

Building a theory-driven model of the spin-off creation process: A Social Information Process perspective

ABSTRACT

This work contributes to the field of Academic Entrepreneurship by providing a theory-driven explanation of spin-off creation, conceptualized as a process that includes the following phases: opportunity identification, entrepreneurial intentions and spin-off creation. Illuminated by the Social Information Processing Theory, it looks at the role of individual and organizational factors in the process of spin-off creation. Based on a Systematic Literature Review- we highlight how each process' phase has been studied and which individual and organizational factors are more relevant in influencing the spin-off creation process. Drawing from our results, we elaborate a conceptual framework that proposes a research agenda for the mechanisms connecting individual and organizational issues in the process of spin-off creation.

Keywords: Academic Entrepreneurship, Spin-off creation, entrepreneurial process, Social Information Processing Theory

INTRODUCTION

Academic Entrepreneurship is the founding of a firm, academic spin-offs, created to commercialize a patented invention or non-patented expertise (Shane, 2004), and is a widely accepted strategic tool for economic and social growth (Audretsch, 2012; Bolzani, Munari, Rasmussen & Toschi, 2020; Mariani, Carlesi & Scarfò, 2017). Indeed, academic spin-offs have a determinant impact on the area in which they operate, from both an economic and social perspective (Vincett, 2010; Zucker, Darby & Brewer 1994). They strengthen the impact of intellectual capital on local economic growth (Mariani et al., 2017). Furthermore, it has been demonstrated that entrepreneurial behaviour positively affects scientists' research performance (Van Looy, Ranga, Callaert, Debackere & Zimmerman, 2004). In conclusion, creating an academic spin-off positively affects the local area outside the university and researchers' performance.

The literature on academic entrepreneurship is quite fragmented (Skute, 2019). There is a lack of research that looks at academic entrepreneurship phenomenon with a holistic perspective (Müller Wieland, Muschner & Schraudner 2019; Wood, 2011), and an absence of a theory-driven model for the spin-off creation process (Nicolaou & Birley, 2003; Rasmussen, Mosey & Wright, 2011). This lack makes it very difficult to accumulate knowledge about how the process mentioned above unfolds (Mrozowski, 2020; Wood, 2011).

We aim to fulfil this gap by performing a Systematic Literature Review (Tranfield, Denyer & Smart, 2003) that rationalizes extant literature on academic spin-off creation through a process lens rooted in the entrepreneurial learning process. This work builds on a processual model of entrepreneurship as the succession of three phases, namely opportunity identification, entrepreneurial intentions and spin-off creation. The model mentioned above is commonly accepted in the literature (Gielnik & Wang, 2018). Furthermore, informed by the Social Information Processing Theory, we enhance our understanding of the role of individual and organizational dimensions in the process. According to this theory, individuals' action results from the interaction between individuals and the

organizational context they are embedded in. Since spin-off creation is a behavior that occurs within an existing organizational setting like the university, the role of the organizational context in individual action cannot be denied nor underestimated. Building on the theory mentioned above, we argue that both the organizational and the individual dimensions interact and impact the spin-off creation process. This work allowed us to address the following research question:

How does the spin-off creation process unfold? And how do organizational and individual factors interact with all the stages of the within the university?

The contribution of this research is twofold. First, we aim to elaborate a comprehensive framework of the extant literature about the spin-off creation process and the role of organizational or individual factors on each phase of the spin-off process. Moreover, we provide a research agenda for mechanisms (Post, Sarala, Gatrell & Prescott 2020), that will explain the mutual relationship among the phases of spin-off creation and the organizational and the individual factors.

The paper is organized as follows. At first, we explain the key concepts representing the theoretical pillars of the contribution; after that, we produce an accurate description of the research method's choices and the adopted procedure. The results illustrate a descriptive analysis to expose the main characteristics of the articles in the review; a thematic analysis to classify the variables around the main concepts, and a narrative synthesis to describe how each phase of the spin-off creation process has been studied. We conclude the work with a research agenda on future research questions about the spin-off creation process and the role of individual and organizational dimensions.

THEORETICAL BACKGROUND.

The spin-offs' role is widely recognized in the studies on Academic Entrepreneurship (Autio, 1997; Hayter, Nelson, Zayed & O' Connor, 2018; Wright, Siegel & Mustar, 2017). Even if other forms of commercialization have attracted scholars' attention (Bolzani et al., 2020; Davey & Galan Muros, 2020), it is clear that this form of engagement has a determinant impact on economic growth (Vincett, 2010).

Traditionally, the only actors involved in Academic Entrepreneurship were academics and post-docs (Siegel & Wright, 2015). Recently, the concept of Academic Entrepreneurship has been extended to include not only scientists but also technicians and students (Siegel & Wright, 2015). Indeed, recent studies in Academic Entrepreneurship need to take in consideration everything that can generate benefits for University ecosystems (Bolzani et al., 2020). For this reason, it cannot be excluded important actors, such as students' start-ups (Shah & Pahnke, 2014) or students involved in entrepreneurship education programs (Lackéus & Middleton, 2015).

Spin-off creation is widely accepted as a process (Rasmussen, 2011). However, few studies have investigated the spin-off creation as a process by mainly using an atheoretical approach (Nicolaou & Birley, 2003). To overcome this gap, we adopt the theoretical lens of entrepreneurship as a process and we examine existing studies on academic spin-off creation by adopting a process lens that we explain in the next paragraph.

Academic entrepreneurship as a process.

It is commonly accepted that entrepreneurship should be studied as the process of creating an organization (Gartner, 1988), and it cannot be otherwise in the academic setting. Instead, the investigation of spin-offs should be approached as a multi-level process, a succession of steps whose evolution implies not only the individual dimension but also contextual determinants (Friedman & Silberman, 2003; Mustar, Renault, Colombo, Piva, Fontes, Lockett, Wright, Clarysse & Moray, 2006). Inspired by extant studies on entrepreneurial process (e.g., Gielnik & Wang, 2018; Hui Chen, Kuen Hung & Cheng Yi, 2014), we identify the process of spin-off creation as the succession of three main steps: the identification of the opportunity, the formation of the entrepreneurial intentions and the foundation of an academic spin-off.

In the following paragraphs, we provide a short description of each phase of the process mentioned above.

Opportunity identification.

The entrepreneurial opportunity occurs whether new goods or services are launched in the market and sold with a profit (Shane & Venkataraman, 2000). The identification of the opportunity is widely accepted as the starting point of entrepreneurship (Gielnik & Wang, 2018; Shane & Venkataraman, 2000), even if there is still ambiguity about the concept's nature. Davidsson (2015) highlights a substantial lack of clarity around the construct of opportunity. Some scholars argue that opportunity is discovered; others think it is created by the entrepreneur (Alvarez & Barney, 2007; Wood & McKinley, 2018). Generally speaking, it can be stated that opportunity is an umbrella-construct able to unify the apparently contrasting theories related to identification or creation (Wood & McKinley, 2018). Its identification is the first step towards creating a new venture (Shane & Venkataraman, 2000). For this reason, the body of knowledge about the opportunity identification has considerably grown in the last years (Davidsson, 2015), making it a central step in the entrepreneurial process.

Entrepreneurial Intentions.

The entrepreneurial intention is defined as a state of mind which leads to entrepreneurial action (Bird, 1988). The concept of intention derives from social psychology and has found fertile ground in entrepreneurship (Liñán & Fayolle, 2015). Recent studies show its role as a fundamental stage in the entrepreneurial process (Krueger, Reilly & Carsrud, 2000; Krueger, 2017). Different models have been adopted to explain how the intention forms, even if there is some compatibility between alternative theories (Liñán & Fayolle, 2015). Two models have been commonly adopted: the Ajzen's Theory of Planned Behavior (Ajzen, 1991), which has been first applied to predict entrepreneurial intentions by Krueger & Carsrud (1993), and Shapero's Entrepreneurial Event elaborated in 1982 (Shapero & Sokol, 1982).

Spin-off Creation.

An academic spin-off is a new venture created to commercialize knowledge or new technology developed within a University (Klofsten & Jones Evans, 2000; Pirnay, Surlemont & Nlemvo, 2003).

A classical definition of spin-off associates the new company to a new technology or a patent (Mcqueen & Wallmark, 1982). However, it is now accepted that a scientist or a student can create a new venture to exploit specific know-how generated during their academic activity (Pirnay et al., 2003; Rappert, Webster & Charles 1999). The extant literature on academic entrepreneurship lacks a comprehensive and theory-driven framework of the academic setting's entrepreneurial process.

Social information processing theory.

The entrepreneurial phenomenon is nested in social processes (Gartner, Bigliardi & Passaro, 2003); in this sense, the social and organizational context's role cannot be ignored. Considering this, we observe the phenomenon with the theoretical lens of Social Information Processing Theory, which considers the interactions between organizational and individual factors (Salancik & Pfeffer, 1978; Zalesny & Ford, 1990). This theory's central intuition is that people's work attitudes and behaviors are affected by the context and result from an individual's background and characteristics. Indeed, it assumes that a job's features are not objective, but the individuals artificially construct them. So, the work environment comes to be the result of an interaction between individual factors and the specific organizational environment.

We build on the theoretical pillars described above to address the following research question:

How does the spin-off creation process unfold? And how do organizational and individual factors interact with all the stages of the entrepreneurial process within the university?

METHOD.

Literature review.

A literature review is a useful tool to collect what is already known (Ginsberg, 1985; Skute, 2019) in a fragmented and complex field, like academic entrepreneurship. It is crucial to propose a holistic understanding of the phenomenon (Hoon & Baluch, 2019; Tranfield et al., 2003). We adopted a conceptual structure (Torraco, 2016), which means that we organized the review around the three

phases of the entrepreneurial process, namely opportunity identification, entrepreneurial intentions and spin-off creation (Gielnik & Wang, 2018).

Systematic Literature Review.

There is no agreement among scholars about the terminology concerning literature reviews (Gough, 2017; Gough, Thomas & Oliver, 2012), even though it is accepted that review articles can be more or less systematic (Snyder, 2019). Systematic Literature Reviews are becoming quite common in management (Crossan & Apaydin, 2010; Hanelt, Bohnsack, Marz & Antunes Marante, 2020) and entrepreneurship (Champenois, Lefebvre & Ronteau 2020; Stephan, 2017). Furthermore, this type of review is useful when scholars need to analyse a process like entrepreneurship (Briner & Denyer, 2012). Therefore, we opted for a Systematic Literature Review to find only the specific contributions needed to address our specific research question (Tranfield et al., 2003). Indeed, this method is useful for selecting only the studies that can add something to comprehend the specific phenomenon like the spin-off creation process (Briner & Denyer, 2012; Nightingale, 2009; Snyder, 2019).

PROCEDURE.

Following Tranfield et al. (2003), we articulated our Systematic Literature Review procedure along with the steps below: selecting the databases, research query, quality assessment, data extraction, and analysis of the results.

Database selection.

We opted for ISI-Wos essentially because of its comprehensiveness (Crisan, Salante, Beleiu, Bondean & Banduchi 2019; Hausberg & Korreck, 2020). Furthermore, we needed to understand how each construct has been studied in academic entrepreneurship without any limitation related to the period; this source was the more suitable because it covers the broadest period compared to the other databases (Falagas, Pitsouni, Malietzis & Pappas, 2008). It has to be mentioned that this database is widely used for Systematic Literature Review in entrepreneurship (Miranda, Chamorro & Rubio, 2018; Skute, 2019; Stephan, 2017; Wagenschwanz, 2020).

Research query.

As Tranfield et al. (2003) proposed and as already done in other similar contributions in entrepreneurship (Stephan, 2017), the following step is selecting the keywords. We identified three different combinations of keywords, corresponding to the entrepreneurial process's three main phases (Gielnik & Wang, 2018).

The decision about the keywords was critical because of the historical ambiguity affecting the field on the definition of entrepreneurial behaviour (Gartner, 1988) and the disputes about what should be considered entrepreneurial behaviour in academic entrepreneurship (Ndonzuau, Pirnay & Surlemont 2002; Perkman, Salandra, Tartari, McKelvey & Hughes, 2019).

Concerning opportunity identification, we used as keywords '*opportunity recognition*' OR '*opportunity identification*', building on the assumption that it is a stable construct in entrepreneurship (Shane & Venkataraman, 2000; Short, Ketchen, Shook & Duane Ireland, 2010). Moreover, opportunity identification is a concept that may comprise both opportunity discovery and opportunity creation (Mickiewicz & Kaasa, 2020).

For entrepreneurial intentions, the adopted keywords were '*entrepreneurial intent**'. Also, entrepreneurial intentions are a stable construct, and the combination of keywords have been already used in previous reviews (Liñán & Fayolle, 2015). The two strings of keywords were combined with '*academic entrepreneurship*' OR '*acedemi spin*' OR '*universit spin*' OR '*academi commercialization*' OR '*universit commercialization*', following what has been done in previous contributions (Skute, 2019). The choice of the keywords above embraced a broad definition of academic entrepreneurship; this choice has its roots in the necessity to avoid the risk of omitting relevant works about opportunity identification and entrepreneurial intentions.

A different perspective has been adopted for the keywords related to spin-off creation, combining two different strings of keywords. The formula chosen by Skute (2019) has been modified to consider only the keywords coherent with the narrow definition of Academic Entrepreneurship: '*academic entrepreneurship* OR *entrepren academi*'. They were combined with '*entrepreneurial*

behavior OR *Entrepreneurial action* OR *spin creation* OR *spin foundation*'. In this case, it was essential to focus on a specific form of entrepreneurial behavior, explicitly creating an academic spin-off (Siegel & Wright, 2015).

Search.

The search was performed in October 2020. Only articles published in peer-reviewed journals and written in English have been taken into consideration. The first search returned 159 articles for opportunity identification, 759 articles for entrepreneurial intentions and 292 for spin-off creation. A synthetic view of the search performed can be found in Table 1.

Insert Table 1 about here

Quality assessment.

A qualitative assessment was performed to the selected articles (Eveleens & Rijnsoever, 2017; Tranfield et al., 2003), based on a specific eligibility criterion: we included only the contributions that investigated the individual or organizational macro-dimensions – or both – on one stage of the entrepreneurial process. To reach the purpose, we performed a staged review: the titles and the abstracts of each article have been read (Torraco, 2016). After that, 8 articles have been selected for opportunity identification, 47 for entrepreneurial intentions, and 27 ones for spin-off creation.

Data extraction.

In the following step, we extracted the data from the papers (Tranfield et al., 2003). For doing this, we built a simple matrix (Torraco, 2016; Webster & Watson, 2002). Each phase of the spin-off creation process - opportunity identification, entrepreneurial intentions and spin-off creation - have been put in the horizontal axis at the head of the table, while the variables have been placed in the vertical axis on the left of the table. The matrix is available under request.

Analysis of the results.

In order to synthesize the extant literature, we proceeded with an integrative review, and we developed the analysis in three steps: a *Descriptive analysis*, that describes the characteristics of the papers included; a *Thematic analysis*, that examines the conceptual dimensions used to address the topic; and *Narrative synthesis*, that analyses how each phase (opportunity identification, entrepreneurial intentions and spin-off creation) has been studied and which are the most studied variables.

While the descriptive analysis gives the reader a general idea about the scientific area of academic entrepreneurship (Tranfield et al., 2003), the thematic analysis offers a classification of all the variables used to investigate the individual or organizational dimensions. The narrative analysis aims to understand how each stage of the entrepreneurial process has been investigated, and the organizational and individual variables studied the most in relation to each stage. Building on the results, we developed a research agenda, which makes our review also generative. It means that this work goes beyond a mere synthesis of the extant literature since it proposes new avenues for future research on spin-off creation process (Post et al., 2020). Considering the extant body of knowledge about the spin-off creation process, we provide a research agenda to address future research (Hoon & Baluch, 2019). Specifically, we shed light on the mechanisms (Hedström & Wennberg, 2017) that should be investigated to develop a theoretical explanation of the spin-off creation process.

RESULTS.

Descriptive analysis.

Over a total of 82 articles, 84 % of the contributions choose a quantitative design, whereas 16% opt for a qualitative approach. Furthermore, 18% of the studies perform a longitudinal analysis, while others opt for a cross-sectional one.

As far as concerns the sample, 34% of the review's studies bases its analysis on students, 60% on scientists, 1% uses mixed samples. Finally, 5% adopts a purely organizational perspective, focusing on the number of spin-offs created.

The last years have seen an increasing interest in the field. This trend has been confirmed by existing bibliometric analyses focused on the recent period (Secundo, Rippa & Cerchione, 2020; Skute, 2019).

Over the total of 47 scientific journals publishing research in academic entrepreneurship, only three of them gather around 25% of all the contributions: namely *Journal of Technology Transfer* (13%), *Research Policy* (8,5%), and *Small Business Economics* (4,5%).

Thematic Analysis.

We firstly classified the variables in two different macro-dimensions: individual and organizational. The role of these macro-dimensions has been considered in existing studies on entrepreneurial behavior within existing organizations (Hornsby, Naffziger, Kuratko & Montagno, 1993). Individual factors are those personal and psychological characteristics which identify the single researcher or student. Organizational variables are all the tangible and intangible characteristics that can influence the individual behavior and attitudes within an established organization (Lu, Leung & Tramain Koch, 2006).

Insert Figure 1 about here

In the following paragraph, we describe each dimension, providing an overview of the variables which captured scholars' attention the most. In Figure 1, we provide an exhaustive list of all the individual and organizational dimensions that scholars investigated on spin-off creation.

Organizational dimensions. The first dimension contains the provision of infrastructure and financing from the university. Within this group, three contributions highlight science parks' role

(Fernandez Alles, Camelo Ordaz & Franco Leal, 2015; Rasmussen, 2011), while seven focus on the academic incubators (Feola, Fesci, Botti & Parente, 2019; Fini et al., 2009). It emerges that the presence of the infrastructure mentioned above has been often considered in combination with others, such as the access to laboratories (Ndonzuau et al., 2002) and the presence of a patent office (Feola et al., 2019). Another aspect that attracted scholars' attention is the technology transfer office: precisely, fifteen works mention this specific infrastructure. Different aspects have been considered, from its mere presence (Clarysse, Tartari & Salter, 2011; Feola et al., 2019) to the provided support (Parmentola & Ferretti, 2018; Rasmussen & Wright, 2015). Less attention has been paid to the role of start-up competitions (Nosella & Grimaldi, 2009) and the provision of financial and non-financial resources for the creation of research-based ventures (Li & Zhang, 2020; Ndonzuau et al., 2002).

Many articles - precisely 23 - are included in the second dimension, focused on Entrepreneurial Education's role on the spin-off creation process (Dickel, Kleeman & Kanti Bose 2019; Müller & Parzych, 2018; Urban & Chantson, 2019). The majority of the studies have investigated the impact of entrepreneurship education on entrepreneurial intentions, both as direct (Müller & Parzych, 2018) and mediated predictor (Urban & Chantson, 2019). Only a few contributions have considered the impact on the other entrepreneurship phases (Muscio & Ramaciotti, 2019; Puni, Anlesinya, Dzigbordi & Korsorku, 2018). Furthermore, extant literature paid little attention to specific forms of education, such as curricular and extracurricular activities or the availability of practical entrepreneurship courses (Arranz, Ubierna, Arroyabe, Perez & Fedez De Arroyabe 2017; Sansone, Battaglia, Landoni & Paolucci, 2019). The variables in this dimension bring out different perspectives for the analysis of the impact of entrepreneurship education: some authors consider the education as an enabler for entrepreneurship in academia (Bergmann, Geissler, Hundt & Grave, 2018; Fernández Pérez, Montes Merino, Rodriguez Ariza & Alonso Galicia, 2019; Urban & Chantson, 2019), others consider entrepreneurship education as a form of support provided by universities (Mustafa, Hernandez, Mahon & Chee, 2016; Saeed, Yousafzai, Yani De Soriano & Muffatto, 2015; Trivedi, 2016; Zamrudi & Yulianti, 2020).

Another dimension comprises the variables describing the university's characteristics, which delineate the University context in which academic entrepreneurs act. The variables in this dimension are quite heterogeneous and different from each other. There are more general variables like the productivity in terms of patents and publication, the funds provided for research (Jung & Kim, 2018), the university reputation at international level (Fini, Grimaldi, Santoni & Sobrero, 2011), the size (Fini et al., 2009) or the composition of the governance (Meoli, Paleari & Vismara, 2019). However, also factors which address specific features of the university have been considered. Examples are the propensity to have relations with external actors, the tendency to collaborate with industry (Foo, Knockaert, Chan & Erikson, 2016; Muscio & Ramaciotti, 2019; Rasmussen, 2011), or the regulations about licencing and spin-offs (Fini et al., 2011). All the factors above have their roots in the recent interest attributed to the context in the study of entrepreneurship in academia (Bercovitz & Felman, 2008; Zhao, Wei, Chen & Yien 2020). It has to be mentioned the contribution by Van Looy, Ranga, Callaert, Debackere & Zimmerman (2011), which hypothesised a relationship between research productivity and spin-off activity at University level.

The following dimension comprises the entrepreneurial culture and climate. Like the previous one, it includes a heterogeneous group of variables united by the concept of organizational culture (Schein, 1990). The concept is here defined as the set of factors that unite the members of a given organization (Tierney, 1988). Most of the variables are investigated in their relationship with entrepreneurial intentions and spin-off creation (Klingbeil, Semrau, Ebers & Wilhelm 2019; Parmentola & Ferretti, 2018; Urban & Chantson, 2019). One of the articles in this group relates the university context, both with opportunity identification and entrepreneurial intentions.

The next dimension assembles all the incentives and facilities. They constitute the university reward system, identified as an entrepreneurial university's internal factors (Guerrero & Urbano, 2012). This group includes a short number of variables, and the contribution investigates only the relationship with entrepreneurial intentions and spin-off creation (Guerrero & Urbano, 2014; Li &

Zhang, 2020; Marzocchi, Kitagawa & Sanchez Barrioluengo, 2019). None of the contributions shed light on the impact of the university reward system on opportunity identification.

Another organizational dimension is the support for entrepreneurship provided by universities. This concept is quite ambiguous, also because several different forms of support have been taken into consideration. To contrast ambiguity, we create an appropriate dimension for this concept. It has to be pointed out that the positive relationship between entrepreneurial support provided by universities and their members' entrepreneurial activity has been confirmed in more than one empirical study (Fini et al., 2009; Todorovic, McNaughton & Guild, 2011). The variables are quite heterogeneous since support is operationalized in different ways. Indeed, three different scales have been considered for measuring support. The first has been developed by Kraaijenbrink, Groen & Bos, (2010) and it is the most adopted (Saeed et al., 2015; Shi, Yao & Wu al., 2019; Wegner, Thomas, Texeira & Maehler, 2019). It considers three different forms of perceived entrepreneurial support: educational, concept development and business development support. It is essential to highlight that this form of support has been included in the group of entrepreneurship education items for coherence needs. Another scale has been developed by Franke & Lüthje (2004) and includes support for the initiation, support for the development and active support. The last one has been developed ex novo by Trivedi (2016) and consists of targeted cognitive and non-cognitive support. Another interesting point is that most of the works investigate the relation between university support and entrepreneurial intentions (Laudano, Zollo, Ciappei & Zampi, 2018; Wegner et al., 2019; Zamrudi & Yulianti, 2020). Only a little portion of contributions focused on the relationship between support and the actual creation of an academic spin-off (Fini et al., 2009; Meoli & Vismara, 2016).

Another dimension concerns the limitation and constraints perceived mainly by scholars in their entrepreneurial path. The variables' nature is quite heterogeneous, going from professional and organizational limitations (Lee & Wong, 2004) to lack of resources (Neves & Franco, 2018).

Part of the organizational macro-dimension is the social factor, whose effect on individuals' attitudes and behaviour within organizations has been widely emphasized by the Social Information

Processing Theory (Salancik & Pfeffer, 1978). It is also coherent with the assumption that the process that leads to the introduction of new products or services implies interactions with other actors. So, it needs consensus by some people and commitment by others (Dimov, 2018). In this group stand out the variables related to the effect of peers (Bergmann, 2017; Moog, Wegner, Houweling & Backes Gellner, 2015), of networks (Urban & Chantson, 2019) and role models (Huyghe & Knockaert, 2015; Prodan & Drnovsek, 2010).

Individual dimensions. We identified two factors: psychological and demographic factors. The first dimension's variables are widely accepted to be determinant in entrepreneurship studies (Frese & Gielnik, 2014). Entrepreneurial self-Efficacy (Mcgee, Peterson, Mueller & Sequeira, 2009) is one of the most investigated variables. Twelve articles examine its role in the spin-off process, mainly related to entrepreneurial intentions (Huyghe & Knockaert, 2015; Ju & Zhou, 2020; Prodan & Drnovsek, 2010; Wegner et al., 2019). Most of the contributions have considered the construct as a mediator (Shi et al., 2019; Wegner et al., 2019; Zamrudi & Yulianti, 2020) of entrepreneurial intentions, but also as moderator (Ju & Zhou, 2020) or direct predictor (Prodan & Drnovsek, 2010). Moreover, many contributions – precisely 16 - adopt the intentional model of Theory of Planned Behavior (Gieure, Mar Benavides Espinosa & Roig Dobòn, 2019; Trivedi, 2016) or Entrepreneurial Event (Dickel et al., 2019; Li & Zhang, 2020). Few contributions consider other factors, such as personality (Mustafa et al., 2016) or regulatory focus (Foo et al., 2016; Johnson, Monsen & Mackenzie, 2017).

The second individual factor includes all the variables describing demographic characteristics and background factors, and it contains several variables. One of the most considered is gender - 5 articles. Its role has been considered only in the studies on entrepreneurial intentions, even if they do it with heterogeneous approaches. As an example, we cite Miranda, Chamorro and Rubio (2017), which speculates on the differences in entrepreneurial intentions determinants, while Roy and Das

(2020) investigates this variable's mediating role. Several background factors have been considered, but none of them has captured the interest of more than two studies.

Overall, we obtained a list of thirteen most common variables, seven belonging to the organizational macro-dimension, and six belonging to the individual macro-dimension. All the variables mentioned above are listed in Figure 2.

Insert Figure 2 about here

Narrative synthesis.

In the paragraph below we expose a narrative synthesis on each phase of the process of spin-off creation, starting with a brief overview on how it has been studied and then focusing on the most considered individual and organizational variables in relation to that specific phase.

Opportunity identification. The contributions that investigate opportunity identification are not many and quite heterogeneous. Four of the eight articles study a sample of scientists, whereas others focus on students. The vast majority (75%) adopt a quantitative and cross-sectional research design to investigate the phenomenon, while the others consider a longitudinal and qualitative approach.

In the context of spin-off creation, the opportunity identification has been theorized both as a variable and as a process (Hannibal, Evers & Servais, 2016; Vohora, Wright & Lockett, 2004). Specifically, it has been defined as a dimension of entrepreneurship education (Puni et al., 2018) or a specific skill for academic entrepreneurs (Clarysse et al., 2011; Ferrero & Bessièrè, 2016; Oftedal, Iakovleva & Foss 2017). It is needed to highlight that some studies approach it as a process

The ambiguous relationship between opportunity identification and entrepreneurial intentions should be noted. Trying to clarify this aspect, Oftedal et al. (2017) investigates the impact of university Context – expressed as regulative, normative and cognitive structures - both on

entrepreneurial intentions and opportunity identification. Regulative structure refers to the regulations to foster entrepreneurship within the university, normative values and norms accepted by university members, while the last is about common knowledge. They have only found a positive and robust effect of normative dimension on opportunity identification and entrepreneurial intentions, while there was no significant cognitive structure effect. Another interesting approach is adopted by Hassan, Saleem, Anwar & Abid Hussain (2020), that speculates on the impact of opportunity identification on entrepreneurial intentions. In this case, the former has been studied as an independent variable, while the latter as the dependent one. Also, the moderating effect of entrepreneurship education is considered.

It has to be highlighted that there is heterogeneity also in the scales adopted for measuring opportunity identification. Hassan et al. (2020) adopts the five-item scale developed by Ozgen & Baron (2007), while Oftedal et al. (2017) develops a new scale building on extant literature (Iakovleva & Kolvereid, 2011).

The only individual factor included in the study of opportunity identification is Entrepreneurial Self-Efficacy (Hassan et al., 2020), while no attention has been paid to demographic factors.

The ambiguous relation between entrepreneurial intentions and opportunity identification, combined with a scarce consideration of the concept of opportunity in academic entrepreneurship, emerges clearly from our study. Furthermore, it is still unclear how a research outcome can become a potential opportunity to exploit in spin-off creation (Hannibal et al., 2016; Rasmussen, 2011).

Entrepreneurial Intentions. Works that investigate the entrepreneurial intentions adopt a quantitative approach with a cross-sectional analysis based on intentional models such as Theory of Planned Behavior (Ajzen, 1991) or Shapero's Entrepreneurial Event (Shapero & Sokol, 1982). The majority of contributions use the TPB determinants (Gieure et al., 2019; Guerrero, Urbano & Gajòn, 2020; Trivedi, 2016), often combined with other individual variables. Specifically, entrepreneurial

self-Efficacy (Zamrudi & Yulianti, 2020), social identity (Goethner, Obschonka, Silbereisen & Cantner, 2012) and personality (Obschonka, Silbereisen & Schmit Rodermund 2010). The contribution by Karimi, Biemans, Lans, Chizari & Mulder (2016), that theorizes the perception of opportunity identification, defined as the subjective perception to have identified an opportunity, as a predictor of entrepreneurial intentions. As far as concerns the sample, 51% of the articles study the scientists, while 47% analyse students. Only one contribution considers a sample of students and scientists.

Several organizational variables of different nature have been used. An example is the different operationalizations of support used: structural and relational support (Zamrudi & Yulianti, 2020), targeted cognitive and non-cognitive support (Trivedi, 2016). Another crucial organizational variable to be mentioned is the effect of peers and its impact on forming the intentions (Bergmann et al., 2018; Moog et al., 2015). In some cases, peers' lack of support is considered an obstacle in the entrepreneurial process (Müller Wieland et al., 2019).

Spin-off creation. A large part of the contributions – namely 78% - focuses on the outcome of the process and studies a sample of scientists. The others adopt a purely organizational approach, concentrating on the number of academic spin-offs created at the university level; no one investigates students' behavior. As far as concerns research design, 59% of articles opt for a quantitative approach, while 37% for a qualitative one. Concluding, there is an almost equal distribution between the type of analysis: 56% have adopted a cross-sectional analysis, the others a longitudinal one.

The first element to be highlighted is the high consideration about the infrastructures provided by the university, such as the role played by the academic incubator (Berbegal Mirabent & Ribeiro Soriano, 2015; Fernandez Alles et al., 2015; Rasmussen, 2011), the access to laboratories and other infrastructures (Fini et al., 2009; Ndonzuau et al., 2002), as well as the importance of technology transfer office (Clarysse et al., 2011; Fini et al., 2011) and the specific support provided by it (Parmentola & Ferretti, 2018; Rasmussen & Wright, 2015). The same studies show an interest in

science parks (Berbegal Mirabent & Ribeiro Soriano, 2015; Fernandez Alles et al., 2015). Great importance has been attributed to a heterogeneous group of university characteristics and different forms of university incentives. Good examples are the external relations of the university (Müller-Wieland et al., 2019; Muscio & Ramaciotti, 2019; Rasmussen & Wright, 2015), the University regulations about spin-offs and patenting (Fini et al., 2011; Muscio et al., 2016; Ndonzuau et al., 2002), as well as policies supporting entrepreneurship (Muscio & Ramaciotti, 2019) and specific incentives for entrepreneurship (Parmentola & Ferretti, 2018; Rasmussen & Wright, 2015).

As far as concerns individual macro-dimension, a significant portion of the contributions builds on motivations (Fini et al., 2009; Galati, Bigliardi, Passaro & Quinto, 2020; Rizzo, 2015). Only Ferrero & Bessièrè (2016) emphasises entrepreneurial self-Efficacy as a psychological trait of academic entrepreneurs. The other individual items are demographic variables such as gender and age (Dottore & Kassicieh, 2017), entrepreneurial experience (Clarysse et al., 2011) and previous experience (Parmentola & Ferretti, 2018; Rasmussen & Wright, 2015).

A significant insight towards a multi-level framework is that of Fini et al. (2009), which has paid attention to the external environment and individual motivations. On the other hand, Parmentola and Ferretti (2018) have found a combination of the university's atmosphere and scientific excellence and previous experience. The variables above have also been found with some specific characteristics of the university such as the collaboration with industry and the department level's tendency to include searching commercial opportunities as part of the research activity (Rasmussen & Wright, 2015).

CONCEPTUAL FRAMEWORK

Considering what is known from the extant body of knowledge, there is insufficient theoretical support to argue a linear unfolding of the process. Because of it, we formulate a circular model. Furthermore, we theorize the impact of the most studied organizational and individual variables on

the spin-off process. Figure 3 represents a graphic synthesis of the conceptual model we obtained after the thematic analysis and the narrative synthesis.

Insert Figure 3 about here

RESEARCH AGENDA.

This work's contribution to theory development is a research agenda for mechanisms (Post et al., 2020). Mechanisms are a series of causal or intentional ties between a phenomenon and the factors that concur to its explanation (Hedström & Wennberg, 2017). We argue that this approach is also relevant in entrepreneurship studies since they can provide appropriate theory-driven explanations in a mainly evidence-based field (Rasmussen, 2011). Furthermore, they are useful to explain a multi-stakeholder process in which different stakeholders have a specific and peculiar role (Fini et al., 2019).

We propose a research agenda for new theory that should be addressed using mechanisms, building on what we considering the most relevant gaps according to our literature review.

Which is the relevance of the research outcome in the process of academic spin-off creation?

The definition of academic spin-off highlights the determinant role of the research outcome (Shane, 2004). The works included in our review confirm this assumption since they evidence the role of research as a starting point for the spin-off creation process (Fernandez Perez, Alonso Galicia, del Mar Fuentes Fuentes & Rodriguez Ariza, 2014; Galati et al., 2020; Rasmussen, 2011). Even if not all research outcomes have the potentiality to generate an academic spin-off (Ndonzuau et al., 2002), we argue that it is a necessary condition to understand the origin of spin-off creation. However, extant empirical works have scarcely addressed this topic. Specifically, it is still unclear how the research outcome is linked with the entrepreneurial process's other phases. Since it is tough to hypothesise a linear model, the mechanisms that link the research outcome with the whole spin-off creation process

are still a black box. Considering this, we claim for further research about the mechanisms mentioned above.

Which is the relationship between the phases of the spin-off creation process?

Academic Entrepreneurship is a quite fragmented field (Skute, 2019). Despite the theoretical lens of entrepreneurship as a process, this review's results confirmed this fragmentation. Indeed, the vast majority of cross-sectional contributions have studied one phase of the process separately from the others. Furthermore, what appears is that a large part of longitudinal studies has adopted atheoretical approaches to focus on the items that can act as enablers or constraints of the spin-off process.

The observation of the existing body of literature makes evident that it still lacks a comprehension about how spin-off creation evolves since little is known about the relationships between the research outcome, the opportunity identification, the formation of entrepreneurial intentions and the spin-off creation. Very few contributions have speculated on the relationship between one of the phases mentioned above (Hassan et al., 2020; Ferrero & Bessièrè, 2016). All this considered, we claim to investigate how the process unfolds from the research outcome to the actual creation of an academic spin-off. Indeed, the mechanisms that link the research outcome, the identification of the opportunity, the formation of entrepreneurial intentions and spin-off creation are still unclear and should be addressed in future research.

How important are the organizational and individual dimensions, and how do they impact the entrepreneurial process of academic spin-off creation?

While the vast majority of the studies investigated the role of the individual macro-dimensions' variables as predictors of entrepreneurial intentions (Feola et al., 2019; Urban & Chantson, 2019; Wegner et al., 2019), very few contributions investigated these variables with opportunity identification (Fernández Pérez, Alonso Galicia, Rodríguez Ariza, Del Mar Fuentes Fuentes 2015; Hassan et al., 2020) or spin-off creation (Dottore & Kassiech, 2017; Parmentola & Ferretti, 2018). On the other side, organizational macro-dimension's variables have been studied mainly on spin-off

creation (Nosella & Grimaldi, 2009; Fini et al., 2011). Conversely, entrepreneurship education has attracted considerable attention in the articles about entrepreneurial intentions (Urban & Chantson, 2018; Gonzalez Moreno, 2019; Karimi et al., 2016). Nonetheless, it has to be highlighted that it is still not clear whether this variable is relevant also in the other phases of the spin-off creation process.

All this considered, it is still needed to develop our understanding of the importance of the macro-dimensions mentioned above on the whole process of spin-off creation. It is still unknown how they impact the research outcome, the identification of opportunities, the formation of entrepreneurial intentions and the spin-off creation. We claim further research about the mechanisms that link the variables mentioned above to all the process phases.

DISCUSSION.

This work aimed to assess the current stock of knowledge and to identify gaps that represent future research opportunities on the spin-off creation process. We addressed the claim for a holistic perspective in AE research (Wood, 2011). The purpose of this research was twofold. At first, we aimed at assessing the current body of knowledge about which individual and organizational variables have been studied and their role in the spin-off creation process. Moreover, we were interested in understanding how each phase of the process – namely Opportunity Identification, Entrepreneurial Intentions and spin-off creation – has been studied in the extant literature related to organizational and individual macro-dimensions. Finally, we aimed to identify what is still unknown, specifically the mechanisms involved in the spin-off creation process that deserve further research.

To reach the objectives mentioned above, we first performed a thematic analysis to obtain a comprehensive framework of the individual and organizational variables. After that, we presented a narrative synthesis to understand how each phase of the spin-off creation process has been studied and which variables have been considered the most in relation to them. Considering the results of the analysis mentioned above, we theorized a circular model. The spin-off process phases do not follow a predetermined order, since very few studies speculated on a linear relationship between the phases

(Ferrero & Bessi re, 2016; Hassan et al., 2020). Moreover, the organizational and individual macro-dimensions influence the whole process even if it is not clear how and in which measure. We included the research outcome as a preliminary step of the spin-off creation process, even if its role needs to be further investigated in future research.

Finally, we proposed a research agenda for mechanisms that link the research outcome, the identification of the opportunity, the formation of entrepreneurial intentions the creation of the spin-off and explaining the relevance of individual and organizational variables in the process. Therefore, we contribute to theory advancement by proposing three research questions that build on what we know from the extant body of knowledge and what we need further research to build an enhanced understanding of the topic. The first shed light on the need to precisely understand the role of research outcome in the spin-off process. The second highlights the necessity to clarify how the process develops and how it occurs from one phase to another. The last one put in evidence that needs to be investigated the role of organizational and individual macro-dimensions in the entire process.

LIMITATIONS.

The main limitation of this work concerns the database. ISI-Wos is widely used for reviews in entrepreneurship because of its comprehensiveness (Hausberg & Korreck, 2020) and its scientific legitimization (Castriotta, Loi, Marku & Naitana, 2018). Nonetheless, it is not excluded that other databases may contain other relevant researches. Another weakness could concern the selection of the keywords. The choice has been extremely reasoned, and it was coherent with the theory about the constructs and the topic in general. However, it can be excluded that a different selection would have led to consider more useful articles. We suggest broadening the analysis by including other databases. To overcome this limit, future researches should perform a search on other databases such as Scopus.

THEORETICAL CONTRIBUTIONS.

This work contributes to theory advancement in several ways. Indeed, we provide a theoretical lens to investigate a process that has been studied mainly with an evidence-based approach in previous

literature. Moreover, our theoretical contribution contributes to knowledge advancement by providing a conceptual model that can be useful for a broader range of organizational studies.

First, we address the need for a theory-driven explanation of the spin-off creation process. For doing so, we adopted the theoretical lens of entrepreneurship as a process (Gielnik & Wang, 2018) to face the fragmentation of the topic and Social Information Processing Theory because of the need to consider both the individual and organizational dimensions. Indeed, we built on the assumption that spin-off creation is a process that occurs within an established organization like the university. Considering this, we address the need to integrate individual and organizational factors in the study of Academic Entrepreneurship (Davidsson & Wiklund, 2001). Starting from the conceptual framework described above, we propose a research agenda to address future research on this process.

We also contribute to the intrapreneurial process's comprehension, defined as entrepreneurship within existing organizations (Antoncic & Hisrich, 2001). In this sense, we contribute to the field of corporate entrepreneurship by opening the black box of the interaction between individual and organizational factors and their impact on the decision to act intrapreneurially (Hornsby et al., 1993). We also address the theoretical need to understand the components of the environment in which intrapreneurship occurs (Kuratko, Montagno & Hornsby, 1990).

Our study is also a critical ring to generate new theory for management studies (Fini et al., 2019). Considering this, it can be useful for a further theoretical understanding of how a new venture comes to be created over time. It can be useful for the studies about the antecedents of organizational goals (Kotlar, De Massis, Wright & Frattini, 2018) and a better understanding of the conflicts between different stakeholders during the spin-off process (Clarysse, Wright, Lockett, Van de Velde & Vohora, 2005; Mustar et al., 2006). Furthermore, it can lead to a better comprehension of a process which implies the transition from a non-commercial to a commercial environment (Fini et al., 2019; Mustar et al., 2006).

PRACTICAL IMPLICATIONS.

Creating a new academic spin-off is a complex phenomenon, given the multiplicity of factors to consider and their interactions. Universities are interested in understanding how to foster entrepreneurial behaviour among their members, but what emerges in our review is that the efficacy of specific policies or reward systems cannot be taken for granted a priori. A better understanding of the previously mentioned mechanisms would make it easier for them to transition from one step to another.

Our review focuses on a phenomenon which occurs within the university. Nonetheless, it is generalizable to similar organizations (Bacharach, 1989). This review emphasises the importance of understanding how organizational factors interact with individual dimension until the outcome. In this sense, we provide University management with a theoretical tool that can help project their organizational characteristics, culture, and reward system.

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Table 1. Synthetic view of search

Concept	Search Terms	No.
Opportunity (OI)	Identification (‘opportunity recognition’ OR ‘opportunity identification’) AND (‘academic entrepreneurship’ OR ‘acedemi* spin*’ OR ‘universit* spin*’ OR ‘academi* commercialization’ OR ‘*universit* commercialization’)	159
Entrepreneurial (EI)	Intentions (‘entrepreneurial intent*’) AND (‘academic entrepreneurship’ OR ‘acedemi* spin*’ OR ‘universit* spin*’ OR ‘academi* commercialization’ OR ‘*universit* commercialization’)	759
Spin-Off Creation	(‘academic entrepreneurship OR entrepren* academi*’) AND (‘entrepreneurial behavior’ OR ‘Entrepreneurial action*’ OR ‘spin* creation’ OR ‘spin* foundation’)	292
Language	English	
Publication types	Articles	
Date of data export	April 2020	

Figure 1 - Macro-dimensions and micro-dimensions

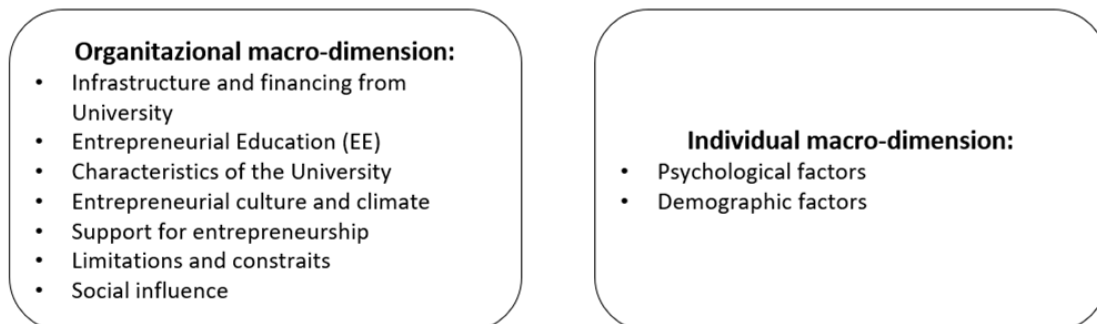


Figure 2 - Most studied organizational and individual variables.

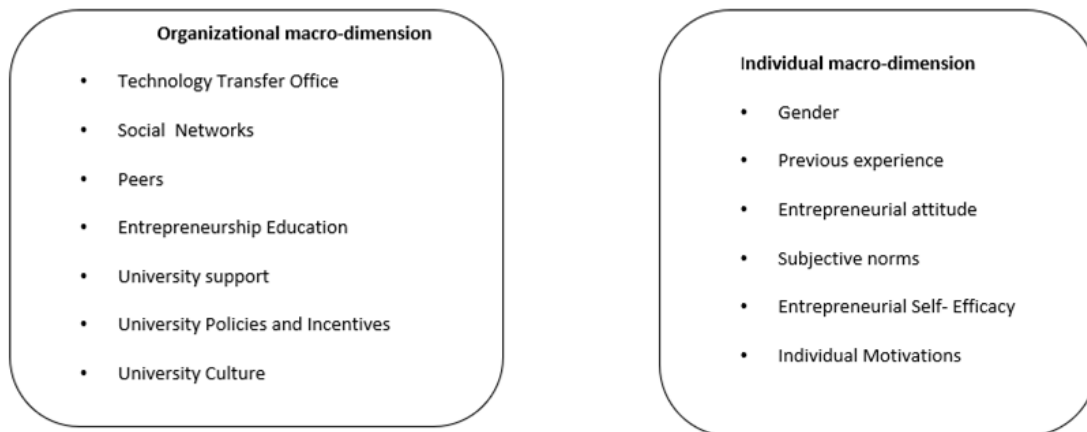


Figure 3 – Conceptual framework

