

TOOLS USED IN INTERVIEWING RESEARCHERS TO DETERMINE INTENTION, MOTIVATION AND PERFORMANCE IN LAUNCHING ACADEMIC ENTREPRENEURSHIP AND INVOLVEMENT IN THE MANAGEMENT OF ACADEMIC SPIN-OFFS

Otilia CRAMARIUC, Carmen Eugenia NASTASE

Ștefan cel Mare University of Suceava, Romania

otilia.cramariuc@usm.ro, carmen.nastase@usm.ro

Abstract:

In recent years we have seen increased interest from universities around the world engaging in the third mission of entrepreneurship and economic development. For this purpose, the development of academic spin-off structures is essential, and the quality of their management is vital in order to resist and establish themselves on the market. Studies analyzing the determinants of the performance of academic spin-offs point to the key role played by the human resources involved in the management of these structures. One of the issues highlighted in many studies (Einsley & Hmieleski, 2005; Kassicieh, 2011; Franklin et al, 2001) is related to the characteristics of academic researchers and their poor entrepreneurial engagement when they lack the motivation and intention for entrepreneurship.

This article is a review of the literature on the questioning tools and methods for investigating researchers who have become entrepreneurs using determinants such as motivation and intention. Thus, 11 relevant studies conducted in different parts of the world that attempt to establish a causal link between motivation and acting with intention on the part of academic entrepreneurs and the ability of the company to make qualitative management decisions, become more agile and enhance its performance were reviewed. Finally, we have centralized the main conclusions drawn from the research reviewed, highlighting a combination of factors that can decisively influence the quality of management and the market success of academic spin-offs.

Key words: academic entrepreneur, entrepreneurial intention, entrepreneurial motivation, entrepreneurial behavior

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1. INTRODUCTION

In the context of the valorization of university research results, academic spin-offs play a key role and the quality of technology transfer from research to industry depends on their proper activity.

Academic spin-offs are considered special cases of entrepreneurship due to the fact that they are often initiated in a scientific environment, whereas business opportunities arise in a business environment (Scholten et al., 2015).

In order to achieve successful technology transfer at university level, one of the key mandatory factors is the quality of the human resources involved in the management and/or operation of these enterprises. In this respect, it can be observed that university spin-offs are mainly managed, at least in the early stages of development, by the researchers who developed the technology. The involvement of scientists in these structures is important, even vital and desirable as long as the invention does not usually have the technological level to successfully enter the market, and its further development requires bringing the technology back to the researchers and improving it in line with market requirements.

The performance of academic spin-offs has been the subject of numerous studies, and it is already a fact that the quality of their human resources is the main factor influencing their success or failure. In this sense, studying the intention and motivation of academic entrepreneurs who are at

the head of academic spin-offs and of researchers who are not yet part of the spin-off structure are relevant aspects in the context of determining key performance factors.

We further reviewed specific literature to identify both aspects related to the intention and motivation of academic entrepreneurs as well as the questioning tools and methods to investigate these traits.

2. METHODOLOGICAL APPROACH

The present study is a synthesis of 11 surveys of academic entrepreneurs and researchers who have not yet entered spin-off entrepreneurship. The research analyzed relates to researchers' intention and motivation towards academic spin-off entrepreneurship and proposes their analysis using various methods of investigation (table no.1). In total the 11 articles analyzed involved 4353 researchers, 353 universities and 724 spin-off structures and were conducted in countries such as: Norway, Italy, Pakistan, Spain, Switzerland, Germany, Hungary and Costa Rica, as reflected in table no. 2.

The 11 articles address the following thematic categories:

- Entrepreneurial intention and its relation to:
 - Cognitive styles of researchers
 - Factors that lead young researchers to start university spin-offs (analysis based on elements of TPB and THM concepts or combination of the two)
 - Entrepreneurial attitude
 - Job satisfaction or dissatisfaction
 - Transition to entrepreneurship (willingness to commercialize own research results) in the context of analyzing the combined influence of economic and personal factors
 - Entrepreneurial skills in the context of studying personality variables of researchers (Big Five - OCEAN)
- Entrepreneurial motivation
 - Types of motivation of researchers when engaging in entrepreneurial activities
 - The causal relationship between entrepreneurial motivation and entrepreneurial success
 - Identifying the dominant motivators for researchers to engage in academic entrepreneurship
- Relationship between the researcher's activity in the spin-off and his/her research performance

3. RESULTS

3.1. THE QUESTIONING TOOLS AND INVESTIGATION METHODS USED IN THE ANALYSIS OF ACADEMIC RESEARCHERS

The questioning tools used to study academic researchers are:

- online questionnaire used predominantly (6 out of 11 items) and face to face (1 item)
- interview-based survey (3 articles)
- Online survey tool – Questback

Research methods used in the construction of the query tool are:

- Theory of Planned Behaviour – TPB
- Triple Helix Model – THM
- Self-efficacy Theory
- Social Cognitive Career Theory – SCCT
- Big Five – OCEAN

- Classification of motivation types formulated by Hayter 2015 and Ryan 2014
- Empirical examination of researchers' motivation based on the main motivational factors identified in the literature
- Instrument developed by Autio&Kauranen 1994
- ORP bibliometric assessment

A brief description of each of these methods is given in table no. 3.

3.2. CENTRALISATION OF THE MAIN CONCLUSIONS OF THE STUDIES REVIEWED

Next we have centralized the main conclusions formulated by the research that was the subject of the articles studied, which are presented in the table no. 4.

Briefly, the conclusions of the 11 studies relate to:

- cognitive style of the researchers
- issues influencing researchers' entrepreneurial attitudes
- factors that determine young researchers to engage in academic spin-off entrepreneurship
- factors that predict researchers' intention towards academic entrepreneurship
- factors influencing the creation of academic spin-offs and entrepreneurial attitudes
- determinants of entrepreneurial intention
- personality variables influencing entrepreneurial skills
- types of motivation in the context of entrepreneurial activities
- the causal relationship between entrepreneurial motivation and entrepreneurial success
- the motivational elements in entrepreneurs' approach to engage in academic entrepreneurship
- the relationship between research and entrepreneurial activity

4. CONCLUSIONS

In terms of entrepreneurial intention that decisively influences subsequent entrepreneurial behaviour:

- Researchers who are characterized by Planning cognitive style, i.e. those who tend to prepare and plan towards goals are best suited to work in entrepreneurial structures
- Entrepreneurial attitude is influenced by university support (infrastructure and incubation centres), government support (fiscal policies), but also support from academic peers, previous experience
- The most important individual factors in predicting entrepreneurial intention are: entrepreneurial attitude, know-how, perceived behavioural control, previous experience, scientific productivity
- In terms of the decision to create a spin-off, scientists give greater importance to reputation and extrinsic rewards than to pecuniary satisfaction
- Researchers who are characterized at a personal level by openness, extroversion and emotional stability are well suited for entrepreneurial contexts

In terms of the entrepreneurial motivation that decisively influences the quality of entrepreneurial activity:

- Extrinsic motivation is an important factor in the decision to engage in entrepreneurial activities
- High entrepreneurial intention is predominantly associated with 3 variables: knowledge, opportunity and personal motivation
- Availability of resources, especially financial resources, was not likely to motivate the researcher to launch projects

- Other aspects favouring the transition to entrepreneurship of researchers are: availability of a suitable manager, existence of production facilities, existence of business incubators, relationship with networks in the specific industry.

Regarding the relationship between the researcher's work in the spin-off and the research performance of the spin-off:

- Data analyzed and interpreted reveal superior scientific performance of academic entrepreneurs compared to their non-entrepreneurial peers
- Involvement in academic entrepreneurship provides researchers with valuable insights into the market and enables them to make the best decisions to effectively adapt research results to better match market needs. This allows research to be better targeted and its applicability increased in the context of understanding market needs.

Although the conclusions drawn are supported by the results of many studies in the field, there are also studies that indicate aspects contrary to the general trend, but which are influenced by the socio-economic contextual characteristics of the area where the analysis was made:

- The study of academic researchers in Pakistan shows that industry plays the weakest role in shaping the entrepreneurial intentions of young researchers, but this (as the authors of the study also point out) is less relevant because in less developed countries (e.g. Pakistan) the link between industry and academia is still weak.
- According to the Hungarian study, dissatisfaction with the income earned in university is the strongest reason for starting a new business, while recognition is the weakest. This is due to the fact that the education system in Hungary is one of the lowest paid in Europe and the allocation for research and development is almost non-existent.

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APPENDIX

Table no. 1. Summary of the main issues studied on the basis of the articles analysed

Theme	No.	Article (title/authors/year)	Target group	Type of research institution, number	Location	Subject of the study	Target group query tool	Investigation method
ENTREPRENEURIAL INTENTION	1	Growth intentions among research scientists: A cognitive style perspective	251 doctoral and post-doctoral students	1 university	Norway	The relationship between entrepreneurial intention and researchers' cognitive styles	Online questionnaire	Self-efficacy Theory
		Mirjam Knockaert, Maw Der Foo, Truls Erikson, Eva Cools						
	2	The Determinants of Entrepreneurial Intention of Young Researchers: Combining the Theory of Planned Behaviour with the Triple Helix Model	213 doctoral students	4 universities	Italy	Factors that lead young researchers to start university spin-offs around their research results	Online questionnaire	Triple Helix Model – THM combined with Theory of Planned Behaviour - TPB
		Rosangela Feola, Massimiliano Vesci, Antonio Botti, Roberto Parente						
	3	Triple Helix and academic entrepreneurial intention: understanding motivating factors for academic spin-off among young researchers	310 young researchers	30 universities	Pakistan	Factors that lead young researchers to start university spin-offs	Questionnaire	Triple Helix Model – THM
		Altaf Hussain Samo, Noor UI Huda						
	4	Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention	1178 academic researchers	82 universities	Spain	The relationship between entrepreneurial intention and attitude	Online questionnaire	Theory of Planned Behaviour - TPB
		Francisco Javier Miranda, Antonio Chamorro-Mera, Sergio Rubio						
	5	Should I Stay, or Should I Go? Job satisfaction as a moderating factor between outcome expectations and entrepreneurial intention among academics	593 academic researchers	7 universities	Switzerland	The link between entrepreneurial intention and job satisfaction or dissatisfaction	Online survey tool - Questback	Social Cognitive Career Theory-SCCT
		Richard Blaese, Schneider Noemi, Liebing Brigitte						
	6	Scientists' transition to academic	496 academic	universities,	Germany	Transition to entrepreneurship	Online	Theory of

		entrepreneurship: Economic and psihological determinants		researchers	centres/ institutes of research		(willingness to commercialise own research results) in the context of analysing the combined influence of economic and personal factors	questionnaire	Planned Behaviour - TPB
		Maximilian Goethner, Martin Obschonka, Rainer K. Silbereisen, Uwe Cantner	2012						
	7	Antecedents of Entrepreneurial Skills and Their Influence on the Entrepreneurial Skills and Their Influence on the Entrepreneurial Intention of Academics		799 academic researchers	82 universities	Spain	Entrepreneurial skills in the context of studying personality variables of researchers	Online questionnaire	Theory of Planned Behaviour – TPB
		Francisco I. Vega-Gómez, Francisco J. Miranda González, Antonio Chammorra Mera, Jesus Pérez-Mayo	2020						Big Five - OCEAN
ENTREPRENEURIAL MOTIVATION	8	Why Would You Ever Want to Become An Academic Entrepreneur?		292 academic researchers (spin-off management)	1 university	Spain	Types of motivation of researchers when engaging in entrepreneurial activities	Survey	Classification of types of motivation formulated by Hayter 2015 and Ryan 2014
		Jasmina Berbegal-Mirabent, Dolors Gil-Doménech, Inés Alegre	2018						
	9	Motivation and success of academic spin-offs: evidence from Hungary		80 academic researchers (spin-off management)	10 universities	Hungary	The causal relationship between entrepreneurial motivation and entrepreneurial success	Survey	Empirical examination of researchers' motivation based on the main motivational factors identified in the literature
		Adam Novotny	2014						
	10	The relevant motivator elements in becoming an academic entrepreneur		74 academic researchers (spin-off management)	68 academic spin-offs	Costa Rica Spain	Identifying the dominant motivators for researchers to engage in academic entrepreneurship	Online questionnaire	Tool developed by Autio&Kauranen 1994
		Mauricio Monge-Agüero, Pedro Baena-Luna, Esther García-Río	2022						
RESEARCH PERFORMANCE	11	An individual-level assessment of the relationship between spin-off activities and research performance in universities		67 administrators of university licensing	284 academic spin-offs	Italy	Relationship between the researcher's activity in the spin-off and his/her research performance	Interview-based survey	Bibliometric evaluation ORP

		Giovanni Abramo, Ciriaco Andrea D' Angelo, Marco Ferretti, Adele Parmentola	2012	offices					
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Table no. 2. Articles grouped by theme, analysed group and location

Theme	No of articles	Target group	Universities	Spin-off	Location
ENTREPRENEURIAL INTENTION	7	3840 academic researchers	207		Norway Italy Pakistan Spain Switzerland Germany
ENTREPRENEURIAL MOTIVATION	3	446 academic researchers (spin-off management)	79	440	Spain Hungary Costa Rica
PERFORMANCE IN RESEARCH	1	67 university licensing office administrators	67	284	Italy
TOTAL	11	4.353 researchers	353	724	

Table no. 3. Brief description of the investigation methods used in the studies reviewed

Investigation method	Brief description
Theory of Planned Behaviour - TPB	<i>TPB - is a concept that comes from the field of psychology and is one of the most popular models used to determine specific individual behaviour. TPB identifies 3 aspects that can predict intention in behaviour:</i> ✓ <i>Attitude: refers to the willingness/willingness to engage in a specific behavior</i> ✓ <i>Subjective norms: refers to social pressure to behave or not behave in a certain way</i> ✓ <i>Perceived behavioral control: refers to personal beliefs about one's ability to exhibit a particular behavior</i>
Triple Helix Model – THM	<i>THM – is a concept according to which the 3 helices of the innovation system consist of:</i> ✓ <i>Academic environment/university</i> ✓ <i>Private sector/industry</i> ✓ <i>Public environment/Government</i>
Self-efficacy Theory	Self-efficacy is a concept of identifying cognitive styles based on the belief that a person can successfully perform the behavior required to produce a particular outcome, and does not refer to the skills a person has, but to the judgments a person has about what they can do with the skills they possess (Bandura, 1977; Gist and Mitchell, 1992; Kickul et al, 2009). According to this method there are 3 types of cognitive styles: ✓ Creating cognitive style: entrepreneurs who like uncertainty, see problems as opportunities and challenges and have a strong preference for risk ✓ Planning cognitive style: entrepreneurs who like to plan and prepare to achieve their goals ✓ Knowing cognitive style: entrepreneurs looking for data tend to keep a lot of details. They prefer complex problems and try to find logical and rational solutions. This process of gathering all the information to make a decision is time-consuming and sometimes leads to an inability to make a decision.
Social Cognitive Career Theory - SCCT	Social Cognitive Career Theory (SCCT) analyzes career choices considers environmental and motivational influences, such as outcome expectations and feasibility beliefs in the form of personal efficacy, to predict career decisions (Lent et al., 1994, 2002).
Big Five - OCEAN	The Big Five personality approach states that there are five influencing factors in entrepreneurship, recognised by the acronym OCEAN (openness, conscientiousness, extraversion, agreeableness, neuroticism), that prove to be determinants of entrepreneurial intention (Goldberg, 1981, 1990) OCEAN: ✓ Openness: refers to the intellectual curiosity of the entrepreneur, the ability to seek out new experiences and generate new ideas. ✓ Conscientiousness: refers to the degree of motivation that should be associated with entrepreneurial behaviour. This motivation will generate the desire to work, the need for achievement, efficiency, accuracy and perseverance. ✓ Extroversion: refers to the characteristics of those people known as leaders, i.e. people who are sociable, adventurous, assertive, dominant, energetic, good communicators and enthusiastic. ✓ Agreeableness: can be described as the ability to have positive and healthy interpersonal relationships, to be dedicated, generous, trustworthy, confident and caring/attentive. ✓ Neuroticism: involves differences in adjustment and emotional instability and is characterized by anxiety, hostility, depression, impulsivity and vulnerability.
Classification of types of motivation	There are 3 categories of motivation to become an entrepreneur according to the classification formulated by Hayter 2015, Ryan 2014), respectively: ✓ Intrinsic motivation: refers to the satisfaction an individual feels when performing an activity they enjoy, where they feel rewarded by

formulated by Hayter 2015 and Ryan 2014	simply performing that activity and do not expect other rewards ✓ Extrinsic motivation: This refers to carrying out an activity for which you will obtain various incentives, either financial, professional or personal (recognition - reputation, prestige, increased market value, access to new infrastructure, new opportunities). ✓ Prosocial motivation: motivation generated by the fact that their actions are for the benefit of others
Empirical examination of researchers' motivation based on the main motivational factors identified in the literature	The study uses empirical examination of researchers' motivation based on the main motivational factors identified in the literature (achievement, independence, research, necessity) and develops The Pattern Matrix spin-off motivation (principal Axis Factoring, Promax with Kaiser Normalization). The matrix of motivation to spin-off was built around 4 factors: ✓ achievement ✓ independence ✓ research ✓ necessity The study investigates motivation which has the following causes/perspectives: ✓ the prospect of increased income ✓ the need for achievement ✓ the need for independence ✓ benefits associated with research
Tool developed by Autio&Kauranen 1994	The study uses an instrument based on the theoretical proposal of Autio & Kauranen 1994, who established forty items organized in four groups that are possible motivating elements for the decision to create a company. Some items of the original instrument have been adapted to facilitate the reader's understanding, resulting in questions on 35 different items grouped into six categories: opportunity, knowledge, personal motivation, previous organisational motivation, available resources and environment.
Bibliometric evaluation ORP	The ORP approach is the bibliometric assessment of individual researchers' performance. The ORP Approach (Observatory on Public Research of Italy – http://orp.researchvalue.it) is the only research evaluation model in the world that is capable of providing national-scale, domain-standardised, individual-level bibliometric assessments. ORP uses raw data licensed from the Thomson Reuters Web of Science (WoS) and, starting from this data and applying complex algorithms to reconcile author affiliations and disambiguate the true identities of authors, each publication is attributed to the academic researchers who produced it.

Table no. 4. Centralisation of the main conclusions of the studies reviewed

Theme	No.	Subject of the study	Conclusions
ENTREPRENEURIAL INTENTION	1	The relationship between entrepreneurial intention and researchers' cognitive styles	Of the three cognitive styles identified, researchers who score high on the cognitive planning style have a higher intention to grow and are suitable for employment in entrepreneurial structures. Researchers who are characterised by Planning cognitive style, i.e. those who tend to prepare and plan towards their goals will feel comfortable in situations that require planning skills which is a key aspect of entrepreneurial growth orientation.
	2	Entrepreneurial intention and factors that lead young researchers to start university spin-offs around their research results (analysis based on combined elements of TPB and THM)	Entrepreneurial attitude is influenced by: ✓ The support that the university offers, in particular through technology transfer centres, in terms of creating new university spin-offs ✓ Government support (e.g. tax policies) ✓ Support from academic peers The stronger the attitude towards entrepreneurial behaviour, the stronger the entrepreneurial intention.
	3	Factors that lead young researchers to start university spin-offs (analysis based on THM elements)	Academia and government have a significant positive relationship with young researchers' academic entrepreneurial intention, while industry has a positive but insignificant influence on entrepreneurial intention. There is a real need for collaboration between academia and government to promote facilities for academic spin-off support structures (business incubators). The fact that this study shows that industry plays the weakest role in shaping the entrepreneurial intention of young researchers is less relevant because in less developed countries (e.g. Pakistan) the link between industry and academia is still weak.
	4	Relationship between entrepreneurial intention and attitude (analysis based on TPB elements)	The most important factors that predict intention towards academic entrepreneurship are: ✓ Individual factors: entrepreneurial attitude, knowing cognitive style, perceived behavioural control, previous experience, scientific productivity and social networks ✓ Contextual factors: work time balance, family environment, subjective norms, university reward system, work environment
	5	The link between entrepreneurial intention and job satisfaction or dissatisfaction	Factors influencing the creation of spin-offs and entrepreneurial attitudes towards them are related to: ✓ the importance the university attaches to this process, whether it treats it as a priority or not (perception of the university's spin-off mission) ✓ organisations within the university that can support spin-offs: OTTs, science parks and incubators, so that potential entrepreneurs do not have to rely solely on their skills but have the opportunity to be advised and taught ✓ previous experience ✓ gender (women are less inclined in this direction) ✓ employment contracts with unchangebil terms In deciding to create a spin-off, scientists place more importance on reputation and extrinsic rewards than self-realisation and quality of life. So pecuniary satisfaction is not the main reason why scientists want to become entrepreneurs. Instead non-pecuniary rewards of personal fulfilment in combination with job dissatisfaction may be the perfect combination for motivating towards an entrepreneurial career and spin-off entrepreneurship.
	6	Transition to entrepreneurship (willingness to commercialise own research results) in the context of	Of the 3 components of the TPB, attitude and perceived control contributed to a good determination of entrepreneurial intentions. Subjective (social) norms had no effect in this regard. Researchers' expected benefits affect their intention only by interlinking with TPB factors. Longitudinal results showed that entrepreneurial intention influences subsequent entrepreneurial behaviour.

		analysing the combined influence of economic factors and personal factors (TPB element analysis)	
	7	Entrepreneurial skills in the context of studying personality variables of researchers (Big Five - OCEAN)	Of the 5 OCEAN characteristics only 3 influence entrepreneurial skills: ✓ Openness ✓ Extroversion ✓ Absence of neuroticism Entrepreneurial skills act as determinants of entrepreneurial intention. Thus attitude and control are variables that will improve the intention to start a new business.
ENTREPRENEURIAL MOTIVATION	8	Types of motivation of researchers when engaging in entrepreneurial activities	Involvement in entrepreneurial activities and the creation of new spin-offs is not influenced by intrinsic motivation. Researchers find no intrinsic motivation in entrepreneurial activities. Extrinsic motivation is an important factor in the decision to engage in entrepreneurial activities. Prosocial motivation, on the other hand, has a negative effect on engagement in entrepreneurial activities.
	9	The causal relationship between entrepreneurial motivation and entrepreneurial success	According to the study, dissatisfaction with university income is the strongest reason for starting a new business, while recognition is the weakest. Therefore the prospect of additional income plays an important role in motivating researchers towards academic entrepreneurship. Also the motives related to the research activity play a significant role as they play an important role in the success of such a company in the early stages of development. Both the need for professional recognition and independence play secondary roles for academic researchers in Hungary.
	10	Identifying the dominant motivators for researchers to engage in academic entrepreneurship	High entrepreneurial intention is predominantly associated with 3 variables: knowledge, opportunity and personal motivation. Another factor favorably influencing the researcher's intention to transition to entrepreneurship is also the dissatisfaction felt at the previous organization he/she was part of. However, the availability of resources, especially financial resources, was not likely to motivate the researcher to launch projects. Other aspects that favour the transition to entrepreneurship for researchers are: availability of a suitable manager, existence of production facilities, existence of business incubators, relationship with networks in the specific industry. Entrepreneurs consider business opportunities so important that, even if the university environment is not conducive to exploiting them, they will still look for ways to launch their own projects.
PERFORMANCE IN RESEARCH	11	Relationship between the researcher's activity in the spin-off and his/her research performance	The analysed and interpreted data of the study reveal superior scientific performance of academic entrepreneurs compared to their non-entrepreneurial peers. As a result, the creation of academic spin-offs does not seem to have negative effects on the scientific performance of the research activity of those involved in the management of such structures (academic spin-offs) and who also carry out research activity. Moreover, involvement in academic entrepreneurship provides researchers with valuable information about the market and allows them to make the best decisions in order to efficiently adapt research results to better match market needs. In this way research can be better targeted and its applicability increased in the context of understanding market needs.