criteria. The defining characteristics of an ASO were discussed earlier in the article. However, it is appropriate to analyze each company in the database to ensure it meets the established criteria (C1 – C3). Verification can be conducted using data from company websites, reports, and relevant documents, supplemented by direct or indirect contact if needed.

4. Research Results and Discussion

The scientific potential and technical feasibility of analyzing the population of ASOs in Poland based on the use of equity linkages connecting special purpose companies and ASOs led to a study conducted from July 2023 to December 2023.

Based on the proposed methodology, 271 companies established between 2010 and 2023 were initially identified as ASOs. These entities were created by 34 SPVs. Additionally, 11 SPVs were active in Poland but did not establish any spin-offs. Importantly, the study assumed the criterion of SPVs, so the authors did not verify connections, such as those with the 1990-established *Fundacja UAM*, which had historically supported technology transfer at *Uniwersytet im. Adama Mickiewicza w Poznaniu*.

The final count of ASOs included in the study was narrowed down to 248 enterprises. The initial number was reduced due to several exclusions: four companies were excluded because they ultimately were not established, and one case involved an ambiguous identification among several similarly named companies. Due to insufficient data, one more enterprise was excluded.

Duplication of ASOs led to the removal of some records (nine cases), leaving data on ASOs in a single row. Following mutual discussion, we deemed it appropriate to exclude a total of eight companies. In four cases, the decisive criterion was the transferred knowledge (C3), and in the remaining four cases, the lack of shareholding by the SPV led to their exclusion. While these companies may still qualify as ASOs, their distinct characteristics set them apart from the target study group. The refined dataset of 248 ASOs provided a strong foundation for substantive analysis.

By obtaining information for each analyzed ASO, we were able to track the dynamics of changes in the population of these enterprises in Poland (Figure 4). Of the 248 ASOs included in the study, 235 were still operational by the end of 2023 (including seven with suspended activities). Final data may undergo minor modifications due to delays in formal data processing in Polish court registries. Thus, the fully verified data pertains to 2022. We believe that it would be worthwhile to repeat the study in the future to provide updated information and a basis for longitudinal analysis that could support future research on the evolution and impact of ASOs in Poland.

The first company in our database was established in 2010 with equity participation from the *Akademia Górniczo-Hutnicza w Krakowie*. Three months later, a company associated with the *Politechnika Łódzka* was established. Naturally, considering the definitional and methodological diversity discussed earlier, we do not imply that this is the absolute beginning of academic entrepreneurship in Poland, which had its origins much earlier. For example, under alternative criteria, one of the pioneering ASOs in Poland could be *Cynel-Unipress sp. z o.o.*, founded in 1984.

The discussion of the impact of definitions on population is one of the objectives of this study. Future research should expand knowledge on the number of Polish ASOs by broadening the categories of special purpose companies to include additional entities such as university foundations, ASOs without equity linkages, and ASOs

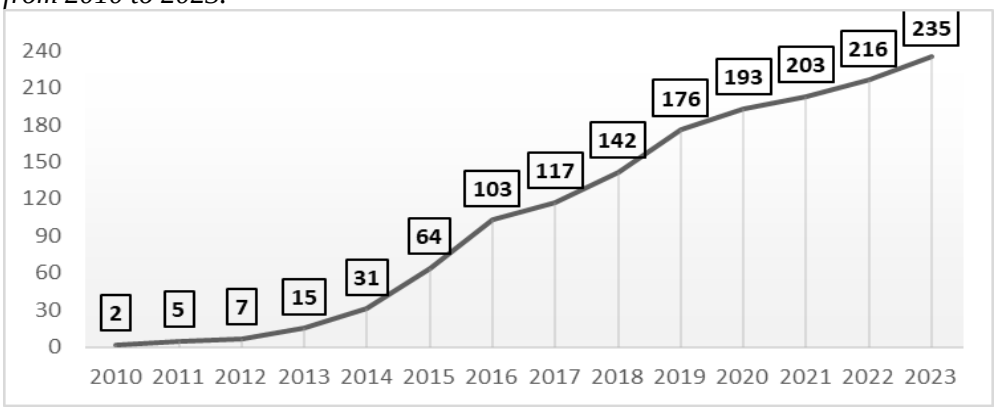
from other types of research institutions. Future research should continue to explore the ASO landscape in Poland by expanding to non-equity linked entities, SPV in form of university foundations, ASOs without formal equity linkages or ASOs associated with diverse research institutions.

We can confirm that new legal frameworks introduced since 2011 have driven a consistent increase in the establishment of ASOs, with a compound annual growth rate (CAGR) of 45%. Between 2010 and 2016, the ASO population doubled, peaking in 2016 with 39 new companies. In subsequent years, growth moderated to around 20 new ASOs per year.

Of the analyzed ASO population, 131 ASOs (over 50% of the analyzed population) were established after 2018, marking a significant period influenced by the introduction of the Higher Education and Science Act, which heightened universities' role in fostering economic innovation (Act, 2018). This pattern suggests promising avenues for future research to explore correlations between ASO formation and the implementation of legal changes or support programs, such as the Innovation Incubator or SPIN-TECH. These analyses could provide insights into how regulatory and support mechanisms have shaped the landscape of academic entrepreneurship in Poland.

Two main categories of academic institutions have driven ASO population growth in Poland: (i) technical university and (ii) traditional universities, each contributing substantially, with 123 and 102 newly established ASOs, respectively. Analysis indicates that technical university generate an average of eight spin-offs per year, traditional universities average seven, and medical universities contribute around six annually. Comparing the number of academic spin-offs in Poland with data from some Western countries reveals weaknesses in the Polish system (Di Gregorio, Shane, 2003; Bolzani *et al.*, 2015).

Figure 4. *Population of academic spin-offs with equity ties to universities in Poland from 2010 to 2023.*

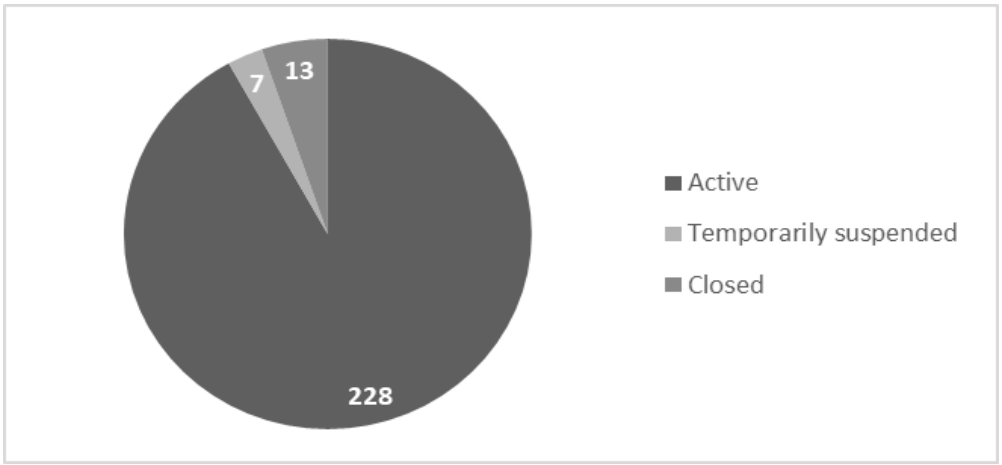


Source: *Own study.*

Despite the substantial risks associated with ventures in new technology areas (Mathisen and Rasmussen, 2019; Gbadegeshin *et al.*, 2022), ASOs show a higher success rate compared to businesses with traditional profiles (Schillo, 2018). Among the 248 academic spin-offs analyzed, an impressive 92%, are still active, while 13 companies has been closed. All 13 discontinued companies operated for over three years, with five lasting over six years.

Comparing the survival rate of Polish ASOs with similar enterprises from other countries shows similar results (Smith and Ho, 2006; Schillo, 2018). Future research could provide valuable insights by evaluating how formal linkages (or the absence thereof) affect ASOs' economic performance and market resilience.

Figure 5. *Status of academic spin-offs with equity ties to universities in Poland for 2023*



Source: *Own study.*

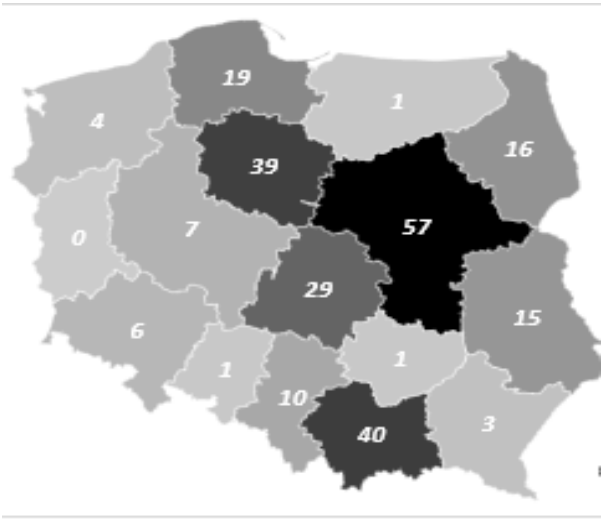
We examined measures of "central tendency" for the initial level of shares held by universities. As investors, universities held an average of 19% (mean); 12% (median); 10% (mode) of shares. The distribution of university shareholding opens multiple research areas, such as how the size of university equity stakes influences company outcomes or university shareholding policies.

Moreover, only a small fraction of ASOs found external investors (e.g., other enterprises), and very few ASOs managed to secure venture capital (VC) funding. This limited external investment points to another potential research direction, as many scholars (e.g., Vohora, Wright, and Lockett, 2004) emphasize the crucial role of VC and other financial resources in the growth and success of ASOs.

Figure 6 illustrates the geographical distribution of ASOs in Poland based on their registration locations. Approximately 55% of the 248 ASOs analyzed were

registered in three primary voivodeships: Masovia (57), Lesser Poland (40), and Kuyavia-Pomerania (39).

Figure 6. *Geographical distribution of academic spin-offs with equity ties to universities in Poland in 2023*



Source: *Own study.*

The concentration ASOs in Masovia and Lesser Poland can be attributed to the strength of metropolitan areas like Warsaw and Cracow, host numerous scientific institutions and support organizations conducive to enterprise creation. The significant ASO presence in Kuyavia-Pomerania, largely due to the entrepreneurial activity of *Uniwersytet Mikołaja Kopernika w Toruniu*, highlights an interesting case for further research.

In contrast, four voivodeships showed minimal ASO establishment activity, with few or no firms created. This is particularly unexpected in regions such as Lower Silesia, Greater Poland, and Pomerania, which possess considerable scientific potential.

Future research could investigate the factors behind these lower-than-expected ASO counts in scientifically strong regions, possibly revealing regional differences in support systems, resource allocation, or institutional priorities affecting ASO development.

In light of these patterns, we calls for future comparative studies on ASO development across national and international contexts. A potential research avenue could involve comparing ASO distribution and growth dynamics in Poland with those in other Eastern European and Scandinavian countries, identifying factors that drive regional variations in academic entrepreneurship.

5. Conclusions, Proposals, Recommendations

The article provides a structured overview of the challenges associated with defining the term academic spin-off. These challenges stem primarily from the wide range of options available in: (i) defining the group of parent institutions (universities, research institutes, or other entities), (ii) defining the group of founders establishing the professional relationship between founders and the parent institution, whether they are faculty, staff, students, or alumni, (iii) utilizing knowledge from the parent institution - specifying how knowledge transfer from the parent institution contributes to the ASO's foundation, (iv) incorporating the criterion of formal affiliation.

Deciding whether a formal relationship, such as equity participation or contractual agreements with the parent institution, should be required as a defining characteristic of ASOs. These factors introduce complexity and variability into the ASO definition, impacting how ASOs are identified and analyzed across different studies and contexts.

The article systematizes the impact of definitional dilemmas on estimating ASO population size, particularly in the Polish context. This supports the thesis that a core challenge lies in determining what exactly to count, or more broadly, what phenomenon is being measured. The ASO definition itself serves merely as a starting point for population analysis. The authors, reflecting on two decades of publications on ASO population estimates in Poland, identify considerable diversity in approaches.

This variation is partly due to a key challenge in ASO identification: the "transience" of knowledge transfer, where the process of transferring academic knowledge to a new enterprise is often fluid and complex. This variability complicates consistent ASO categorization and highlights the need for clear, adaptable definitions to support accurate population estimation.

To address the knowledge gap in ASO population estimates, the authors developed and tested a methodology specifically for Poland. This approach focuses on identifying ASOs through publicly available data, cross-verifying information from various sources, and constructing a comprehensive company database.

The methodology relies on criteria that are both identifiable and accessible in public sources, particularly focusing on capital ties with universities SPV. While this approach excludes ASOs without formal capital connections to their parent institutions, it allows for a highly precise database of a well-defined segment of ASOs in Poland. This precision enables the methodology to be used for consistent tracking over time, providing a foundation for ongoing sector monitoring and future surveys.

This approach strikes a balance between comprehensiveness and data reliability, offering a tool for long-term analysis of the academic spin-off ecosystem in Poland. The capital-ties-based methodology enabled the identification of 248 ASOs, establishing a foundational database suitable for population analysis and exploring various micro and macroeconomic phenomena.

The study shows the significant analytical potential of the applied approach not only in terms of population analysis but also, among other things, some aspects of the effectiveness of support policies or the level of entrepreneurship of academic staff. The use of this approach seems to significantly expand and systematize the available knowledge about the scale and characteristics of the ASO phenomenon in the Polish economy. It is worth recommending this line of research to other research approaches and proposing further methods and approaches.

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