UPFBE

Working Paper Series

2020/5

Ákos Tóth-Pajor, Miklós Hornyák, Mónika Kuti, Zsolt Bedő

The success of the university based crowdfunding in light of the university centered entrepreneurial ecosystem development

This publication was funded by the Higher Education Institutional Excellence Program of the Ministry of Innovation and Technology in Hungary, within the framework of the 4th thematic programme ”Enhancing the Role of Domestic Companies in the Reindustrialization of Hungary” of the University of Pécs. Grant Number: TUDFO / 47138/2019 – ITM.

UNIVERSITY OF PÉCS
Faculty of Business and Economics

The success of the university based crowdfunding in light of the university centered entrepreneurial ecosystem development

Ákos TÓTH-PAJOR, toth-pajor.akos@ktk.pte.hu, University of Pécs, Faculty of Business and Economics, Assistant Lecturer

Miklós HORNYÁK[1], hornyakm@ktk.pte.hu, University of Pécs, Faculty of Business and Economics, Assistant Professor

Monika KUTI, kutim@ktk.pte.hu, University of Pécs, Faculty of Business and Economics, Associate Professor

Zsolt BEDŐ, bedo.zsolt@ktk.pte.hu, University of Pécs, Faculty of Business and Economics, Associate Professor

Abstract

Universities implement readily available solutions and tools to become more entrepreneurial with the expectation of short-term success. Establishing university based crowdfunding platforms is one example of this phenomenon. While these solutions are easily accessible and implementable it is not understood what factors make these platforms an efficient tool to inspire entrepreneurial activity at higher education institutions. In other words, will there be a large crowd publishing and funding projects on the platform or will it remain an empty online marketplace? To assess this question, we apply the concept of a university centered entrepreneurial ecosystem, UCEE, which enables us to consider the environment of the university holistically. By taking into account the functional attributes of the UCEE concept, we are able to show that the successful implementation of a university based crowdfunding platform is dependent on the completeness of the ecosystem around the university. Thus, we can consider successful university based crowdfunding as a desired output of a complete university centered entrepreneurial ecosystem. Our findings provide valuable insight into the functioning of the entrepreneurial university concept and practice, informing both policy and institutional level decision makers.

Keywords

University based crowdfunding, entrepreneurial university, entrepreneurial ecosystems, text mining

[1] Corresponding author.
E-mail address: hornyakm@ktk.pte.hu,
Postal address: H-7761, Kozármisleny Petőfi utca 48.

1. Introduction

Universities around the world are being pressured by various stakeholders of their socio-economic environment to change their practices to enable them to solve relevant socio-economic problems both locally and globally (Etzkowitz 1998; Goldstein 2009, 2010). This notion in the academic literature has been termed as the 'third mission' (Etzkowitz et al. 2000), triple helix (Etzkowitz 2003a, 2008), quadruple helix (Carayannis and Campbell 2012; Foray et al. 2012), and entrepreneurial university (Clark 1998; Etzkowitz 2003b, 2008; Goldstein 2008). Despite the competing ideas in this area, all of them point in the same direction, which is for universities to rethink their knowledge generation processes in a way that the outside world has better access to these processes and the ability to provide inputs related to socio-economic problems that are then solved within the university. While the above concepts share a common objective, they differ in their proposed paths to reach this common objective. They either discuss the required changes on a macro scale without elaboration on the operational level characteristics needed to achieve the objective (Goldstein, 2008) or they narrow down their analysis to a single unit of the institution such as the technology transfer function of the university (Clarysse et al. 2007; Owen-Smith and Powell 2001).

The other line of research related to entrepreneurship within the university assesses entrepreneurial education in general and the role of pedagogy, assessment, student clubs, and the physical spaces in particular (Pittaway et al. 2015). The weakness of this literature in understanding the institution's role in the local entrepreneurial space is its close focus on the processes of the educational dimension of the university. It does not address the involvement of the multiple stakeholders surrounding the university, the interaction of the different functions of the institution that also aims at boosting the entrepreneurial activity within it.

To close the gap between the macro and micro perspective of the two distinct lines of literature, we apply the concept of 'entrepreneurial ecosystems' that has been introduced by Isenberg (2010) with the intention to better understand the micro environment of the entrepreneurial activity in a more complex, holistic manner.

In line with the argument of those who claim that the entrepreneurial ecosystem is a sufficient framework to understand the specificity of the local entrepreneurial activity in a close locality, conceptual papers have emerged that position the university in the center of the ecosystem (Miller and Acs 2017). These works argue that the university can establish a structure that boosts entrepreneurial orientation of the individuals working within the institution and can also systematically connect outside stakeholders with researchers and students. Bedő et al. (2019) propose a systematic concept mimicking Stam (2015) that breaks down the ecosystem into ten functional attributes that

contribute to the enhancement of the entrepreneurial activity within and around the university. These functional attributes take into consideration the literature on the entrepreneurial university and entrepreneurial education discussed above and establish a system that allows operationalization and empirical testing of the UCEE concept.

Recently, a trend has emerged among universities to set up their own crowdfunding platforms to enable affiliates of the university to articulate their own initiatives and to make an effort to collect funding, support, and publicity for their projects. This tendency triggers startup companies such as Hubbub.net to start offering tailor made solutions for universities to launch their branded platforms. Such solutions clearly contribute to the emergence and to the development of the entrepreneurial university making entrepreneurial initiatives visible and fundable for all stakeholders within and outside the institution. While university based crowdfunding is a great opportunity for universities to boost entrepreneurial activity, it is not understood what factors make such a system successful in terms of the number of projects published and funded. In other words, how can an institution that adopts such a system ensure that students and researchers publish their projects on the platform with the strategy to raise funding for specific purposes and also to seek validation and partners for the implementation of the project. The authors of this paper have experienced that achieving traffic – projects published by project owners and projects funded by interested stakeholders – is a challenging task in a resource constrained environment. The authors' personal experiment with a licensed platform solution at the University of Pecs in Hungary demonstrated that the platform solution, by itself, will not open the stream of projects in the intended way.

In this paper we argue that if the functional attributes of the UCEE are not available and/or not in place at a higher education institution, the success of the crowdfunding platform to boost entrepreneurial activity around the institution is limited. More specifically, if the UCEE is less complete, then the success rate of the projects on the crowdfunding platform decreases. To test our hypothesis, we used data gathered from the crowdfunding platform provider Hubbub.net that serves clients in multiple locations around the world. Based on the dataset we found that our hypothesis is valid implying that if the UCEE is incomplete at a particular institution, projects are less likely to succeed in reaching their funding targets. These results still hold if we distinguish projects based on their launch dates and include other control variables responsible for the success of crowdfunding projects on commercial (non-university based) platforms.

Our results imply that to launch a university based crowdfunding platform with the purpose of successfully stimulating entrepreneurial activity at the university requires as many functional attributes of the UCEE to be in place and to function as possible. Thus, the success of university based

crowdfunding can be seen as a desired output of a complete university centered entrepreneurial ecosystem.

The paper is organized as follows. First, we introduce the relevant literature related to university centered entrepreneurial ecosystems and university based crowdfunding. We then describe our data collection and data cleaning procedure, and we discuss the methodology of index creation and text mining applied in the empirical analysis. We also introduce descriptive statistics and the initial results related to the key variables. In the results section we show evidence that the completeness of the UCEE is related to the success of the crowdfunding projects. Finally, we conclude by summarizing the findings of our study.

2. Materials

2.1. Crowdfunding in the university centered entrepreneurial ecosystem

In this section of the paper we will introduce the UCEE concept and the position of the crowdfunding system in particular to highlight the factors and mechanisms within the system that influence entrepreneurial activity around the university. We will also define the system of hypotheses tested during the research process.

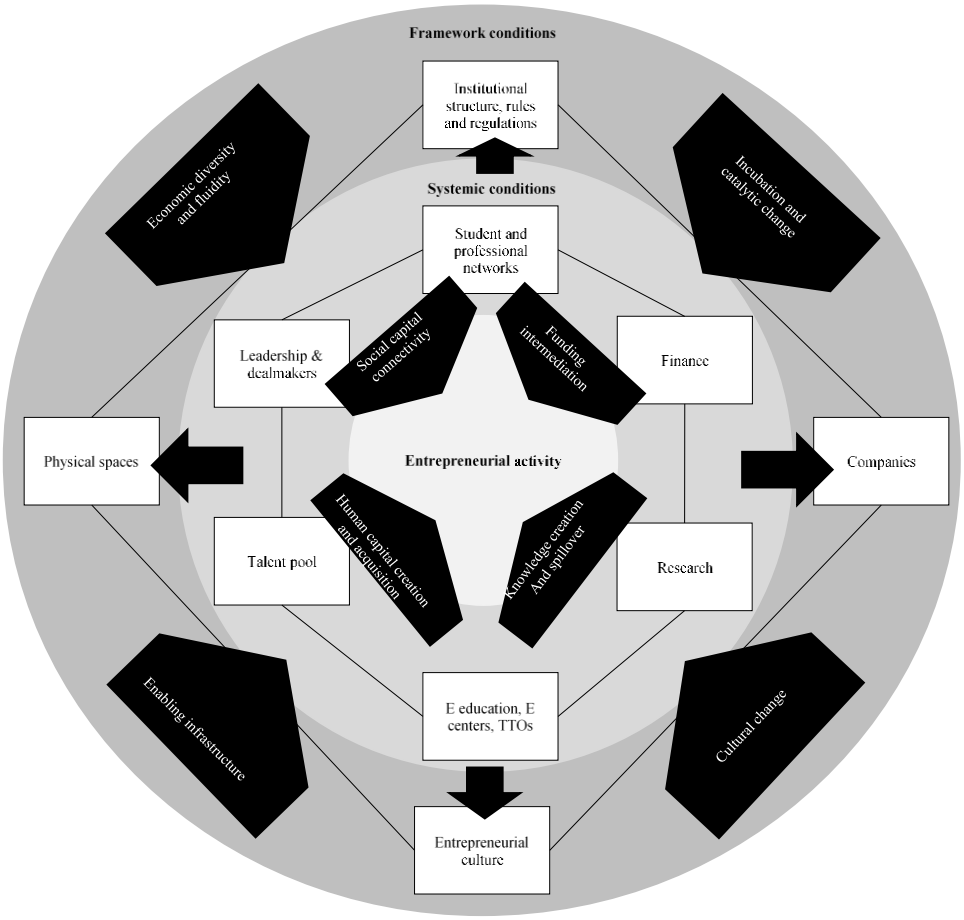
We use the general definition of the entrepreneurial ecosystem previously proposed by scholars in the field with a university role to catalyse such activity.

> On entrepreneurial ecosystems, *"an entrepreneurial ecosystem is best conceptualized as a complex adaptive system which, like a forest ecosystem, is composed of a rich array of inter-relationships"* (Roundy 2016: 238) and, "*are combinations of social, political, economic and cultural elements within a region that support the development and growth of innovative startups and encourage nascent entrepreneurs and other actors to take risks of starting, funding, and otherwise assisting high-risk ventures"* (Spigel 2017: 50) or, *"a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory"* (Stam and Spigel 2016:1).

The UCEE, in line with Stam's (2015) conceptual framework, consists of two layers: framework conditions and systemic conditions. In these two layers of conditions we can find ten functional attributes that have an effect on the knowledge, skillset, motivation, and behaviour of individuals within the university (see Figure 1). The mechanisms that affect individuals' entrepreneurial journey within the ecosystem are also highlighted in Figure 1. Framework conditions contain the existing historical, cultural, and institutional constraints/enablers that exist within a regional context. As noted in Figure 1, legacies of location related to its prior industry, history of entrepreneurship, religious and cultural history, prior population demographics, and regulatory history will establish the initial

conditions for an entrepreneurial ecosystem (Audretsch et al. 2011; Autio et al. 2014). Likewise, the cultural conditions such as attitude towards entrepreneurship and the existence of current institutions play an important role in setting the scene within which entrepreneurial efforts occur (Alvedalen and Boschma 2017; Spigel 2017).

Figure 1: University centered entrepreneurial ecosystem



Source: Bedo et al. (2019)

Systemic conditions are the ongoing attributes that establish the functioning of the ecosystem and can be considered the 'eco' component that is constantly changing and adapting (Stam 2015). They include essential people, for example, the entrepreneurs, the investors, the mentors, and the dealmakers (Feldman and Zollner 2012). Such conditions also include the density and connectivity of social networks and the existence of social capital in these networks (Feld 2012). Additional components include the availability of financial capital, the value of professional support networks, and the availability of new knowledge and technologies that can be commercialized (Stam 2015).

The university based crowdfunding system is part of the financing functional attribute, which lies on the systemic condition layer. We argue that if the crowdfunding system exists to enable entrepreneurial initiatives to raise funding and to seek validation from the crowd in the local environment, then the other nine functional attributes have to provide a supportive environment, otherwise this technological solution will not be used to serve these purposes neither by the demand side (entrepreneurs seeking funding and validation) nor by the supply side (crowd interested in funding and evaluating innovative projects). Only the completeness of the functional attributes can generate such synergies which can contribute to the successful implementation of a university based crowdfunding platform. Thus, we argue that there is a positive relationship between the success of the crowdfunding projects and the completeness of the UCEE. We assume that there is a bilateral interaction between the attributes which can create synergies and accelerates the development of the UCEE. A university based crowdfunding platform can interact with the systemic and framework conditions of a university centered entrepreneurial ecosystem in the following ways:

1. The existence of student clubs positively affects the network effect around the CF platform to emerge, and as a result, success rate (Pittaway, et al. 2015).
2. The existence of entrepreneurial role models (leadership) that might function as 'dealmakers' who share insights into the entrepreneurial journey and connect complementary competences affects CF success (Feldman and Zoller 2012).
3. If the university systematically manages talents via a horizontal organizational unit to enable them to find their desired path of development, then the CF is successful.
4. Support services (curricular, co-curricular, or extra-curricular activities) and intermediaries (entrepreneurship center, tech transfer office, or innovation center) increase the probability of a successful CF platform.
5. Qian's (2018) empirical study showed that there is a positive causal relationship between innovative activities at cities and engineering knowledge as a form of synthetic and arts knowledge serving as a symbolic knowledge base, while there is no effect of biomedical knowledge (analytical). Consequently, we hypothesize that the existence of synthetic and symbolic knowledge at the university increases the probability of attractive projects on the platform that enhances interest from the supply side as well.

Framework conditions layer:

1. Existence of entrepreneurship and innovation in the strategic documents as main priorities for the institution signals a structural and regulatory environment within the institution that is conducive to entrepreneurial activity. This should have a positive effect on the use of the CF platform.
2. The existence of physical spaces as incubators, FabLabs, hatcheries, and co-creation spaces that facilitates student interaction positively affects CF success.
3. Entrepreneurial culture adopted by the higher education institution supports CF attractiveness.
4. Corporate relationship and engagement on the university level via an integrated, cross-disciplinary organizational unit enables innovative ideas and projects to receive validation and feedback that also increases the likelihood of a platform to concentrate interaction in order to succeed.

2.2. University based crowdfunding and success factors

Crowdfunding is a means of alternative financing for higher education institutions in the era of technological disruption. Access to early-staged funding is an obstacle for innovation (Cosh et al. 2009; Mollick 2014; Hu et al. 2015) which is an issue for universities with limited finances. Crowdfunding is able to bridge the funding gap (Hemer et al. 2011; Meinshausen, Schiereck and Stimeier 2012; Röthler and Wenzlaff 2011). University based crowdfunding and its role in a university based entrepreneurial ecosystem is an under-researched field since the phenomenon is relatively scarce. Crowdfunding platforms run by universities can help raise funds for tuition fees for students, student ventures, non-profit causes, research projects, or endowments. The concept of a crowdfunding platform to raise funds for university start-ups at the intersection of knowledge transfer departments, researchers, and the university crowd and start-ups has been developed by Wieck et al. (2013). To what extent university based crowdfunding complements, supplements, or crowds out traditional research grants remains an open-ended question (Baskerville and Cordery 2014). If entrepreneurial moral hazard and private cost information are controlled, then crowdfunding can complement traditional entrepreneurial financing (Strausz 2017).

University breaks-related slack time increases innovation outcomes on Kickstarter both in terms of the quantity of very high and very low quality projects launched in the context of project selection, effort, and coordination (Agrawal et al. 2018). There are mixed research findings on how crowdfunding contributes to product innovation in which both novelty and usefulness are reflected at the same time (Mukherjee et al. 2017). Signalling is a means of overcoming inefficiencies during crowdfunding

(Vismara 2017). Use of media and crowdfunding experience signal project quality and founder credibility thus mitigating information asymmetry (Courtney et al. 2017). Regarding the choice between entrepreneurs' self-description versus idea presentation in the campaign text, the higher frequency of mention of the entrepreneurs' names lead to higher funding success (Gafni et al. 2017). Crowdfunding functions as a price-discrimination tool during marketing to signal competency and credibility (Sayedi and Baghaie 2017). Dynamic modifications in signalling strategy are ways to adjust post-campaign costs and benefits (Chakraborty and Swinney 2017).

The social capital of the entrepreneurs' home country can mitigate moral hazard during a crowdfunding campaign (Lin and Pursiainen 2018). Home bias exists from the backers' perspectives (Lin and Viswanathan 2014). Geographical location, l*ocal altruism, and localized social capital, including social relations and compliance with social norms, are important factors during crowdfunding* (Gaudici et al. 2017). Social network size and quality signals previous professional experiences, smaller target amounts, shorter campaign periods, and more updates contribute to reward-based crowdfunding campaign success (Mollick 2013, 2014). Friends and family, social influence, and updates play important roles during a project funding cycle (Kuppuswamy and Bayus 2017). Analysing the promotional activities on social media, Lu et al. (2014) find that the temporal distribution of customer interest and concurrent promotion from multiple sources are keys to crowdfunding success. Owner experience and the frequency of social media contacts as a measure of social networking activity are related to success (Nitani et al. 2017). In the context of creator-backer interaction, comment quantity, sentiment, comment score, reply length, and reply speed increase the success rate (Wang et al. 2018).

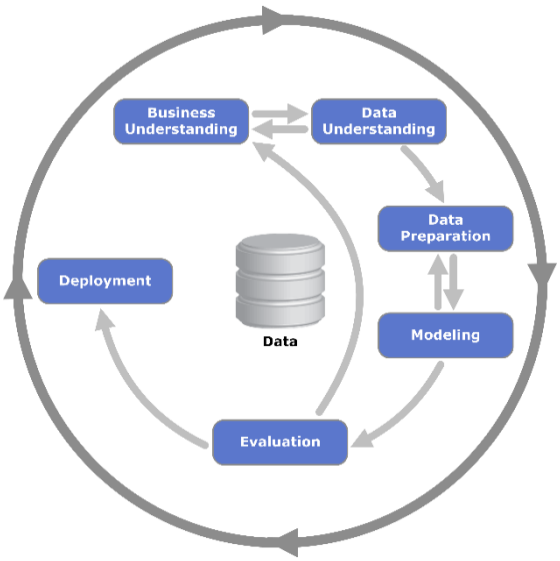
Funding cycles follow a U-shaped pattern over the crowdfunding campaign (Kuppuswamy and Bayus 2015a). Backers' funding decisions depend on the proportions of target and actual amounts and the number of days left until the end of campaign period (Li and Duan 2014). Backers' funding activities increase from Saturday to Wednesday and decrease thereafter (Kuppuswamy and Bayus (2013). Entrepreneurial quality signals of the creator (Doosti and Tan 2018) and herding behaviour of the backers (Kuppuswamy and Bayus 2013) do matter in the success of crowdfunding campaigns. Lower target amounts, shorter campaign durations, and narrative legitimacy send entrepreneurial signals on the achievability of the project goals (Frydrych et al. 2014). Crowdfunding campaigns launched by non-profit organizations are more successful than other organizational forms, since their initiatives target general communities with reduced focus on profit (Bellefamme et al. 2013). Reward-seeking funders with egotistic behaviour to benefit from the campaign increase overfunding rate, while altruistic backers are more satisfied with helping the project meet its funding target (Koch 2016).

This paper assumes that the crowdfunding success factors within a university based environment are similar to that of well-known crowdfunding platforms. Thus, we can use the well-known success factors as control variables to investigate the relationship between the completeness of the UCEE and the success of the crowdfunding projects in the presence of multiple controls.

3. Methods

During our research, we built on the CRISP-DM (Cross Industry Standard Process for Data Mining) methodology. Figure 2 shows the conceptual framework of the CRISP-DM methodology. This methodology supports the entire analytical process in six steps from understanding the task to the introduction of the model.

Figure 2: CRISP-DM process diagram



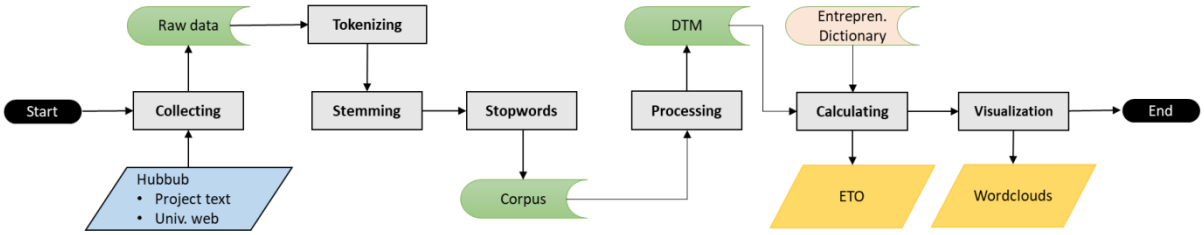
Source: http://www.bigdatabusiness.com.br

In the first step, Business Understanding, we defined our research question. We hypothesize that the completeness of the UCEE influences the successful implementation of the university based crowdfunding platforms. We measure the success of the implementation in terms of successful crowdfunding projects. Thus, we assume that projects can gather more funds and raise their target funding with higher probability if they come from a more complete UCEE. By focusing on the relationship between the completeness of the university centered entrepreneurial ecosystems and the success of university based crowdfunding projects, we investigate how the presence of functional attributes can increase the success rate of the university based crowdfunding projects. To answer our

research question, we have gathered data about 734 community-financed projects from Hubbub[2], which is a service provider for university based crowdfunding platforms.

In the second step, Data understanding, we have identified Structured and Unstructured data from our data source. Structured data includes quantitative data from the Hubbub website and data about the facilities and services of the project owners' university. Unstructured data consists of text data about the projects (pitch text, comments, etc.) from the website of Hubbub and from the index webpage content of the project owner's university. Then we created the term of occurrence matrix from the text data of the university's index webpage after completing the standard text mining steps. From the term occurrence matrix we calculated the entrepreneurship word frequency of occurrence according to the domain specific entrepreneurship dictionary. Thus, we established the entrepreneurship term occurrence (ETO) variable, which was created in the feature engineering step. The process is shown in Figure 3.

Figure 3: The text mining process of the University's index webpage



Source: Own Construction

In the third step, which is Data Preparation, we performed two activities. First, by using feature engineering[3], we created new aggregate and categorical variables based on the examination of the existing data. We developed the *Entrepreneurship Term Occurrence (ETO)* variable from the university index website's text mining process, which qualitatively characterizes the university environment. For the quantitative characterization of the project environment, we collected university attributes based on the website of the university, which describes the systemic and framework conditions of the university centered entrepreneurial ecosystems related to our conceptual ecosystem framework (See Figure 1). We created dummy variables to describe whether the investigated higher education

[2] https://hubbub.net/

[3] "Feature engineering is the process of using domain knowledge to create features that make algorithms work better. In this process we are transforming raw data into features that better represent the problem." (Amit Shekhar)

institutions possess the desired functional attributes of the UCEE. The categorization of the universities are based on our own judgement concerning the different functional attributes.

We then aggregated the qualitative and quantitative information about the universities into indices, which are normalized proxies for the completeness of the university centered entrepreneurial ecosystems. We created indices as the sum of the attribute dummies with and without the ETO variable. Then, we also aggregated the information as the product of the functional attributes with and without the ETO variable by adding 1 to the dummy variables. Thus, we have four indices which describe the completeness of the university centered entrepreneurial ecosystems. The indices catch the current state of the UCEE development in the case of the different higher education institutions which implemented a university based crowdfunding platform. The development of the UCEE is a long process, thus we consider the indices as proxies for the outcome of this development process.

As the dependent variable in our regressions, we measure the success of the crowdfunding projects with the success rate (RT) which was calculated using the *Raised amount / Target amount* formula. In the case of the RT variable, the extreme values were replaced by the 99th percentile because of the outlier values of the success rate. We also created the *MFR dummy* and the TARGET dummy variable which shows whether the project reached the minimum funding requirement and the target amount. Hubbub considers a project successful if it reaches the minimum funding requirement. Thus, we could also calculate the probability of success for the projects in different groups. As control variables we used different well-known crowdfunding success factors from the crowdfunding literature. We created a pooled variable called *Activity* to characterize the different activities around the projects. This variable includes the number of donors, page views, and comments. The *Duration* of the project was calculated in days using the *Deadline - Start data* formula.

Binary categorical variables were based on the pitch text of the projects using text expert analysis. The *Creator_type* variable shows whether the project owner is an individual or a team. The *Aim_type* variable shows whether the project serves an individual or a community. In the case of the *Profit_type* variable, we distinguished non-profit or for-profit projects. Length type variables were created from the text data of the projects by using the standard text mining process: stemming and stop wording. We measured the length of text attributes and calculated *Updates_length, Comments_length*, and *Pitch_length* variables. We also distinguish projects according to their launch year with dummy variables.

In the fourth step, Modelling, we developed different models based on the above-mentioned variables. By developing our models, we investigated how the completeness of the university centered entrepreneurial ecosystems contributes to probability of success. We hypothesize that projects from

a complete ecosystem can raise more funds and the completeness of the ecosystems can improve the probability of success as well. Concerning the success rate, we built *linear regression models with robust standard errors* using RT as the dependent variable and the different university centered entrepreneurial ecosystem indices as key explanatory variables in addition to the control variables known from the crowdfunding literature. Furthermore, we investigated the probability of success in different groups based on the ecosystem measures.

4. Results

Concerning the overall probability of success, 75% of the projects could reach their minimum funding requirements and only 25% of the projects managed to reach their target amounts. The projects in our sample were launched between 2012 and 2017. Table 1 shows the probability of success according to the launch dates of the projects for the different years. In Table 1 we can observe that in 2012 almost all the projects were successful, and the probability of success was very high. We can see that as the number of projects increased between 2014 and 2016, the probability of success declined in the case of the minimum funding requirement and the target amount.

Table 1: Probability of success according to the launch dates of the projects

	2012	**2013**	**2014**	**2015**	**2016**	**2017**
Probability of reaching the minimum funding requirement	0.968	0.968	0.825	0.686	0.742	1.000
Probability of raising the target amount	0.968	0.613	0.268	0.155	0.232	0.500
N	31	31	97	271	302	2

Source: Own Construction

In Table 2 we present the probability of success according to the type of founders. In the case of the differences we present the significance level (***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively) and proportion test statistics in parentheses. An interesting observation is that those projects which were founded by a team have a higher probability of success than those projects which were founded by individuals. In the case of the minimum funding requirement the difference is 20.3%, and in the case of the target amount the difference is 15.3%. The differences are significant at the 1% level. This finding is in line with the entrepreneurship literature.

Table 2: probability of success according to the type of founders.

	Probability of reaching the minimum funding requirement	Probability of raising the target amount	Number of projects according to type of founders
Individual	0.622	0.158	265
Team	0,825	0.311	469
Team-Individual	0.203*** (37.242)	0,153*** (20.752)	

Source: Own Construction

Table 3 shows the descriptive statistics of the dependent and explanatory variables we used for the model construction. Concerning our dependent variable, we can see that the average of the success rate is 54.7%. This means that, on average, projects could raise 54.7% of their target amounts. In the case of the normalized values of UCEE indices we can observe that if we sum up the functional attribute dummy variables, the higher education institutions have an index score of 0.483 on average, and if we include the ETO variable we get a 0.337 index score on average. On the other hand, if we aggregate the functional attributes as products of the dummy variables, the average index score is 0.065 with the ETO variable and 0.074 without the ETO variable.

Table 3: Descriptive statistics

Variables	Mean	Standard Deviation	Minimum	Median	Maximum	N
Success rate (RT)	0.547	0.469	0	0.513	2.3	734
UCEE Index 1 (sum, normalized, no ETO)	0.483	0.266	0	0.5	0.89	734
UCEE Index 2 (sum, normalized, ETO)	0.337	0.189	0	0.359	1	734
UCEE Index 3 (product, normalized, ETO)	0.0646	0.147	0	0.00781	1	734
UCEE Index 4 (product, normalized, no ETO)	0.074	0.137	0	0.0078	1	734
ETO	4.45	4.96	0	3.5	30	734
Number of comments	4.13	9.8	0	1	176	734
Number of page views	6630	21800	110	3060	251e3	734
Number of updates	1.43	2.87	0	0	27	734
Number of donors	31	51	0	19	647	734
Ln (Activity)	7.97	1.11	4.7	8.04	12.4	734
Ln (Pitch length)	7.38	0.543	5.18	7.38	10	734
Pitch length	1870	1490	178	1600	22600	734
Comment length	190	533	0	62.5	10600	734
Tagline length	65	24.5	0	69	110	734
Title length	28.8	14.1	4	26	60	734

Source: Own Construction

Table 4 shows the success rate according to the terciles of the different university based entrepreneurial ecosystem indices. In the case of the differences we present the significance level (***,

**, and * denote significance at the 1%, 5%, and 10% levels, respectively) and t-statistics in parentheses. Results suggest that projects from a more complete UCEE could raise significantly more funds. The difference is only insignificant in the case of UCEE Index 2. These results are in line with our hypothesis, which states that there is a positive relationship between the success of crowdfunding projects and the completeness of the university based entrepreneurial ecosystems. Those higher education institutions which possess more functional attributes of the university centered entrepreneurial ecosystem can implement its university based crowdfunding platform more successfully.

Table 4: Success rate according to the different university based ecosystem indices

	UCEE Index 1 (sum, normalized, no ETO)	**UCEE Index 2 (sum, normalized, ETO)**	**UCEE Index 3 (product, normalized, ETO)**	**UCEE Index 4 (product, normalized, no ETO)**
Q1	0.446	0.468	0.439	0.446
Q2	0.525	0.672	0.613	0.525
Q3	0.671	0.501	0.588	0.671
Q3-Q1	0.225***	0.0337	0.149***	0.225***
	(5.3)	(0.797)	(3.43)	(5.3)

Source: own construction

Table 5 shows the probability of reaching the minimum funding requirement according to the different university based ecosystem indices. In the case of the differences we present the significance level (***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively) and proportion test statistics in parentheses. Results suggest that projects from a more complete UCEE have a higher probability to reach the minimum funding requirement. We can also interpret this result as proof of our university centered ecosystem concept.

Table 5: The probability of reaching the minimum funding requirement according to the different university based ecosystem

	UCEE Index 1 (sum, normalized, no ETO)	**UCEE Index 2 (sum, normalized, ETO)**	**UCEE Index 3 (product, normalized, ETO)**	**UCEE Index 4 (product, normalized, no ETO)**
Q1	0.661	0.653	0.649	0.661
Q2	0.747	0.845	0.812	0.747
Q3	0.848	0.758	0.795	0.848
Q3-Q1	0.187***	0.105**	0.146***	0.187***
	(23.1)	(6.5)	(13)	(23.1)

Source: Own Construction

Using our *linear regression* models with robust standard errors, we investigated whether there is a positive relation between the success rate and the UCEE indices. We used the combination of *Duration,*

Activity, Pitch_length, and *Creator_type* variables as control variables which explained the success of the projects according to the crowdfunding literature. We applied the natural logarithm of the Activity and Pitch length variables while the UCEE indices were normalized. Table 6 shows the results of the linear regression models.

Table 6 : Linear regression models.

	(1)	**(2)**	**(3)**	**(4)**
α	-0.001546	-0.022257	-0.078129	0.044219
	(0.216654)	(0.217447)	(0.213432)	(0.217319)
Ln (Activity)	0.152757***	0.153719***	0.165571***	0.154004***
	(0.013413)	(0.013437)	(0.013349)	(0.013444)
Duration	-0.004630***	-0.004682***	-0.004395***	-0.004643***
	(0.000526)	(0.000526)	(0.000519)	(0.000527)
Ln (Pitch Length)	-0.086912***	-0.083682***	-0.088092***	-0.087038***
	(0.027300)	(0.027279)	(0.026748)	(0.027422)
Team dummy	0.178078***	0.186131***	0.199621***	0.187807***
	(0.031217)	(0.031114)	(0.030590)	(0.031120)
UCEE Index 1 (sum, normalized, no ETO)	0.165468***			
	(0.055225)			
UCEE Index 2 (sum, normalized, ETO)		0.197637**		
		(0.077334)		
UCEE Index 3 (product, normalized, ETO)			0.594917***	
			(0.100507)	
UCEE Index 4 (product, normalized, no ETO				0.264452**
				(0.107508)
R^2	0.302397	0.300071	0.326252	0.299612
Adj. R^2	0.297599	0.295257	0.321619	0.294795
Num. obs.	733	733	733	733
***p < 0.01, **p < 0.05, *p < 0.1				

Source: Own Construction

Based on these results, we can claim that a more complete UCEE can improve the success rate of the projects significantly according to the different indices. The activity and the team dummy have a positive relation with the success rate. However, lower *Duration* and *Pitch length* also have a beneficial effect. We argue that higher education institutions with more functional attributes such as facilities and services, project related activities, shorter duration, concise pitch texts, and a strong team around the project appear the most prominent success factors in the case of the crowdfunding projects.

4.1. Robustness check

We also investigated the robustness of our results as we included the launch dates of the projects into our regression models. In Table 7 we present the results of the robustness check. The indices remained significant, and the results show that the success rate of the projects declined significantly in the cases of the projects which were founded between 2014 and 2016 compared to those projects which were founded in 2012. We explain this result with the growing number of crowdfunding projects.

Table 7: Robustness of the results - Source: Own Construction

	(5)	**(6)**	**(7)**	**(8)**
(Intercept)	0.154427	0.143394	0.102877	0.197138
	(0.219634)	(0.220144)	(0.216309)	(0.220122)
Ln (Activity)	0.141908***	0.142760***	0.150580***	0.142363***
	(0.014807)	(0.014826)	(0.014631)	(0.014817)
Duration	-0.004526***	-0.004577***	-0.004349***	-0.004540***
	(0.000521)	(0.000521)	(0.000513)	(0.000521)
Ln (Pitch length)	-0.051234*	-0.047777*	-0.049836*	-0.049777*
	(0.028775)	(0.028728)	(0.028157)	(0.028769)
Team dummy	0.164538***	0.171519***	0.186571***	0.172975***
	(0.030760)	(0.030672)	(0.030235)	(0.030653)
D2013	-0.118921	-0.139608	-0.140289	-0.126557
	(0.098047)	(0.097933)	(0.096198)	(0.097982)
D2014	-0.364511***	-0.375744***	-0.367039***	-0.370143***
	(0.080855)	(0.080790)	(0.079372)	(0.080817)
D2015	-0.392764***	-0.403229***	-0.400165***	-0.406554***
	(0.077366)	(0.077284)	(0.075891)	(0.077201)
D2016	-0.296155***	-0.306119***	-0.323118***	-0.304775***
	(0.078556)	(0.078623)	(0.077301)	(0.078569)
D2017	-0.007162	-0.039734	-0.054257	-0.074490
	(0.292876)	(0.292440)	(0.285833)	(0.290984)
UCEE Index 1 (sum, normalized, no ETO)	0.147158***			
	(0.054746)			
UCEE Index 2 (sum, normalized, ETO)		0.172967**		
		(0.076425)		
UCEE Index 3 (product, normalized, ETO)			0.560093***	
			(0.099687)	
UCEE Index 4 (product, normalized, no ETO)				0.258907**
				(0.105558)
R^2	0.339509	0.337599	0.338412	0.360845
Adj. R^2	0.330361	0.328424	0.329249	0.351992
Num. obs.	733	733	733	733

***p < 0.01, **p < 0.05, *p < 0.1

5. Conclusion

Overall, evidence suggests that successful implementation of a university based crowdfunding platform is dependent upon the completeness of the university centered ecosystems. University based crowdfunding appears as a functional attribute of the UCEE concept which enables entrepreneurial initiatives to raise funding and to seek validation from the crowd in the local environment. There is a bilateral interaction between the functional attributes of the UCEE. Thus, we can consider successful university based crowdfunding projects as a desired output of the university centered entrepreneurial ecosystem development.

We showed that university based crowdfunding has become more and more popular in recent years, but with the growing number of university based crowdfunding projects the probability of success declined. We presented evidence that the probability of success and the success rate increases if the UCCE of a higher education institution is more complete. Our main finding suggests that there is a positive relationship between the success of the university based crowdfunding projects and the completeness of the university centered entrepreneurial ecosystems. This result strengthens our assumption that only the completeness of the functional attributes can generate such synergies which can contribute to the successful implementation of a university based crowdfunding platform. We found that the completeness of the UCEE, project related activities, shorter duration, concise pitch texts, and a strong team around the project are the most prominent success factors of the university based crowdfunding projects.

Acknowledgement

We thank Virginia Balogh (University of Pécs) for her assistance in data construction and Molly E. Craver (Ohio University) for her comments that greatly improved the manuscript.

Funding:

This publication/research has been supported by the European Union and Hungary and co-financed by the European Social Fund through the project EFOP-3.6.2-16-2017-00017, titled "Sustainable, intelligent and inclusive regional and city models".

The research was financed by the Higher Education Institutional Excellence Programme of the Ministry for Innovation and Technology in Hungary, within the framework of the 4th thematic programme "Enhancing the Role of Domestic Companies in the Reindustrialization of Hungary" of the University of Pécs".

Declarations

Conflicts of interest/Competing interests: Not applicable

Availability of data and material: Data available from Hubbub.net

Code availability: R, custom code is available by request or to the journal

Authors' Contributions: Not applicable

JEL Classification: L26, M13, O35

References

Agrawal, A., Catalini, C. & Goldfarb, A., 2015, Slack Time and Innovation. SSRN Electronic Journal. http://dx.doi.org/10.2139/ssrn.2599004

Alvedalen, J. & Boschma, R., 2017, A critical review of entrepreneurial ecosystems research: towards a future research agenda. European Planning Studies, 25(6), pp.887–903. http://dx.doi.org/10.1080/09654313.2017.1299694

Audretsch, D. B., Falck, O., Feldman, M. P., & Heblich, S., 2012, Local Entrepreneurship in Context. Regional Studies, 46(3), pp.379–389.
http://dx.doi.org/10.1080/00343404.2010.490209

Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M., 2014, Entrepreneurial innovation: The importance of context. Research Policy, 43(7), pp.1097–1108.
http://dx.doi.org/10.1016/j.respol.2014.01.015

Baskerville, R.F. & Cordery, C.J., 2014, Crowdfunding: A Threat or Opportunity for University Research Funding? SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.2458638

Bedő, Zs., Erdős, K., Pittaway, L., 2019, University-Centered Entrepreneurial Ecosystem: A Conceptual Framework. Working Paper Series, Faculty of Business and Economics, University of Pecs,
https://journals.lib.pte.hu/index.php/workingpapers/issue/view/18

Carayannis, E. G. & Campbell, D. F. J., 2012, Mode 3 Knowledge Production in Quadruple Helix Innovation Systems. 21st-Century Democracy, Innovation, and Entrepreneurship for Development. New York, Springer. 63 p.

Clark, B. R., 1998, Creating entrepreneurial universities: organizational pathways of transformation. Oxford: Pergamon, IAU Press. 163 p.

Clarysse, B., Wright, M., Lockett, A., Mustar, P., & Knockaert, M., 2007, Academic spin-offs, formal technology transfer and capital raising. Industrial and Corporate Change, 16(4), pp.609–640.
http://dx.doi.org/10.1093/icc/dtm019

Courtney, C., Dutta, S. & Li, Y., 2016, Resolving Information Asymmetry: Signaling, Endorsement, and Crowdfunding Success. Entrepreneurship Theory and Practice, 41(2), pp.265–290.
http://dx.doi.org/10.1111/etap.12267

Etzkowitz, H., 1998, The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. Research Policy, 27(8), pp.823–833.
http://dx.doi.org/10.1016/s0048-7333(98)00093-6

Etzkowitz, H. ,2003a, Innovation in innovation: The triple-helix of university-industry-government relations. Social Science Information. 42(3), 293–337.
Etzkowitz, H., 2003b, Research groups as “quasi-firms”: the invention of the entrepreneurial university. Research Policy, 32(1), pp.109–121.
http://dx.doi.org/10.1016/s0048-7333(02)00009-4

Etzkowitz, H., 2008, The Triple Helix: University-Industry Government Innovation in Action. New York: Routledge. 164 p.

Etzkowitz, H. et al., 2000, The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. Research Policy, 29(2), pp.313–330.
http://dx.doi.org/10.1016/s0048-7333(99)00069-4

Feld, B., 2012, Startup Communities: Building and Entrepreneurial Ecosystem in your City, Hoboken, NJ: John Wiley and Sons Inc.

Feldman, M. & Zoller, T.D., 2012, Dealmakers in Place: Social Capital Connections in Regional Entrepreneurial Economies. Regional Studies, 46(1), pp.23–37.
http://dx.doi.org/10.1080/00343404.2011.607808.

Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., Nauwealers, C. & Ortega-Argilés, R. ,2012, Guide for Research Innovation Strategies for Smart Specializations (RIS3). European Commission

Frydrych, D., Bock, A. J., Kinder, T., & Koeck, B., 2014, Exploring entrepreneurial legitimacy in reward-based crowdfunding. Venture Capital, 16(3), pp.247–269.
http://dx.doi.org/10.1080/13691066.2014.916512

Gafni, H., Marom, D. & Sade, O., 2018, Are the life and death of an early-stage venture indeed in the power of the tongue? Lessons from online crowdfunding pitches. Strategic Entrepreneurship Journal, 13(1), pp.3–23.
http://dx.doi.org/10.1002/sej.1293

Goldstein, H.A., 2008, The "entrepreneurial turn" and regional economic development mission of universities. The Annals of Regional Science, 44(1), pp.83–109.
http://dx.doi.org/10.1007/s00168-008-0241-z

Goldstein, H. A., 2009, What we know and what we don't know about the regional economic impacts of universities. In: Varga, A. (ed.): Universities, Knowledge Transfer and Regional Development: Geography, Entrepreneurship and Policy. Cheltenham, UK; Northampton, MA, USA: Edward Elgar. 11–35.

Isenberg, D. J., 2010, The big idea: how to start an entrepreneurial revolution. Harvard Business Review 88 (6): 40–50

Koch, Jascha-Alexander, 2016, The Phenomenon of Project Overfunding on Online Crowdfunding Platforms – Analyzing the Drivers of Overfunding (April 4, 2016). Proceedings of the 24th European Conference on Information Systems (ECIS 2016); Istanbul, Turkey 2016.
https://ssrn.com/abstract=2808427

Kuppuswamy, V. & Bayus, B.L., 2013, Crowdfunding Creative Ideas: The Dynamics of Project Backers in Kickstarter. SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.2234765

Lin, T.-C. & Pursiainen, V., 2017, Fund What You Trust? Social Capital and Moral Hazard in Crowdfunding. SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.3088905

Lu, C.-T., Xie, S., Kong, X., & Yu, P. S., 2014, Inferring the impacts of social media on crowdfunding. Proceedings of the 7th ACM international conference on Web search and data mining - WSDM '14.
http://dx.doi.org/10.1145/2556195.2556251

Miller, D.J. & Acs, Z.J., 2017, The campus as entrepreneurial ecosystem: the University of Chicago. Small Business Economics, 49(1), pp.75–95.
http://dx.doi.org/10.1007/s11187-017-9868-4

Mukherjee, A., Yang, C. L., Xiao, P., & Chattopadhyay, A. , 2017, Does the Crowd Support Innovation? Innovation Claims and Success on Kickstarter. SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.3003283

Nitani, M. & Riding, A., 2017, On Crowdfunding Success: Firm and Owner Attributes and Social Networking. SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.2945081

Owen-Smith, J. – Powell, W. W., 2001, To Patent or Not: Faculty Decisions and Institutional Success at Technology Transfer. Journal of Technology Transfer 26(1–2), 99–114.

Pittaway, L., Gazzard, J., Shore, A. and Williamson, T. 2015, Student clubs: experiences in entrepreneurial learning. Entrepreneurship & Regional Development 27 (3–4): 127–153, http://dx.doi.org/10.1080/08985626.2015.1014865

Qian, H., 2018, Knowledge-Based Regional Economic Development: A Synthetic Review of Knowledge Spillovers, Entrepreneurship, and Entrepreneurial Ecosystems. Economic Development Quarterly, 32(2), pp.163–176.
http://dx.doi.org/10.1177/0891242418760981
Roundy, P.T., 2016, Start-up Community Narratives: The Discursive Construction of Entrepreneurial Ecosystems. The Journal of Entrepreneurship, 25(2), pp.232–248.
http://dx.doi.org/10.1177/0971355716650373

Sayedi, A. & Baghaie, M., 2017, Crowdfunding as a Marketing Tool. SSRN Electronic Journal.
http://dx.doi.org/10.2139/ssrn.2938183

Spigel, B., 2017, The Relational Organization of Entrepreneurial Ecosystems. Entrepreneurship Theory and Practice, 41(1), pp.49–72.
http://dx.doi.org/10.1111/etap.12167

Stam, E., 2015, Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. European Planning Studies, 23(9), pp.1759–1769.
http://dx.doi.org/10.1080/09654313.2015.1061484

Stam, E. & Spigel B., 2016, Entrepreneurial ecosystems." U.S.E. Discussion paper series, 16(13)
https://dspace.library.uu.nl/handle/1874/347982

Strausz, R., 2017, A Theory of Crowdfunding: A Mechanism Design Approach with Demand Uncertainty and Moral Hazard. American Economic Review, 107(6), pp.1430–1476.
http://dx.doi.org/10.1257/aer.20151700

Vismara, S., 2018, Signaling to Overcome Inefficiencies in Crowdfunding Markets. The Economics of Crowdfunding, pp.29–56.
http://dx.doi.org/10.1007/978-3-319-66119-3_3

Wang, N. et al., 2018, Understanding the importance of interaction between creators and backers in crowdfunding success. Electronic Commerce Research and Applications, 27, pp.106–117.
http://dx.doi.org/10.1016/j.elerap.2017.12.004.

Wieck, E., Bretschneider, U. & Leimeister, J.M., 2013, Funding from the Crowd: an internet-based crowdfunding platform to support business set-ups from universities. International Journal of Cooperative Information Systems, 22(03), p.1340007.
http://dx.doi.org/10.1142/s0218843013400078.

Ákos TÓTH-PAJOR

Ákos Tóth-Pajor graduated in 2013 at the University of Pécs Faculty of Business and Economics from the Finance MSc program. He continued his studies at the Doctoral School of Business Administration at the University of Pécs. He currently works as an assistant lecturer at the University of Pécs Faculty of Business and Economics Department of Finance and Accounting. His research interests include capital allocation decisions, intertemporal choice and investment decisions.

Miklós HORNYÁK

Miklós Hornyák obtained a degree in GIS engineer at the Technical University of Budapest, in 2000. He holds a PhD in Economics from the University of Pécs (2019). After graduation Miklós worked as independent IT consultant for 15 years. From 2015 he works as an assistant lecturer and from 2020 as assistant professor in the Department of Management Science. His research interests include using data and textmining, GIS, big data and AI in competitiveness and regional field.

Mónika KUTI

Mónika Kuti is an associate professor in corporate finance at the Department of Finance and Accounting at the Faculty of Business and Economics, the University of Pécs. She is editorial board member at Pénzügyi Szemle (Financial Review). Her research field is financial innovation.

Zsolt BEDŐ

Zsolt Bedo is the director of innovation at the Faculty of Business and Economics at the University of Pecs. His field of expertise is the university centered entrepreneurial ecosystems. He received PhD in the theme of corporate governance, his Habilitation theme was entrepreneurial ecosystems. He is consultant and mentor to startup companies initiated within and outside of universities.