



# University Spin-off: A Review

Adityo Wicaksono<sup>1\*</sup>, Eryadi K. Masli<sup>2</sup>, and Trina Fizzanty<sup>1</sup>

<sup>1</sup>Digital Marketing Division, National Research and Innovation Agency of Indonesia, Jakarta, Indonesia

<sup>2</sup>Department of Business Technology and Entrepreneurship, Swinburne University of Technology, Victoria, Australia  
adit004@brin.go.id

**Abstract.** Contemporarily, university spin-off (USO) has become a major topic in the academic entrepreneurship literature. Universities around the globe have realized that establishing USOs can bring substantial benefits to their organizations and the regional economy. Hence, the USO phenomenon became essential to be further comprehended. Its conceptual advancement grew gradually, yet at a slow pace. This situation provides opportunities for scholars to explore a deeper understanding of the USO phenomenon and contribute to the literature. Therefore, this paper depicts the existing conceptualization of USO and maps the potential topics to be explored. Through a systematic literature review (SLR) and scientometric analysis, this paper aims to enrich the previous reviews of USO and provide guidance for future research. We present our depiction of USO by using the framework of 5W1H (what, who, why, where, when, and how). Four potential topics for future research are provided as additional findings.

**Keywords:** Academic Entrepreneurship, Scientometric, University Spin-Off, USO.

## 1 Introduction

In recent decades, the trend of developing USOs as a tool to boost the regional economy has expanded globally. The trend started with the concept of an academic entrepreneur [1] and entrepreneurial university [2], which was pushed by the Bayh-Dole Act (BDA) in the United States of America (US) in 1980. These concepts signify the extensive involvement of universities and academics in research commercialization, spin-off development, and collaborations with firms [3]. Such activities are recognized as the university's third mission, besides teaching as the first and conducting research for the second mission. Based on this, USO emerged as a new form of a firm established within a university and exploiting its resources (such as technologies, scientists, and capital) to gain competitive advantages.

Afterward, developed countries started to adopt a BDA-like policy for their universities. Nine European countries are mentioned to be the early adopters of the concept, including Spain, the United Kingdom (UK), Denmark, France, Italy, Austria, Germany, Norway, and Finland [4]. However, the policy's actualization could have been better; only three countries within the list could spur university-industry collaborations (UICs), namely

Austria, Germany, and Finland. Meanwhile, most developing countries (such as Indonesia, Mexico, Brazil, India, South Africa, Malaysia, and the Philippines) became late adopters, and the percentage of UIC is lower than the developed countries [5]. This indicates that the successful actualization of UIC and USO remains low globally.

In its progression, USOs can contribute significantly to the economy by commercializing R&D, diffusing innovations, enhancing productivity, and creating jobs [6–10]. As one notable example, Silicon Valley became one of the globally known hotspots of USO development in The US. Stanford, as one of the prominent entrepreneurial universities in the area, was able to generate big companies (such as Google) from its spin-off program. Today, Google, also known as Alphabet, is valued at \$1.45 trillion and employs 156 thousand workers globally. The success of the USO concept in the US has driven other countries to imitate it.

Along with the wide adoption of the USO concept, various issues have arisen. The most common ones are failing at the early stage and stunted growth [11–13]. Thus, a deep comprehension of the USO phenomenon became essential to address the problems for governments and scholars. As the phenomenon is continuously being studied, review papers are needed to track how far the conceptualization goes. Information regarding what still needs to be studied is essential for grant theory development. Therefore, this paper provides a detailed depiction of the USO concept review using SWIH. Some existing reviews are taken into consideration in generating novel insights, including O'Shea et al. [14], Mustar et al. [15], Djokovic and Souitaris [16], Pattnaik and Pandey [17], Miranda et al. [18], Mathisen and Rasmussen [19].

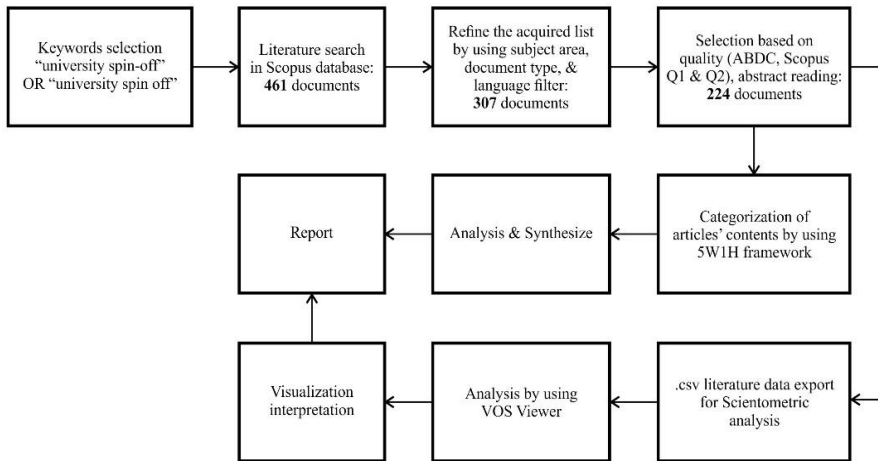
## 2 Methods

This paper employs a systematic literature review (SLR) and scientometric analysis to produce insights. SLR is proper for unearthing insights from abundant information from relevant literature. This type of review is considered a stand-alone review, which helps aggregate, interpret, and explain the existing literature for new knowledge production [20]. Based on its purpose, the review can be categorized into four types: describe, test, extend, and critique [21]. Referring to the categorization, We consider our review to be a descriptive review that tries to investigate the state of the literature to address a peculiar inquiry, topic, or concept.

Further, this review follows eight steps of systematic literature review procedures [21], including (1) research problem formulation, (2) protocol development, (3) literature search, (4) selection, (5) quality assessment, (6) data extraction, (7) analysis and synthesize, and (8) report development. First, we proposed a need for constructing fragmented knowledge within literature into an overarching depiction of USO. Second, we drew the complete protocol in Figure 1; it starts with selecting keywords to find in the Scopus database. We use the keywords "university spin-off" OR "university spin-off" for the literature search. Third, in the literature search, we acquired 461 documents. Fourth, We refined the acquired document list with the subject area, document type, and language filters. It results in 307 documents. Fifth, We further shortlisted the document based on the Australian Business Dean Council (ABDC) list, Scopus Q1, and Q2. As for the relevance, We read the abstract

of the documents. As the final result, We have 224 documents to be reviewed. Sixth, We categorized the articles" contents into our framework 5WIH. Seventh, the categorized contents were analyzed and synthesized. Lastly, We write the review.

Meanwhile, scientometric analysis enriches our review by providing a map of the potential areas of topics for future research. The scientometric lens views scientific literature as information or media for communication that can be quantitatively analyzed [22]. The approach relies on data availability from various sources, namely Scopus, Web of Science (WoS), EBSCO, Emerald, and Google Scholar. The quality of these databases will influence the result of the scientometric analysis. Therefore, this study utilizes the Scopus database as one of the most reliable and high-quality sources of scientific literature. The data that has been acquired in our SLR was analyzed by using VOSviewer. This approach will result in four outputs, including (1) mapping the topics, (2) identifying emergence and potential topics, and (3) area origin of the literature.



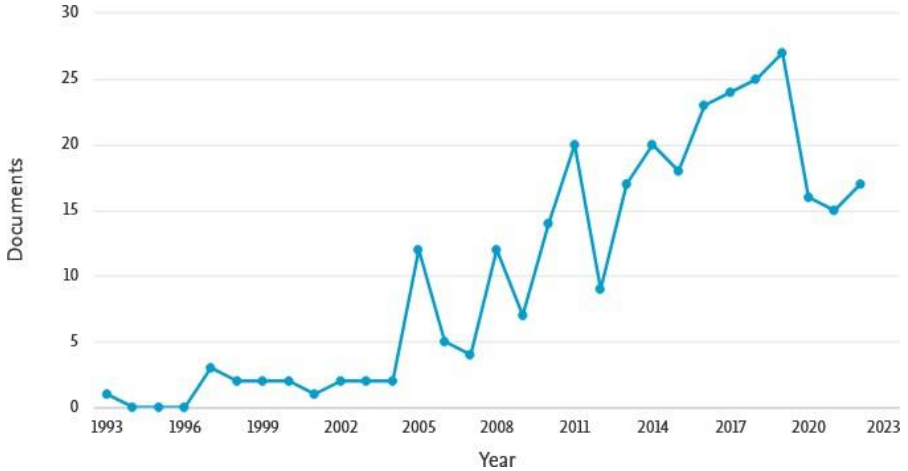
**Fig. 1.** SLR and scientometric protocols.

## 3 Findings

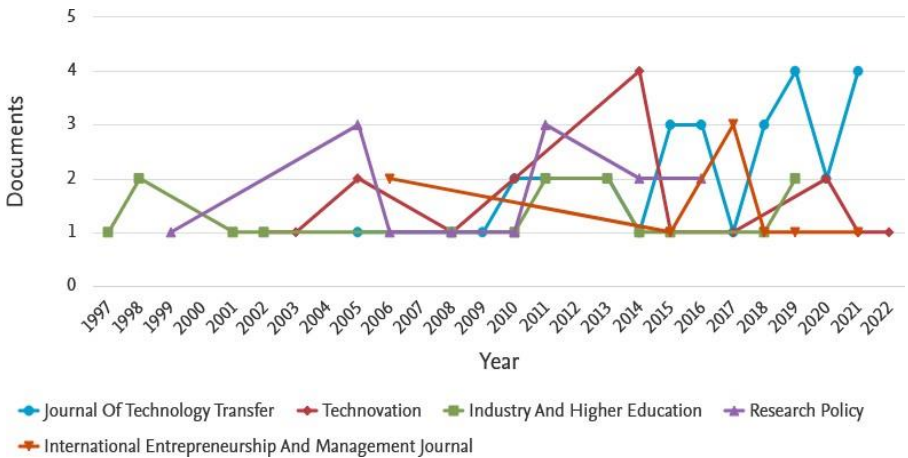
### 3.1 What?

This section covers (1) the statistical overview of literature (publication trends, what journal, and what type), (2) definitions, and (3) factors of USO development. This review adds to the Pattnaik and Pandey [17] work that also addresses the inquiries of what, why, and how. First, in the statistical overview, there was a growing trend in the number of published documents from 2005 until 2019 (Fig 1). Then, from 2020 until 2021, the number drops by about 40%. The diverted global research priorities can cause this due to the COVID-19 pandemic. As the pandemic eases, this topic is expected to be elevated. Further, if we deep dive, five journals consistently published many USO-related articles (Fig. 3),

namely the Journal of Technology Transfer, Technovation, Industry and Higher Education, Research Policy, and the International Entrepreneurship and Management Journal. This figure can be guidance on where to publish or to source articles for academic entrepreneurship and USO researchers.

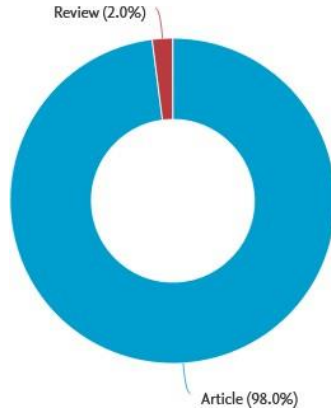


**Fig. 2.** Number of published scientific articles related to USO.  
Generated by using the Scopus database.



**Fig. 3.** The publication trend in the top five journals related to USO.  
Generated by using the Scopus database.

In the statistic overview, We see that the percentage of review articles still needs to be improved compared to generic scientificarticles. Hence, this provides opportunities for Us to provide more up-to-date reviews to enrich the USO literature. Expanding into multiple databases is also necessary to produce more overarching reviews.



**Fig. 4.** The percentage of USO-related articles and reviews. Generated by using the Scopus database.

Second, what is the meaning of USO through the lens of scholars? This entity has been described in various definitions, yet there has yet to be a universal definition widely agreed upon by scholars and academics. The earlier notable definition of USO is described by Smilor, Gibson, and Dietrich [23] as “a company that is founded (1) by a faculty member, staff member or student who left the university to start a company or who started the company while still affiliated with the university, and (2) around a technology or technology-based idea developed within the university.” In a more straightforward way, USO can be defined as “firms that have been spun off from academic departments or research centers within a university to commercialize technology invented at the university” [24].

Another definition is proposed by Wright et al. [25]: "a start-up company whose formation is dependent on the formal transfer of intellectual property rights from the university and in which the university holds an equity stake." This definition can be applied widely in the contemporary context, as it resonates with the current global uptrend of start-up development. Meanwhile, Shea et al. described USO with two criteria, "(1) The transfer of a core technology from an academic institution into a new company, and (2) The founding member(s) may include the inventor academic(s) who may or may not be currently affiliated with the academic institution [26]." Overall, the summary of USO" s definitions can be seen in Table 1.

**Table 1.** Summary of USO definitions.

Definition	Source
“A company that is founded (i) by a faculty member, staff member or student who left the university to start a company or who started the company while still affiliated with the university, and/ or (ii) around a technology or technology-based idea developed within the university.”	[23]
“... firms that have been spun off from academic departments or research centers within a university with the aim of commercializing technology invented at the university.”	[24]
“a start-up company whose formation is dependent on the formal transfer of intellectual property rights from the university and in which the university holds an equity stake.”	[25]
“... (1) The transfer of a core technology from an academic institution into a new company. (2) The founding member(s) may include the inventor academic(s) who may or may not be currently affiliated with the academic institution.”	[26]
“... a new venture initiated in a university setting and based on technology developed at a university.”	[27]
“... a company formed with some university equity ownership, based on technology developed at that university.”	[28]

Modified from: [17]

From the compilation of definitions, some consistent components persist within the scholarly description. The components are (1) a new venture (or a start-up), (2) initiated within a university, (3) founded by academic team members, (4) a solid attachment to the university, and (5) technology-related. With these components, We try to integrate the scholars' description of USO and propose a new definition: A start-up initiated within the university and founded by academic team members, which has a solid attachment to the university through the technology commercialization process.

Third, there are ample factors affecting USOs' formation and development that have been identified in the literature (see Table 2.). The factors can be categorized into internal and external. From the existing literature, we can acknowledge some notable internal factors, namely the ability to acquire external funding, inherited competencies, maintained linkages to parents, team variety, founders' knowledge and experience, firms' size, network (capability), and CEO managerial skills. However, more than merely identification is required. Prioritization of factors is necessary for every different stage of USO development. Such research still needs to be more extensive in the literature.

Meanwhile, the external factors include incubators' support, universities' research strength, proximity with the parent, VCs' fund, academic researchers' job dissatisfaction, connectedness to local resources, effective filtration, financial resources, industrial partnerships, involvement of external entities in the founding team, legislative instruments,

cultural instruments, multiple actors' involvement, public policy institutional framework, and the regional entrepreneurial ecosystem. Some of these factors have yet to be empirically tested. Hence, this identification may provide opportunities for future research.

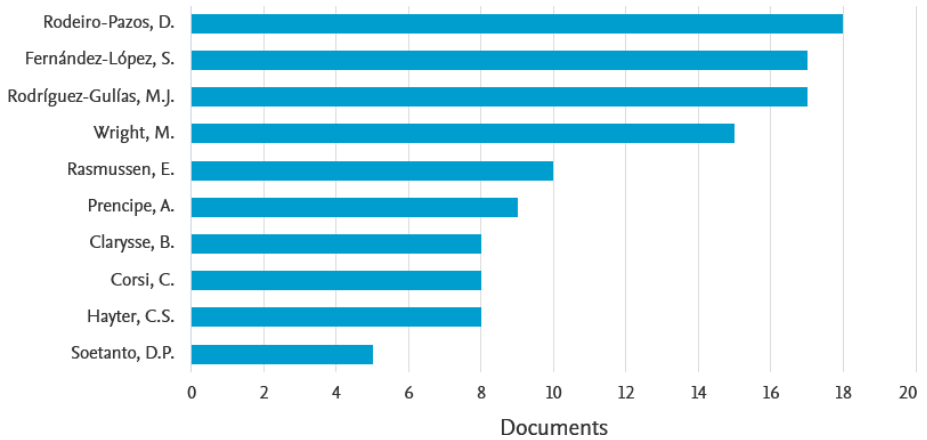
**Table 2.** Factors of USOs' formation and development.

<b>Internal Factors</b>	<b>Source</b>
• USO's" ability to acquire external funding	[28]
• Inherited competencies	[29]
• Maintained linkages to parent universities	
• Teams" Variety	[30]
• Academic founders" knowledge and experience	[31]
• Firms" size and minimum size	[32]
• Network (capability)	[33]
• CEO managerial skills	[34]
<b>External Factors</b>	<b>Source</b>
1. Incubators" support	[9,10,35]
2. Universities" research strength	[28]
3. Geographical proximity with the parents	[29]
4. VCs" fund	[30]
5. Academic researchers" job dissatisfaction	[36]
6. Connectedness to local resources	[37]
7. Effective filtration	
8. Financial resources	[34]
9. Industrial partnerships	
10. Involvement of external entities in the founding team	[38]
11. Legislative and cultural instruments	[39]
12. Multiple actors' involvement	
13. Public policy institutional framework	[40,41]
14. Regional entrepreneurial ecosystem	[37]

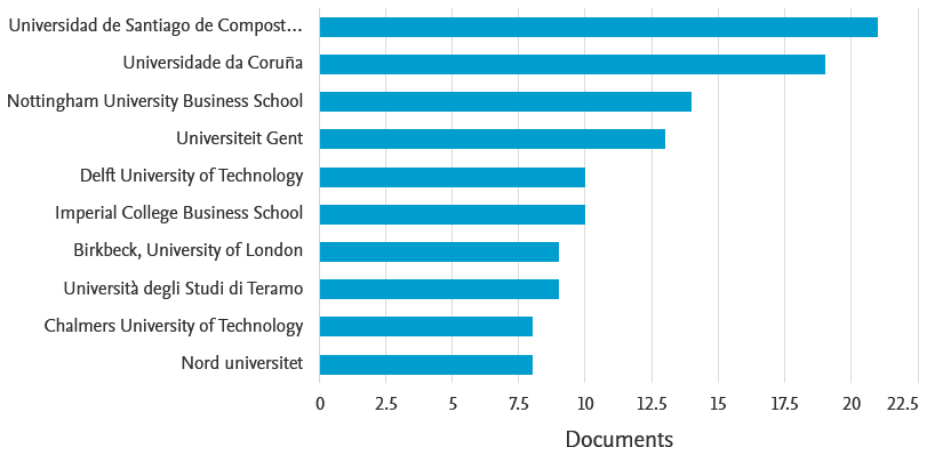
### 3.2 Who?

The inquiry of "who" is involved in the USO literature and reality will be described in (1) a statistical overview of authors and organizations who produced USO articles and (2) actors in the USO milieu. First, from the Scopus database analysis, We can see five productive authors in USO" s literature (Fig. 5), including Rodeiro-Pazos, Fernandez-Lopez, Rodriguez-Gullas, Wright, and Rasmussen. Meanwhile, the top six organizations that generated the most USO articles are Universidade de Santiago de Compostela,

Universidade da Coruna, Nottingham University, Universiteit Gent, Delft University of Technology, and Imperial College (Fig. 6).



**Fig. 5.** Number of authors' publications related to USO.  
Generated by using the Scopus database.



**Fig. 6.** Number of documents by affiliation.  
Generated by using the Scopus database.

Second, multiple actors are crucial to be present and involved actively within USO's milieu. Extant literature has mentioned that various actors actively engaged with USOs (Table 3.). Parent universities, researchers, technology transfer offices (TTOs), incubators, and Technology Holding Company (THC) can be considered the central actors of USO's milieu in the early stage. Meanwhile, external market actors, investors (including VCs), and experienced entrepreneurs are essential in the later phase of USOs.



**Table 3.** Actors in USOs' Milieu.

Actors	Source
TTO, incubators, investors, and experienced entrepreneurs	[42]
Technology holding company (THC)	[10]
Parent Universities	[29]
External market actors	[43]
Academic researchers	[36]
“Technology transfer officers, academic founders, external entrepreneurs, investors, and business incubators.”	[37]
Venture capitals (VCs) and industries that act as venture capitals to spin-offs	[25,44]

### 3.3 Why?

This section covers (1) why USO is essential (the benefits) and (2) why USO is difficult to sustain. There are at least four notable benefits of USO to its surroundings, namely enhancing regional innovation, enhancing the regional economy, creating jobs, and strengthening technology transfer and R&D commercialization (Table 4.). From this explanation, USO is a powerful tool to enhance the regional economy and innovation. However, if the focus is only on generating USOs, the enhancement will only last for a while, as this entity has a high failure rate at its early stage and is difficult to sustain.

**Table 4.** Benefits of USO to its surroundings.

Benefits of USO	Source
Enhancing regional innovation and productivity	[6,8]
Enhancing regional economy	[6,10,26]
Contributing to job creation or employment	[8,10,26,45]
Strengthening technology transfer and R&D commercialization	[8,45]

So, why is it difficult to sustain? Researchers have comprehended issues and barriers in various USOs' development phases. Some of the significant issues (or barriers) in the USOs' development include prone to failure at the early stage, low market performance, imbalance between scientific and business orientations, the influence of the university's ecosystem, lack of diversity in founders, also limited resources and capacity. These issues are peculiar to USOs, as they grew inside the university by exploiting parents' resources. The unique characteristic of the university ecosystem is influencing how they form teams and exploit resources. Thus, USO requires different support and interventions compared to start-ups and traditional firms in general.

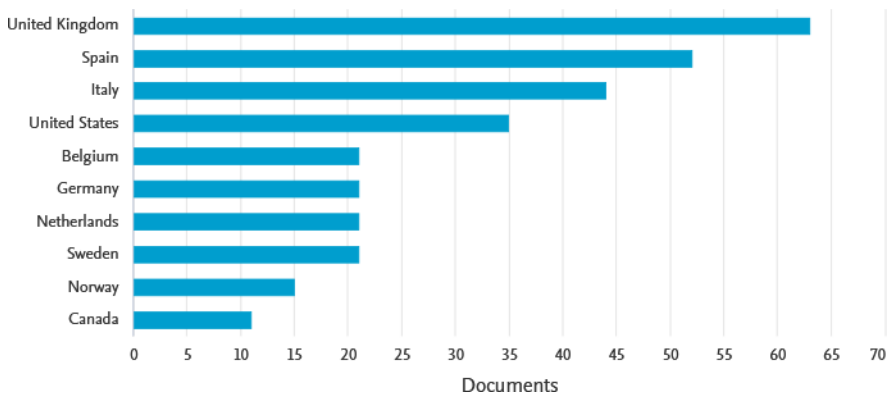
**Table 5.** Issues and barriers in USOs' development.

Issues and barriers	Source
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Prone to fail at the early stage and stunted growth at the later stage	[8,11,46]
Low market performance	[33,47]
Unbalance between scientific and business orientations	[48]
Influence from the university" s (parent) ecosystem	[49]
Lack of diversity in founders and team cause a deficiency in market knowledge.	[12,30]
Limited resources and capacity	[43]

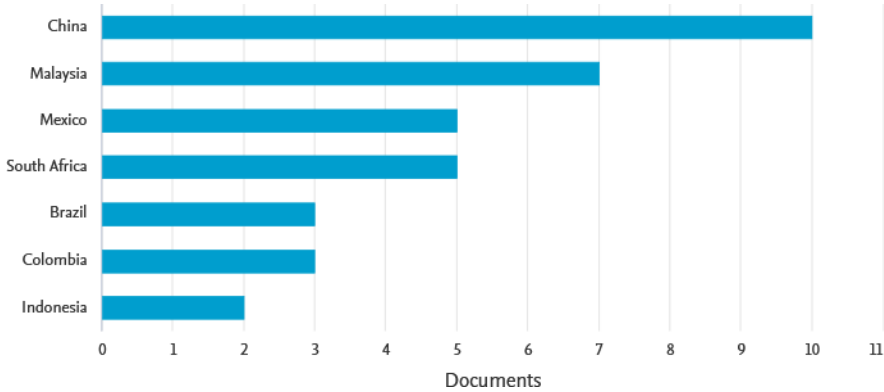
### 3.4 Where?

The inquiry of “where” unpacks the insights on the location context of USO studies and actual implementations. Through a scientometric statistical overview, we can comprehend that most of USO research was conducted in developed countries, such as the UK, Spain, Italy, and the US (Fig. 7). Overall, the UK produces the highest number of publications with 63 documents, followed by Spain (52), Italy (44), the US (35), Belgium (21), Germany (21), Netherlands (21), Sweden (21), Norway (15), and Canada (11). This number indicates that developed countries in the European region have a higher interest and capability in studying the USO phenomenon compared to other regions.



**Fig. 7.** Number of USO-related publications by country (developed countries).  
Generated by using the Scopus database.

In contrast, only a few USO studies came from developing countries (Fig. 8). In the context of developing countries, China produces the highest publication number (10 documents), followed by Malaysia (7), Mexico (5), South Africa (5), Brazil (3), Colombia (3), and Indonesia (2). This chart indicates that developing countries are less interested in studying the USO phenomenon or can be translated that they are less interested in developing USOs due to many limitations. This condition provides opportunities for researchers to explore the USO phenomenon in the context of developing countries that have different limitations compared to developed countries.



**Fig. 8.** Number of USO-Related Publications in Developing Countries.  
Generated by using the Scopus Database.

### 3.5 When?

The inquiry of “when” in this study unravels the time dimension of the USO concept and sub-topics emergence. The concept of USO was established in the "80s, starting with the concept of the academic entrepreneur [1] and entrepreneurial university [2]. The concept's popularity was boosted by enacting the Bayh-Dole Act (BDA) in the United States of America (US) in 1980. Afterward, USO became one of the research trajectories in academic entrepreneurship. This trajectory is then filled by various research sub-topics. Furthermore, the subtopics of USO can be visualized through scientometric analysis by using VOSviewer overlay depiction (Fig. 9). From this visualization; we can see some variations of topics, namely classic and saturated (depicted as big dark blue circles), classic yet less saturated (depicted as small dark blue circles), and emerging topics (depicted as small light green or yellow circles). Several topics that can be categorized as classic and saturated are USOs' creation, growth, development, and network. There are also classic topics (emerged in 2015), yet there is potential to be examined, such as synergistic effect and university research alliance. Lastly, the emerging topics that have potential for future research are (1) the relationship of scientists' or academics' job satisfaction to the USO formation and sustainability, (2) USO survival, (3) the connection between USOs, a technology holding companies (THCs), and parent universities, (4) influencing factors of the entrepreneurial intention of academics or USOs founders.

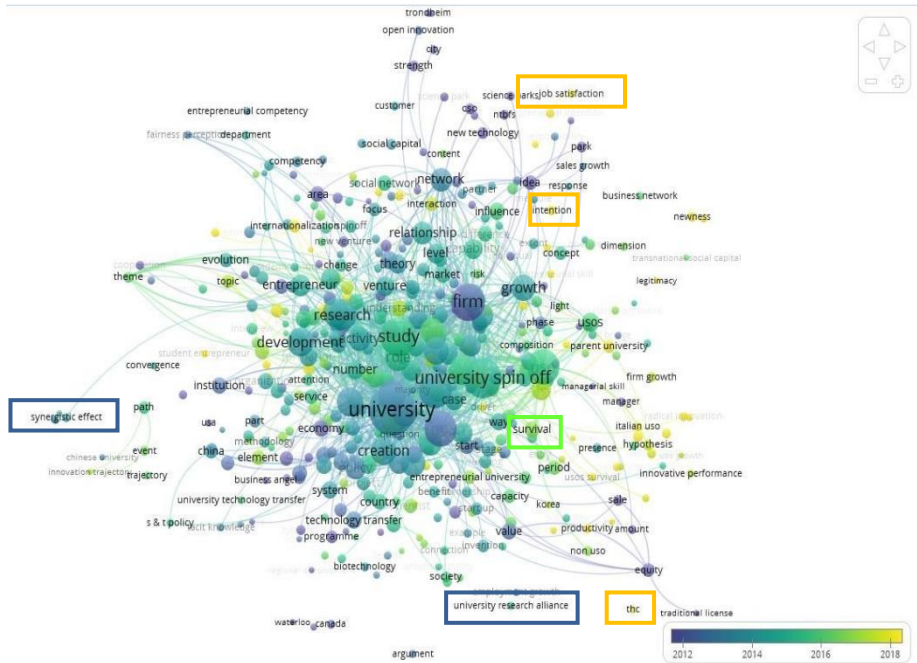


Fig. 9. Overlay visualization of USO-related text data analysis.

### 3.6 How?

"How" in this review explains the process of USO development that researchers theorized. Existing literature has discussed the processes, stages, and critical junctures during USO development. The notable concepts of USOs' development processes can be seen in Table 6. Vohora et al. [44] conceptualized that USO development has its critical junctures, including "opportunity recognition, entrepreneurial commitment, the threshold of credibility, and the threshold of sustainability." USOs must pass these four critical junctures to become self-sustained firms and grow bigger. Messina et al. [8] work enriches this concept; they proposed that during each juncture, USOs require different efforts, support, and treatment. Another notable concept is the process model for the entrepreneurial capability of USO emergence [50]. This model depicted four entrepreneurial capabilities necessary to develop USO, starting with "technology-market matching," "claiming and protecting the invention," "attracting and mentoring the founding team," and "strategic timing of firm formation." The model involves various actors, including scientist-entrepreneurs, lab members, university TLO, academic collaborators, experienced entrepreneurs, and venture capitalists (VCs).

Furthermore, Pattnaik and Pandey's work provides a more holistic model, translating the USO development process into four different stages, including building parent capabilities for a spin-off foundation, validating research results, disclosing the intellectual properties, and choosing between leasing the technology or establishing USOs [17]. This concept

holistically observes USOs in connection with their parents since the precursor phase of formation. Meanwhile, from a different perspective, Ndonzuau et al. [51] explain the process of USO development into four stages, namely generating viable ideas, transforming the ideas, creating a new firm, and creating value. This concept treats USOs almost similar to start-ups or businesses in general, yet neglects the peculiarity of USOs" characteristics born within the university ecosystem, which has strong ties with academic culture.

**Table 6.** USO's Development Processes.

<b>Processes</b>	<b>Source</b>
<p>“USO critical junctures: (1) opportunity recognition, (2) entrepreneurial commitment, (3) threshold of credibility, and (4) threshold of sustainability.”</p>	[8,44]
<p>Four entrepreneurial capabilities are necessary to develop USO, starting with “technology-market matching”, “claiming and protecting the invention,” “attracting and mentoring the founding team,” and “strategic timing of firm formation.”</p>	[50]
<p>“Stage 1, building university capabilities for the foundation of market viable technology spin-offs. Stage 2 testing and confirming research results. Stage 3: disclosing inventions and filing a patent(or not). Stage 4, leasing or building spin-off to generate social and economic value.”</p>	[17]
<p>There are four stages of the USO development process: (1) generating viable ideas, (2) transforming ideas into the process, (3) creating a new firm for exploitation, and (4) creating economic value.</p>	[51]

Based on the existing explanation, we organize the process into a more comprehensive framework that consists of four major stages and critical junctures (FIGURE 10). The stages are (1) the precursor phase, (2) the initiation phase, (3) the development phase, and (4) sustaining phase. Each phase contains several processes that are already mentioned in the existing literature. First, the USO development process starts with idea generation. Then, it passes the opportunity recognition juncture into the precursor phase that contains technology development and validation, invention protection, and technology-market matching processes. Second, after passing the entrepreneurial commitment juncture, the process continues to the initiation phase, which consists of team formation-mentoring and firm establishment processes. Third, when the firm passes the threshold of credibility juncture, it will enter the development phase that comprises value creation and market development processes. Lastly, USOs must pass the sustainability threshold to become self-sustained (or mature) firms.

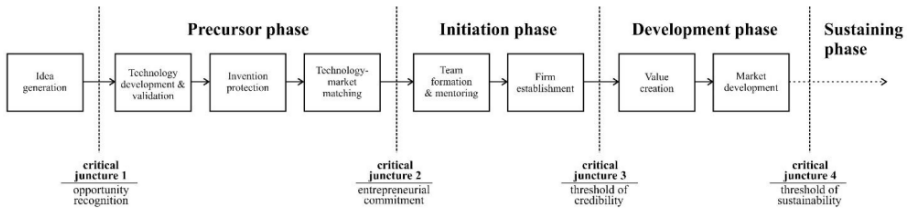


Fig. 10. USO Development Process Developed from [17,44,50,51].

## 4 Conclusion

USO has been acknowledged as an effective tool that can enhance the economy by commercializing R&D, diffusing innovations, enhancing productivity, and creating jobs [6–10]. As the USO concept is widely adopted, various issues arise. The notable ones are failing at the early stage and stunted growth [11–13]. Therefore, a deep understanding of the USO phenomenon is essential to address the problems for governments and scholars. Review papers are needed to track how far the conceptualization goes. Information regarding what still needs to be studied is essential for grant theory development.

By employing SLR and the scientometric approach, this paper produces an overarching depiction of USO in a framework of 5WIH. As a result, We summarized the concept of USO from our findings in Table 7. Overall, this review provides three theoretical contributions. Firstly, We propose a new definition of USO that builds from existing descriptions and gathers the factors that influence USO's development. This updated definition and factors can be applied widely and are helpful for contemporary contexts.

Table 7. Summary of USO concept.

Components	Description
What?	<ul style="list-style-type: none"> <li>• USO can be defined as a start-up that was initiated within the university and founded by academic team members, which has an intense attachment to the university through the technology commercialization process.</li> <li>• Internal factors of USOs' development: the ability to acquire external funding, inherited competencies, maintained linkages to parent, team variety, founders' knowledge and experience, firms' size, network (capability), and CEO managerial skills.</li> <li>• External factors of USOs' development: incubators' support, universities' research strength, proximity with the parent, VCs' fund, academic researchers' job dissatisfaction, connectedness to local resources, effective filtration, financial resources, industrial partnerships, involvement of external entities in the founding team, legislative instruments, cultural instruments, multiple actors involvement, public policy institutional framework, and the regional entrepreneurial ecosystem.</li> </ul>
Who?	<ul style="list-style-type: none"> <li>• Top five most productive authors in the USO literature: Rodeiro-Pazos, Fernandez-Lopez, Rodriguez-Gullas, Wright, and Rasmussen.</li> </ul>

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	<ul style="list-style-type: none"> <li>• Top six organizations that produced USO articles: Universidade de Santiago de Compostela, Universidade da Coruna, Nottingham University, Universiteit Gent, Delft University of Technology, and Imperial College.</li> <li>• Actors during early stage development of USOs: parent universities, researchers, TTOs, incubators, and THC.</li> <li>• Actors during later stage development of USOs: external market actors, investors (including VCs), and experienced entrepreneurs.</li> </ul>
Why?	<ul style="list-style-type: none"> <li>• Benefits of USO to its surroundings: enhancing regional innovation, enhancing the regional economy, creating jobs, and strengthening technology transfer and R&amp;D commercialization.</li> <li>• Issues and barriers in USO" development: prone to failure at the early stage, low market performance, unbalance between scientific and business orientations, influence from the university's ecosystem, lack of diversity in founders, and limited resources and capacity.</li> </ul>
Where?	<ul style="list-style-type: none"> <li>• Most USO studies and actualizations are conducted in developed countries, such as the UK, Spain, Italy, the US, Belgium, Germany, Netherlands, Sweden, Norway, and Canada.</li> <li>• Only a few USO studies and actualizations were conducted in developing countries, such as China, Malaysia, Mexico, South Africa, Brazil, Colombia, and Indonesia.</li> </ul>
When?	<ul style="list-style-type: none"> <li>• The concept of USO was established in the 80s and started with the concept of academic entrepreneurship and the entrepreneurial university.</li> <li>• Classic and saturated topics of USO: USOs" creation, growth, development, and network.</li> <li>• Classic yet potential topics of USO: synergistic effect and university research alliance.</li> <li>• Emerging topics of USO: (1) the relation of scientists" or academics" job satisfaction to the USO formation and sustainability, (2) USO survival, (3) the connection between USOs, technology holding companies (THCs), and parent universities, (4) influencing factors of the entrepreneurial intention of academics or USOs founders.</li> </ul>
How?	<ul style="list-style-type: none"> <li>• The development process of USOs can be described into four phases: (1) the precursor phase, (2) the initiation phase, (3) the development phase, and (4) sustaining phase.</li> <li>• Precursor phase: technology development and validation, invention protection, and technology-market matching.</li> <li>• Initiation phase: team formation-mentoring and firm establishment.</li> <li>• Development phase: value creation and market development.</li> <li>• Sustainable phase: needs to be explored.</li> <li>• Each phase's transition must pass critical junctures, including: "opportunity recognition, entrepreneurial commitment, a threshold of credibility, and threshold of sustainability."</li> </ul>

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Secondly, We extend the work of Thomas et al. [50], Pattnaik and Pandey [17], Vohora [44], and Ndonzuau et al. [51] and provide a comprehensive framework for the USO development process. Thirdly, this review highlights four potential topics for future research: (1) the relation of scientists" or academics" job satisfaction to the USO formation and sustainability, (2) USO survival, (3) the connection between USOs, a technology holding companies (THCs), and parent universities, (4) influencing factors of the entrepreneurial intention of academics or USOs founders. There is also a scarcity of USO conceptualization in the developing countries" context, which has the potential to be explored. Furthermore, as our practical contribution, the summary of the USO concept can be helpful for new scholars and USO stakeholders to understand the phenomenon in a nutshell and build on it. Meanwhile, the limitation of this review is the single database utilized for SLR and scientometric analysis. Thus, employing multiple databases besides Scopus will enrich our work.

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