

# Open Data Hackathons: An Innovative Strategy to Enhance Entrepreneurial Intention

Fotis Kitsios, Maria Kamariotou

Department of Applied Informatics, University of Macedonia, Thessaloniki, Greece

## Abstract

**Purpose:** In terms of entrepreneurship, open data benefits include economic growth, innovation, empowerment and new or improved products and services. Hackathons encourage the development of new applications using open data and the creation of startups based on these applications. Researchers focus on factors that affect nascent entrepreneurs' decision to create a startup but researches in the field of open data hackathons have not been fully investigated yet. This paper aims to suggest a model that incorporates factors that affect the decision of establishing a startup by developers who have participated in open data hackathons.

**Design:** 70 papers were examined and analysed using a three phased literature review methodology which was suggested by Webster and Watson, (2002). The determinants that lead to their decision come of a set of variables, have been investigated by previous research and affect a nascent entrepreneur to create a startup.

**Findings:** Eventually, by identifying the motivations for developers to participate in a hackathon, and understanding the benefits of the use of open data, researchers will be able to elaborate the proposed model and evaluate if the contest has contributed to the decision of establish a startup and what the factors that affect the decision to establish a startup apply to open data developers, and if the participants of the contest agree with these factors.

**Originality:** The paper expands the scope of open data research on entrepreneurship field, stating the need for more research to be conducted regarding the open data in entrepreneurship through hackathons.

**Keywords:** open data; startup; entrepreneurship; innovation competitions; hackathons

## Introduction

Startups play a key role in innovation processes and open innovation approach is wide spread. Companies search for new innovation models in order to improve competitive advantage and performance. Nowadays new ventures use new technologies in order to create new business models, and increase profitability and competitiveness (Alberti and Pizzurno, 2017; Conradie and Choenni, 2014; Li *et al.*, 2016). In terms of entrepreneurship, an entrepreneur plays his role by doing new things or doing things

that have already been done in a new and innovative way. Thus, he tends to accept changes and be more innovative. Entrepreneurs help to the increase of the economic performance by adding innovations, making easier the technological progress easier and causing change (Moghavvemi *et al.*, 2016).

Open data is a new and innovative way which can contribute to economic performance, innovation and entrepreneurship. Benefits using open data involve economic growth, innovation, empowerment as well as new or improved products and services (Juell-Skielse *et al.*, 2014; Zuiderwijk *et al.*, 2015). Open data may help existing businesses to create opportunities with visualization that maintains the better utilization of data. Costs can be reduced, as data are free to use. Visualization may also maintain the creation of innovative applications and use of data. Also, it may support the development of open data that are based on applications, which is something that motivates developers to build open source software for further distribution. Furthermore, it supports the handling of the free and easily available data and the availability of benchmarking data as well. In the future, a growing amount of services will be accommodated and applications will be created based on open data (Schmidt *et al.*, 2016).

Open data and hackathons are new and important research areas. Developers have created the application in hackathons using open data, so they can reduce the cost of the development of their applications and organizers provide the necessary resources to them. As far as developers have created their applications they could expand it to a new startup because they have the support of organizers and they can be more easily networked. So, they have the resources that they need. Hackathons is an opportunity to increase the growth of entrepreneurship. Startups collaborate with external partners in order to increase the generation of new ideas, and thus participants in hackathons have this opportunity (Zhao *et al.*, 2016). Johnson and Robinson (2014) indicate that participants who have been involved in a hackathon and have developed an application could make a decision for future development. However, in the longer term until research is conducted, it is ambiguous whether the outcomes of an open data competition will have long-term impacts. Researches in this field can provide guidelines to organizers in order to strengthen the hosting of hackathons and promote entrepreneurship. Also, results can provide conclusions about how organizers, entrepreneurs, universities and other communities that can support developers to create new startups. It is important to examine if the factors which affect the creation of a startup affect the decision of developers who participate to hackathons to create a startup based on their applications.

In entrepreneurship field, various researchers have surveyed entrepreneurs' technology acceptance. The issue of innovation adoption and usage is a significant research question (Moghavvemi *et al.*, 2016). As open data is a new technological research area it is important to investigate the relationship between entrepreneurship and open data because entrepreneurs are creative and they intend to develop innovative services and products. The main question of entrepreneurship research is to explain why some individuals start a new venture, whereas others do not (Zapkau *et al.*, 2017). Despite the fact that researchers have surveyed theories and models which investigate the impact of Information Technology on entrepreneurs' behavior, the surveys which regard on the link between open data and entrepreneurship are limited. However, prior studies explored the process nature of new venture formation in which individual differences may influence different aspects of venture formation over time. Researchers offered a comprehensive understanding of the factors which affect both the entrepreneurial intention and

entrepreneurial behaviour (Carlos Pinho and Sampaio de Sá, 2014; Chorev and Anderson, 2006; Eveleens *et al.*, 2017; Groenewegen and de Langen, 2012; Lasch *et al.*, 2007; Song *et al.*, 2008; Van Gelderen *et al.*, 2006; Zhou *et al.*, 2015; Zhu *et al.*, 2017). But knowledge regarding how nascent entrepreneurs can be influenced by the use of open data is still limited. Consequently, previous researches in terms of the motivation of developers to participate in open data contests, as well as the understanding of benefits and challenges deriving from using open data are limited. Previous researchers only describe the activities which organize the contest (Grabowski *et al.*, 2015; Lee *et al.*, 2015; Rosell *et al.*, 2014). Other researchers discuss the output of a hackathon, such as an application or device (Komssi *et al.*, 2015; Rosell *et al.*, 2014). So the motivations and the understanding of the significance of open data and the benefits of their use have to be further investigated empirically. Furthermore, researches focus on factors that affect nascent entrepreneurs' decision to create a startup but researchers in the field of open data hackathons have not been investigated yet. So there are not conclusions about the enhancement of entrepreneurship through the hosting of hackathons and contests. Also, the developers' decision to continue or to abandon the application has to be further examined.

This study proposes a framework which suggests the factors that affect the decision of a nascent entrepreneur who participated in a hackathon to establish a startup. The specific model is based on previous literature on open data and entrepreneurship and examines factors that are related to motivations concerning participation in hackathons. It is based on the benefits of the use of open data and factors that are related with the nascent entrepreneur. This study directs the gap in the literature regarding the relation between open data hackathons and entrepreneurship and concurs to the development of a new successful startup. The paper conduces to entrepreneurship literature in terms of recommending a model that takes into consideration the factors which affect the decision of a nascent entrepreneur to establish a startup through their participation in open data hackathons.

The structure of this paper is as following: after a brief introduction to open data hackathons and entrepreneurship, the challenges of entrepreneurship related with developers from open data are discussed and the need for an approach based on this link is presented. Next section includes the description and the implementation of the literature review methodology which was followed in order to highlight the issues which are discussed in this paper. Then a theoretical framework is analyzed based on the literature review about open data hackathons and factors that affect the decision of nascent entrepreneur to establish a startup. Next section, suggests a conceptual framework based not only on the open data and entrepreneurship approach but also on the recommended methods for investigating the factors of the model, whereas the final section concludes the paper.

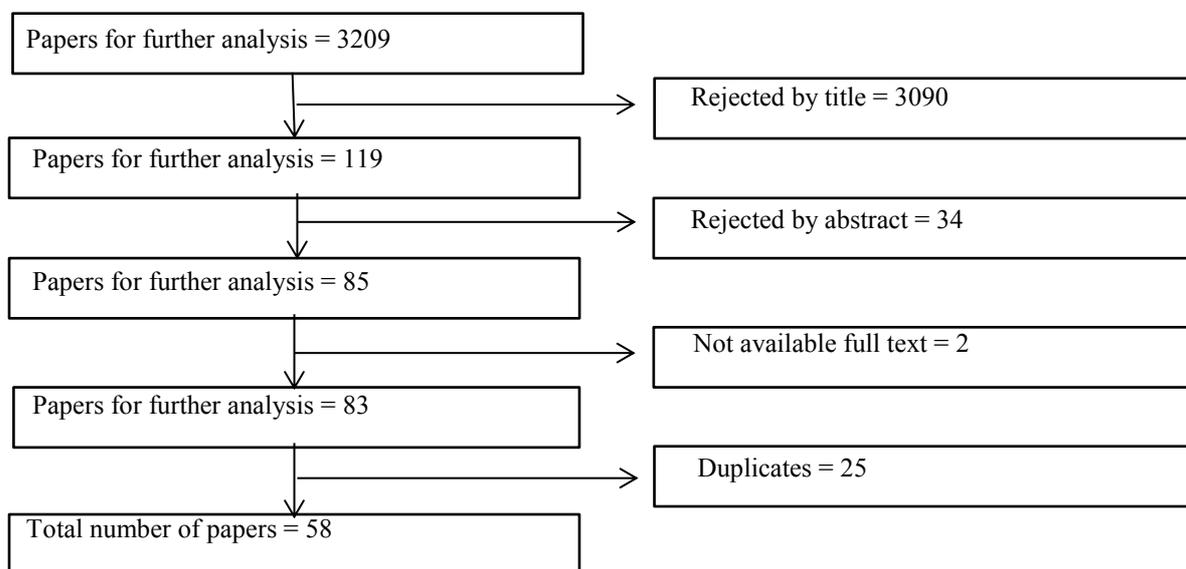
## **Literature review methodology**

In this study the methodology of literature review suggested by Webster and Watson (2002) was used in order to search and analyse the relevant studies. This methodology was used by many researchers in the field of Information Technology and Management (Chen *et al.*, 2010, Jourdan *et al.*, 2008, Kamariotou and Kitsios, 2017; Kitsios and Kamariotou, 2016; Piccoli and Ives, 2005). Three steps are suggested by this methodology of literature review to achieve effective implementation of the above. These steps

named; search, in which the definition of keywords and databases, and the selection of individual topics is analysed, the "backward search" and finally the "forward search" (Webster and Watson, 2002). Databases are Scopus, Science Direct, Web of Science and ABI/INFORM and searching was done using a combination of keywords "open data literature review", "open data and use", "open data and impact", "open data and benefits", "hackathons", "entrepre\* and success factors". Articles are only in English and are published in scientific journals or conferences, not in books.

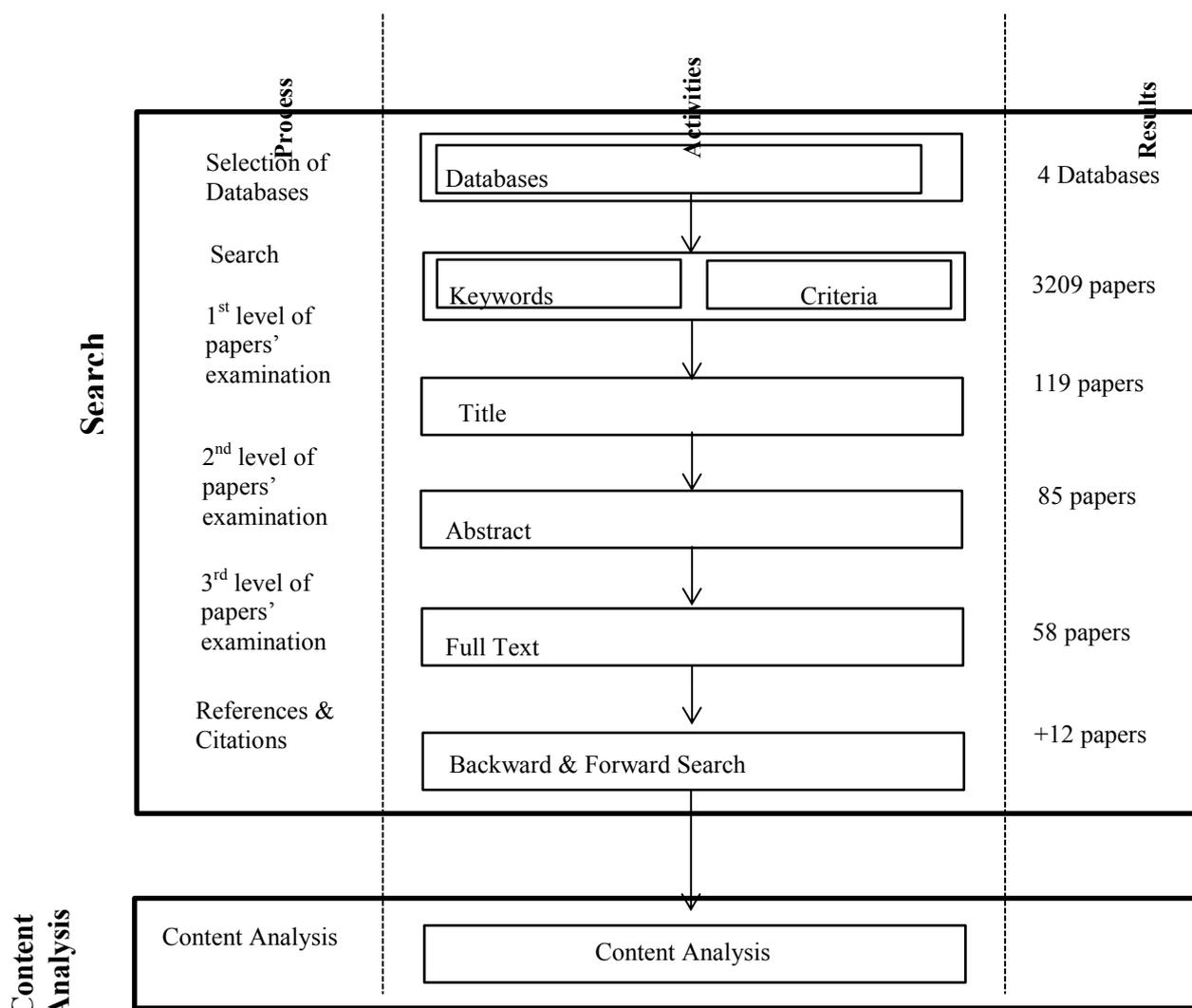
In Figure 1, the selection process of the relevant articles is shown. Having searched all databases there has been a total outcome of 3209 articles. The titles and abstracts of the publications were scanned and 119 articles were selected for further analysis according to their titles. Scanning their abstracts only 85 were selected for further analysis. Unfortunately, full texts could not be accessed for all of them, reducing the sample to 83. 25 of them were duplicated in all databases, so they were excluded.

**Figure. 1. Article selection process I.**



In Figure 2, the second and the third phase of the selection process of relevant articles are shown. The citations and references of the residual articles were then reviewed, identifying another 12 potentially relevant articles, which resulted in a final sample of 70 articles. Search was completed when resulted in common articles from all databases and different combinations of keywords. It was then that the critical mass of relevant literature sources was considered as having been collected.

**Figure. 2. Article selection process II.**



Papers were classified in three basic concepts which are open data, hackathons, developers and entrepreneurship. Concepts “open data” and “entrepreneurship” have been investigated by many researchers. There is a lack of researches that link open data with hackathons or hackathons with entrepreneurship. The reason is that hackathons is a new concept and researchers are still trying to focus on this area. Open data have been investigated since 2008 but entrepreneurship has been investigated since 1985. So the research gap which this study is trying to bridge is confirmed.

## Theoretical framework

### *Open Data*

Open data are freely accessible online, available to be reused without barriers due to technical constraints and they are provided under open access allowance that permits the data to be reused without constructions (Jetzek *et al.*, 2014; Kassen, 2013, Meijer *et al.*, 2014). Open data develop an ecosystem, which represents the relationship among government, innovators and citizens, which is also included within the external environment of the economy, legal system, and policy expertise. The open

government ecosystem includes interactions between government and innovators from technology sectors, private industry, and academic institutions in order to transform the form of new data standards, to investigate in new designs of information systems and new technology platforms that allow the development of information or technology resources for the future.

The main stakeholders involved in open data processes are data providers, open data legislators, open data facilitators and many different kinds of open data users, such as citizens, researchers, journalists, developers, entrepreneurs and academics. These stakeholders have various interests and these interests may conflict (Zuiderwijk *et al.*, 2015). A good government aims to interact with the open government ecosystem. These interactions are among government and users or citizens, business, and civil sector organizations. Other interactions are mentioned among public managers and citizens, civil society organizations and businesses that enable government to discover what types of government data and information is needed and what data or government information services count as transparency. In this effort, open government ecosystem also engages users and entrepreneurs who approach government data in view of the business opportunities they impersonate.

The releasement of open data has two main advantages. The first concerns the increased participation of citizens in government, the transparency and improvement of decision-making and the comprehension of smarter government tactics through data. The second advantage is the releasement of data by enterprises in order to develop innovative applications (Conradie and Choenni, 2014). Supporters of open data assume that the knowledge and innovation will be raised when scientists, entrepreneurs, citizens share data. In order to achieve this, governments have the obligation to make data available without costs (Harrison *et al.*, 2012). Another way with actors to be informed about the use of open data is by organizing hackathons, workshops and conferences (Zuiderwijk *et al.*, 2015).

In terms of businesses, open data benefits can be economic growth, innovation, empowerment and new or improved products and services (Zuiderwijk *et al.*, 2015). Open data may support existing business opportunities with visualization that supports the better utilization of data, and the decrease of costs because the data are free to use. Furthermore, open data contribute to the development of innovative applications and use of data, the development of open data that are based on applications and encourages developers to build open source software for further distribution, the data handling itself, the free and easily available data and the availability of benchmarking. Johnson and Robinson (2014) when describing the benefits of open data in various civic hackathons in several countries, they refer that open data enhances transparency, accountability and reuse of public information for social purposes and public interest.

P1: The benefits of the usage of open data increase the motivation of developers to participate in hackathons.

On the other hand, researchers define barriers and challenges that incommode the use of open data. The barriers were distributed into ten categories, named; availability and access, findability, usability, understandability, quality, linking and combining data, comparability and compatibility, metadata, interaction with the data provider and opening and uploading (Janssen *et al.*, 2012; Zuiderwijk *et al.*,

2015). Other barriers are related to technical issues, privacy or law (Conradie and Choenni, 2014). Challenges and problems may arise due to the capability of users and application developers to recognize the opportunities related to open data, unfamiliar business idea in order to use data to create new business, lack of technical readiness to use data sources due to complex data format or interfaces, weakness to derive appropriate data sources for application aims, inadequate availability of regional data sources for developing applications for local services, unclear licensing of open data, legal issues related to data that are not ceremoniously open by decision of owner, technical limitations related to data publishing platforms, guarantee of quality and reliability of data, lack of local data and usefulness of open data (Jaakkola *et al.*, 2014). Education, experience from users, citizens and enterprises and support from government are essential in order to use open data (Pope and Greene, 2003).

P2: The barriers of the usage of open data have a negative impact on participation to hackathons.

P3: The easily access to open data sources enhances the participation in hackathons.

In order to increase the exertion of open data by the public, institutions distribute open data to mobile and web applications that present useful content based on assembled and synthesized open data for easy use (Mutuku and Mahihu, 2014). In the future, it is estimated that an increasing amount of services and applications will be developed based on open data (Schmidt *et al.*, 2016).

### *Success factors for entrepreneurial intention*

The establishment of a new startup entails many difficulties. Factors which are related to the success of startups concern the characteristics of the process, the individual (characteristics of the entrepreneur involved in the process), the environment (factors affecting the entrepreneurial process), and the organization (characteristics of the new startup) (Zapkau *et al.*, 2017). Activities involved in starting a business are related to gathering market information, estimating potential profits, finishing the groundwork for the new business, structuring the business, and setting up business operations (Zapkau *et al.*, 2017). In entrepreneurship research, a major topic is the recognition of factors that contribute to the development of a new business (Harms *et al.*, 2007).

Previous studies have examined the significance of various demographic variables such as personality, human capital and ethnic origin, marital status, education levels, family size, employment status and experience, age, ethnicity, gender, socio-economic status, religion and personality traits, political, social and economic environment (Zapkau *et al.*, 2017). Businesses that belong to younger women usually have difficulty in securing financial resources because of the woman's age, which accouters an inadequate guarantee to investors (Mas-Tur *et al.*, 2015). Literature on success factors of new firms put two critical success factors forward specifically: human capital of the entrepreneur and the initial organizational setup of the new firm. In these factors Waters *et al.* (2002) add mentoring. Mentors will provide higher levels of career related support than psychosocial support. Another important factor is strategy and organizational structure (LeBrasseur *et al.*, 2003). The novice entrepreneur has to choose the type of the strategy which the new startup will follow and the organizational structure in order to facilitate the process of decision making. The product that should provide a complete solution and has to meet real needs and provide good

quality, the communication between R&D and marketing which should be monitored and fostered and strategic alliances with key customers in order to entry to new markets and promote the product equally are key factors in achieving positive results (Chorev and Anderson, 2006). Product innovation, competition intensity, environmental dynamism, environmental heterogeneity, marketing experience, financial resources, low cost strategy, R&D investments, and university partnerships are also factors proposed by Song et al. (2008). These factors are related to the factors that have been proposed by Chorev and Anderson (2006) because they present a holistic dimension of the strategic analysis and promotion of the new product of the startup. The nascent entrepreneur analyzes the internal and external environment, he chooses the target group of the product and he selects the suitable strategy. R&D and Marketing capabilities promote the new product and enhance the strategic alliances with key customers. In this view, an innovative new idea of the new product is needed (Kokfai *et al.*, 2015).

Another important factor is the use of networks to access information, ideas and opportunities (Tello *et al.*, 2012). Social and business networks also play an important role in the entrepreneurial process. The social networking dimension means that a new entrepreneur is linked to other people and organisations and these links may provide access to resources that may establish a new startup (Breschi *et al.*, 2014; Carlos Pinho and Sampaio de Sá, 2014; Estay *et al.*, 2013; Li *et al.*, 2016; Van Gelderen *et al.*, 2005).

Another important factor is the entrepreneur's experience which determines the selection of opportunities to investigate, aim at and carry on in case of uncertainty. This will be achieved by knowledge gained through learning about the business and its environment, such as from industry experience. In this way, nascent entrepreneurs with industry experience are informed about the new business opportunity and processes, which limit the uncertainty of the venturing evaluation (Cassar, 2014).

Last, psychological factors contain need for achievement, locus of control, low risk-taking, human capital, problem-solving orientation, assertiveness, interpersonal reactivity, self-leadership aimed at maintaining a positive attitude and persistence (Fisher *et al.*, 2014). Personal attitude and perceived behavioral control are added in these factors by Hui-Chen et al. (2014).

Chattopadhyay and Ghosh (2008) analyze four significant factors named, social capital, support from family, education and experience. Their survey in 217 entrepreneurs shows that the factors are classified in six categories. The first category includes factors related to demographic characteristics such as age, gender, education, ethnic background, and nationality. The second category includes factors related to personal characteristics, such as technical expertise, managerial experience, and entrepreneurial experience. The third category includes factors related to personality trait, such as the need for achievement, locus of control, risk-taking, tolerance of ambiguity, and need for independence. The fourth category includes social factors, such as parental role model, cultural role models, family support, and community support. The fifth category includes cultural factors, such as individualism-collectivism, uncertainty avoidance, and materialism. The last category includes factors related to confucian dynamism and environmental factors, such as economic resources, lack of employment opportunities and political climate.

On the other hand, a survey by Hansemark (2013) at 91 entrepreneurs did not confirm the hypothesis that need for achievement and locus of control predict the entrepreneurial activity in the beginning of a new business. The success will be achieved, if the entrepreneur it is supported by others. For example, the family network increases success. Especially during the startup phase, unpaid work by family members can indemnify for financial restrictions, social network or lacking other basic resources, such as human capital and financial capital (Eveleens *et al.*, 2017; Zhu *et al.*, 2017).

Strategic entrepreneurial capability is an important component of the establishment of a startup. The concept “capability” highlights the role of strategic management in consolidating, appropriately controlling, and reconfiguring external and internal organizational resources and the capability to match the requirements of the changing environment (Kokfai *et al.*, 2015; Shan *et al.*, 2014). This capability is significant because the new entrepreneur has to select the appropriate strategy and make an analysis of the environment.

P4: Innovation influences the creation of startup.

P5: Human capital is associated with the creation of startup.

P6: Individual social capital is associated with the creation of startup.

P7: Experience is related to the creation of startup.

P8: Financial capital is related to the creation of startup.

P9: Personal attributes and ways of thinking and acting lead to the creation of startup.

P10: The environment surrounding the nascent venture is associated with the creation of startup.

P11: The gender of the entrepreneur influences the creation of startup.

P12: Education and training are related to the creation of startup.

P13: Need for Achievement and Locus of Control are associated to the creation of startup.

### *Innovation hackathons: process and motivations*

Governments ask to engage citizens and developers who build an application using open data promoted and distributed through contests. By organizing these contests, governments hope to inform about the importance and the use of open data while also encouraging the development of new applications. In spite of the rate of their popularity, contests and hackathons are a new phenomenon and surveys are limited. More attention should be given to these events. There is limited research highlighting the benefits of the contest or hackathon, for both sponsoring governments and hackathon participants. These hackathons are often combined with prize money for participants and they typically inform, promote and persuade public of the use of open data and their value. Hackathons display a specific challenge or topic (such as tourism), on which the sponsoring government aims to involve participants for the development of an application for public which will meet the market needs (Johnson and Robinson, 2014; Kamariotou and Kitsios, 2017). Therefore, the main challenge of organizing a competition or a hackathon is to persuade developers to provide innovative ideas, which can be transformed to applications for the public. Open

data contests or hackathons have the same purpose, but developers develop applications based on open data. So, governments are obligated to provide data free and easily.

Hackathon can be considered as an event where people come together in order to collaborate on developing and launching a new or finished application, which will solve public problems (Rosell *et al.*, 2014).

Training, fairness of the judgment system, collaboration and new knowledge are motivations regarding the participation in the contest (Rosell *et al.*, 2014). Fun and enjoyment, intellectual challenge, status and reputation, user need, professional and personal identity, autonomy, learning and skills development, money, extrinsic reciprocity, signaling and career Concerns act as a stimulus for developers to participate in the innovation contests (Juell-Skielse *et al.*, 2014). Motivations such as fun, learning and collaboration persuade developers to explore ideas that involve high market and technical uncertainties (Kitsios and Kamariotou, 2018; Kitsios *et al.*, 2017; Komssi *et al.*, 2015).

Johnson and Robinson (2014) noticed that previous competitions have engaged open data in order to learn new skills to participants and to develop innovative applications. In contrast, Juell-Skielse *et al.* (2014) indicated that the most important motivations for developers in the innovation contest “Travelhack 2013” were fun, intellectual challenge and status and reputation. Money scored low as motivational factor. However, Lee *et al.* (2015) conducted interviews in participants in 8 cities in Europe and concluded that contest organizers noticed that money would be a significant motivator for participants, providing a foundation for them to expand development of their applications. Juell-Skielse *et al.* (2014) in their survey in participants of open data competition, concluded that although more than 80 % of the teams planned to develop their service further, only one third had continued the development, after the competition. One possible explanation could be the organizers’ decision not to support any of the services after the contest. Lee *et al.* (2015) supported that as the organizers in open data competitions became more aware of developer motivations, as greater was the effort made to involve entrepreneurs and venture capitalists on the panels of judges. Furthermore, they hosted events and closing ceremonies that involved potential funders. Some developers found success through this model because they had the opportunity to discuss about their applications, to present them in real-time and to get funding.

Previous researches in what motivates the developers to participate in open data contests, as well as in the understanding of the benefits and challenges using open data are limited. Previous researchers only describe how to organize the contest (Grabowski *et al.*, 2015; Lee *et al.*, 2015; Rosell *et al.*, 2014). So the motivations and the understanding of the significance of open data and the benefits of their use have to be investigated more empirically. Also, whether the application should be continued or abandoned by the developers has to be further examined.

As it is mentioned above, studies to benefits and challenges using open data are limited . Hackathons are organized in order to inform and persuade developers to use open data and to develop applications based on data. Motivations and benefits support the decision to establish a startup. Developers have developed the application, organizers have supported them to find resources, to analyze the market and to complete their applications. So the establishment of a new startup is an opportunity for them.

Efforts made to urge open data in order to persuade potential users to be willing to use data. Social network such as friends, family and other people may influence developers to use open data. Effort expectancy concerns how easy the associated actor of open data ecosystem is with the use of technology and the extent to which someone believes that the use of the technology will be free. For example, the lack of user friendly interfaces to open data is believed to dissuade open data users. As businesses and public organizations do not distribute updated data in reused formats, developers are not able to use them in order to develop new applications. Furthermore, infrastructure and tool providers do not provide with the necessary tools to developers. Therefore, they do not have access to new technologies and they cannot develop user friendly interfaces in their applications. So, citizens do not appreciate the value of new applications. As a consequence, there may be significant differences with regard to the contents of open data because different actors are participated. The availability of open data technologies, such as open data platforms, software, tools and interfaces, increases an individual's or an organization's expectance to perform better. If networks, connection to internet, appropriate open data infrastructures are available, the intention to use open data will be increased. If actors do not have access to internet, government data and other required resources, it will be more difficult to be persuaded to use open data (Zuiderwijk *et al.*, 2015).

Businesses and other organizations should participate in hackathons and distribute free data to developers in order to help them to create new services for citizens. Also, developers can generate ideas for new services in order to increase firm performance and profitability. Other entities that participate in hackathons are sponsors who fund nascent entrepreneurs and support them to begin new startups. Finally, support services and consultancy or mentors support businesses to understand how open data can improve their companies are required in order to persuade them to open their data. Other entities in hackathons are marketplace providers who offer a marketplace in which applications and data driver services are available to be bought. Tool providers are responsible for offering tools to developers in order to create applications based on different user needs and implement and evaluate the application. Cloud service providers offer the physical facilities to the entities of the value network and gain revenues from the facilities' "rent" (Immonen *et al.*, 2014; Kitsios *et al.*, 2017; Lindman *et al.*, 2014).

P14: The motivation of the participation in open data contests/hackathons and the development of an application is positively related to the decision of establishing a startup.

Table 1 summarizes the suggested propositions regarding open data and factors which affect the creation of a new startup.

Table 1. Propositions

Propositions	References
P1: The benefits of the usage of open data increase the motivation of developers to participate in hackathons	Conradie and Choenni, 2014; Johnson and Robinson, 2014; Zuiderwijk <i>et al.</i> , 2015
P2: The barriers of the usage of open data have a negative impact on participation to hackathons	Jaakkola <i>et al.</i> , 2014 ; Janssen <i>et al.</i> , 2012; Zuiderwijk <i>et al.</i> , 2015
P3: The easily access to open data sources enhances the participation in hackathons	Conradie and Choenni, 2014; Jaakkola <i>et al.</i> , 2014
P4: Innovation influences the creation of startup	Chorev and Anderson, 2006; Song <i>et al.</i> , 2008

P5: Human capital is associated with the creation of startup	Eveleens <i>et al.</i> , 2017; Waters <i>et al.</i> , 2002; Zapkau <i>et al.</i> , 2017; Zhu <i>et al.</i> , 2017
P6: Individual social capital is associated with the creation of startup	Breschi <i>et al.</i> , 2014; Carlos Pinho and Sampaio de Sá, 2014; Chattopadhyay and Ghosh, 2008; Estay <i>et al.</i> , 2013; Li <i>et al.</i> , 2016; Van Gelderen <i>et al.</i> , 2005 ; Zapkau <i>et al.</i> , 2017
P7: Experience is related to the creation of startup	Chattopadhyay and Ghosh, 2008
P8: Financial capital is related to the creation of startup	Eveleens <i>et al.</i> , 2017; Zhu <i>et al.</i> , 2017
P9: Personal attributes and ways of thinking and acting lead to the creation of startup	Chattopadhyay and Ghosh, 2008; Zapkau <i>et al.</i> , 2017
P10: The environment surrounding the nascent venture is associated with the creation of startup	Zapkau <i>et al.</i> , 2017
P11: The gender of the entrepreneur influences the creation of startup	Zapkau <i>et al.</i> , 2017
P12: Education and training are related to the creation of startup	Chattopadhyay and Ghosh, 2008; Zapkau <i>et al.</i> , 2017
P13: Need for Achievement and Locus of Control are associated to the creation of startup	Chattopadhyay and Ghosh, 2008; Fisher <i>et al.</i> , 2014; Hansemark, 2013; Hui-Chen <i>et al.</i> , 2014
P14: The motivation of the participation in open data contests/hackathons and the development of an application are positively related to the decision of establishing a startup	Lee <i>et al.</i> , 2015

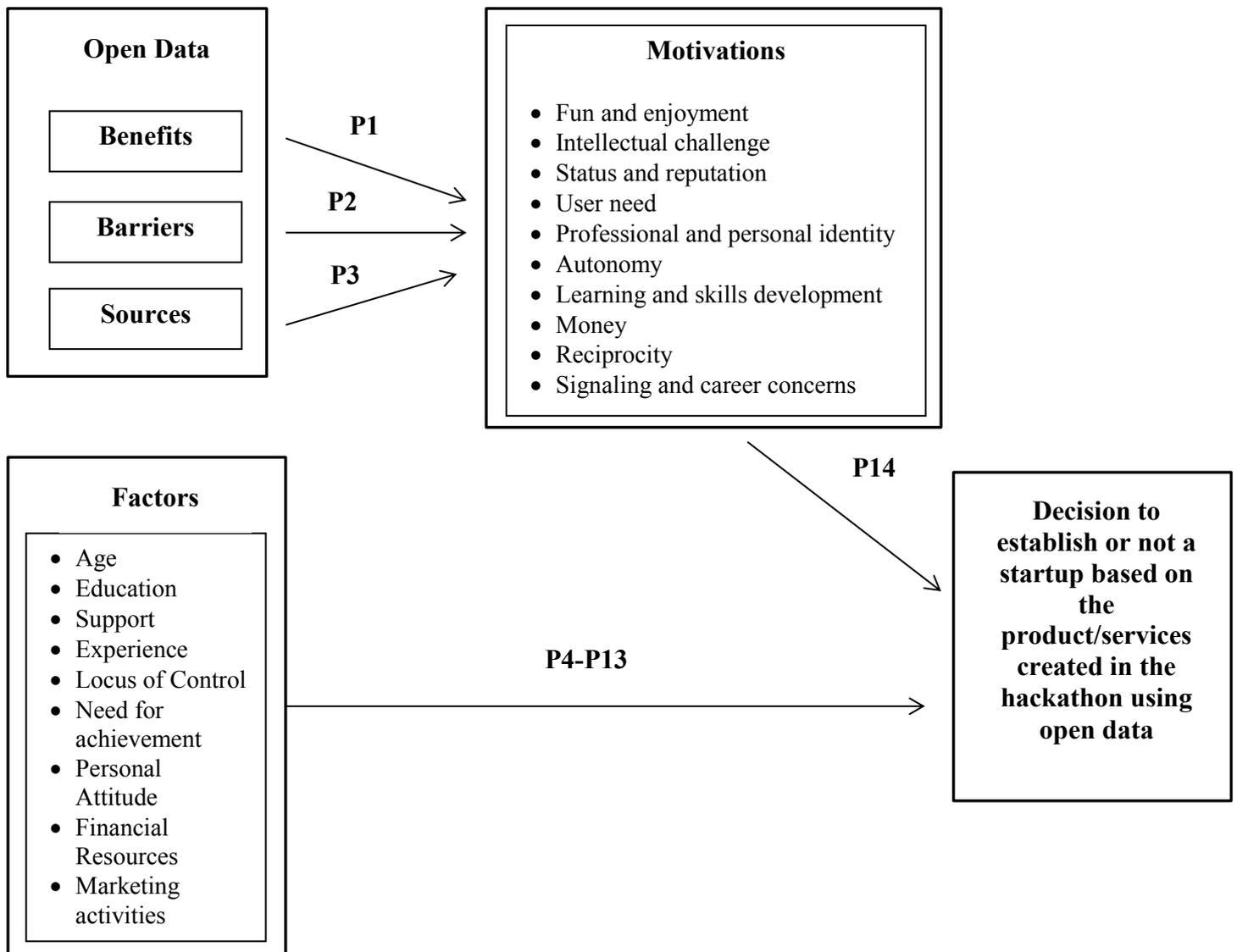
Regarding surveys that examine the relationship between open data with entrepreneurship, only Lakomaa and Kallberg (2013) show that 138 startups use open data to create a successful business plans. Zhou et al. (2015) conducted a survey in 200 new venture founding teams and the results show that one of the most significant factors which influence their decision to create a startup is the personality diversity which influences entrepreneurial team performance. Hackathons help nascent entrepreneurs to cooperate with other entrepreneurs and create their team. Furthermore, Chorev and Anderson (2006) and Kokfai et al. (2015) noticed that the value proposition of the product or service which will be developed is an important factor which influences the entrepreneurial decision. Hackathons gives them the opportunity to develop their application, to evaluate it and to decide if they could expand it and create a startup based on it. Moreover, Tello et al. (2012) indicated that the development of a product or service requires access to information. Open data provide free and easily accessed information which helps nascent entrepreneurs to develop their application and to expand it. They can have access to information they need in order to create a startup. Thus, it is necessary to develop a framework which will integrate the determinants and impacts of entrepreneurial decision.

## Proposed Conceptual Model

Figure 3 shows the proposed conceptual framework. This framework has been developed based on the existing literature. The purpose is to create a framework, which fulfils two important topics that their linkage constitutes a challenge for further investigation. Open data contests is a new research area and the main goals of these contests are to inform about open data, and motivate developers and public to use open data, by providing developers with the motivation to expand their applications and establish startups. Their participation in innovation contests is an opportunity for this effort and provides developers with the knowledge of how to find out the necessary resources and to meet individuals who

will support them.

**Figure 3. Proposed conceptual model**



The proposed conceptual framework examines the relations between the motivation, which is provided by hackathons to developers to establish a startup, and the impact of the factors that affect the decision to establish or to abandon a startup. Eventually, by identifying the motivations to participate in a hackathon, and understanding the benefits of the use of open data, researchers will be able to evaluate if the contest has contributed to the decision of establish a startup and what are the factors that affect developers to establish a startup, as well as if the participants of the contest agree with these factors.

Table 2 provides a description of the propositions and their explanation based on the existing literature.

Table 2. Variables and Definitions

Propositions/ Variables	Definitions	References
<b>Motivations to take part in the competition</b>	Fun and Enjoyment	(Juell-Skielse <i>et al.</i> , 2014; Kitsios and Kamariotou, 2017; Komssi <i>et al.</i> , 2015)
	Intellectual Challenge	
	Status and Reputation	
	User Need	
	Professional and Personal Identity	
	Autonomy	
	Learning and Skills Development	
	Money	
<b>Sources for search open data</b>	Reciprocity	(Kitsios and Kamariotou, 2017; Schmidt <i>et al.</i> , 2016)
	Signaling and Career Concerns	
	References to data as provided in journal articles	
	Newsletters or other publications	
	Government or institutional announcements	
	Searching in specific data archives/repositories/systems	
	Web search engines	
	Directories or catalogs	
<b>Benefits of the use of open data</b>	Social media	(Janssen <i>et al.</i> , 2012; Kitsios and Kamariotou, 2017; Zuiderwijk <i>et al.</i> , 2015)
	Blogs	
	Direct requests to data providers	
	More transparency	
	Democratic accountability	
	Creation of trust in government	
	Improvement of public policies	
	Fair comparison with other research results	
	Easier access to data and discovery of data	
	Creation of new data based on combining data	
	Sustainability of data (no data loss)	
	The ability to reuse data/not having to collect the same data again and counteracting unnecessary duplication and associated costs (also by other public institutions)	
	Availability of information for investors and companies	
	Optimization of administrative processes	
	New governmental services for citizens	
<b>Barriers of the use of open data</b>	New (innovative) social services	(Conradie and Choenni, 2014 ; Jaakkola <i>et al.</i> , 2014 ; Janssen <i>et al.</i> , 2012; Kitsios and Kamariotou, 2017; Zuiderwijk <i>et al.</i> , 2015)
	Development of new products and services	
	Improvement of citizen services	
	Contribution toward the improvement of processes, products, and/or services	
	Economic growth and stimulation of competitiveness	
	Stimulation of innovation	
	Emphasis of barriers and neglect of opportunities	
Lack of ability to discover the appropriate data		
Difficulty in searching and browsing due to no index or other means to ensure easy search for finding the right data		
Lack of knowledge to make use of or to make sense of data		
Lack of information		
No information about the quality of the open data		
Incomplete information, only part of the total picture shown or only a certain range		

	No license for using data	
	Data available in various forms	
	Data formats and datasets are too complex to handle and use easily	
	Lack of the necessary capability to use the information	
	No process for dealing with user input	
	Having to pay a fee for the data	
	Registration required before being able to download the data	
	Legacy systems that complicate the publicizing of data	
	No uniform policy for publicizing data	
	No resources to publicize data (especially small agencies)	
<b>Factors which influence the decision of establishment a successful startup</b>	Age	(Cassar, 2014; Chattopadhyay and Ghosh, 2008; Doutriaux, 1992 ; Fisher <i>et al.</i> , 2014; Harms <i>et al.</i> , 2007 ; Mas-Tur <i>et al.</i> , 2015; Shan <i>et al.</i> , 2014; Song <i>et al.</i> , 2008)
	Education	
	Support	
	Experience	
	Locus of Control	
	Need for achievement	
	Personal Attitude	
	Financial Resources	
Marketing activities		

The term of open data includes benefits, barriers and sources. The motivations are related to the intention of developers to participate in the competition. The motivations are related to fun and enjoyment, intellectual challenge, status and reputation, user need, professional and personal identity, autonomy, learning and skills development, money, reciprocity, signaling and career concerns.

Sources about open data are related to references of data as provided in journal articles, newsletters or other publications, government or institutional announcements, searching in specific data archives/repositories/systems, web search engines, directories or catalogs, social media, blogs and direct requests to data providers.

Benefits from the use of open data are related to more transparency, democratic accountability, creation of trust in government, new governmental services for citizens, improvement of citizen services, new (innovative) social services, contribution toward the improvement of processes, products, and/or services, development of new products and services, the ability to reuse data/not having to collect the same data again and counteracting unnecessary duplication and associated costs (also by other public institutions), optimization of administrative processes, improvement of public policies, fair decision-making by enabling comparison and easier access to data and discovery of data.

In contrast, barriers from the use of open data which concern barriers and neglect of opportunities, no resources mentioned on publicized data (especially small agencies), no process for dealing with user input, lack of ability to discover the appropriate data, no information about the quality of the open data (see category "Information Quality"), data formats and datasets too complex to handle and use easily, having to pay a fee for the data, no license for using data, lack of information, incomplete information, only part of the total picture shown or only a certain range and legacy systems that complicate the publicizing of data. If developers understand the significance of open data through the benefits, they will more positively decide to participate to open data contests and develop applications based on data and

they will be supported by organizers to establish a startup. On the other side, barriers and challenges regarding to the use of open data will be an obstacle for developers to participate in the contest and to develop an application based on open data. So the decision to establish a startup is abandoned.

Finally, the last factor includes variables related to the intention of developers to create a startup. These factors are age, education, support, experience, locus of control, need for achievement, financial resources and marketing activities and the conclusion is about their ability to influence developers to establish a startup.

## Conclusions

To move the existing literature forward, it is necessary to synthesize the existing knowledge and the existing findings, as well as the research gaps, to make suggestions about how future research should be conducted. So far a limited number of academic studies have concentrated on motivations for developers to participate in open data contests and the benefits for developers to continue their idea and establish a startup, based on the application that has been developed. This study proposed a framework to suggest a number of factors that affect developers on establishing a startup. The specific model is based on previous literature on open data and entrepreneurship and examines the factors that are related to motivations for participation at hackathons, the benefits of the use of open data and the factors that influence a nascent entrepreneur. This study bridges the gap in the literature regarding the relationship between open data hackathons and entrepreneurship and contributes to the development of a successful new startup.

From the perspective of startups which often have limited resources, open data open up interesting possibilities. Open data hackathons help nascent entrepreneurs to get funding, to expand their applications in new services or products, to be knowledgeable about customers' needs and to launch them in the market. The most significant factors which affect the nascent entrepreneur's decision to establish a startup are the funding and the marketing plan (Lasch *et al.*, 2007; Song *et al.*, 2008). This result has important implications for entrepreneurs and businesses to open data, and help nascent entrepreneurs to develop services and products based on market's needs. Furthermore, it is important for economic actors like venture capitalists, public authorities and local governments to support nascent entrepreneurs to find capitals and start their new ventures. Organizers in open data competitions involve entrepreneurs and venture capitalists on the panels of judges in order to help nascent entrepreneurs to get funding. Finally, another significant factor is the importance of specific organisational and entrepreneurial traits (Song *et al.*, 2008). The finding of team members who are highly motivated, detail-focussed and achievement oriented is crucial. When nascent entrepreneurs participate in open data hackathons, they meet other people who have the same goals. Thus, founding teams with greater openness and creativity is easier. This is important in order to foster the high growth potential of startups.

By identifying the factors that affect the nascent entrepreneur's decision to establish a startup, implications for both research and practice are presented. The paper contributes to entrepreneurship literature in terms of suggesting a model that takes factors which affect the decision of a nascent entrepreneur to establish a startup through their participation in open data hackathons under consideration. Furthermore, it is proposed that academics and organizers of hackathons should test this

model, in order to examine the effect of these factors in the decision of developers to establish a startup and to improve the organization, according to participants needs. For researchers, the framework clarifies the contributing factors of open data, entrepreneurship and its impact; it provides opportunities for researchers to validate the framework. Nevertheless, the results of an exploratory study will be summarised in an improved conceptual model for further research. The sample could include developers in innovation hackathons who will provide information on their intention to expand their applications and create start-ups. First, future researchers could conduct interviews with developers in order to examine how the concept of open data is familiar with them and if they understand the questions and the variables of the proposed model. Then, researchers could collect data using questionnaires to a larger sample of developers in order to examine the validity of the results. The generalization of the research findings is difficult because the use of open data is not widespread in the same level in all countries. Also, the influence of the factors which affect the intention of nascent entrepreneurs is not the same in all countries. For example, the personal attitudes, the support of family, the level of education as well as the funding are not provided in the same level in all countries. Furthermore, the hosting of hackathons is not popular in all countries yet. With insight into these determining factors, organizers gain a wide understanding into hackathons effectiveness. Consequently, this assists open data competitions with improvements in motivations and entrepreneurial performance. Given such insight, appropriate actions may be considered to create and foster an environment that promotes entrepreneurial effectiveness in hackathons, which enhances the usage of open data and the development of startups.

## References

- Alberti, F.G. and Pizzurno, E. (2017). "Oops, I did it again! Knowledge leaks in open innovation networks with start-ups", *European journal of innovation management*, Vol. 20, pp. 50-79.
- Breschi, S., Lenzi, C., Malerba, F. and Mancusi, M.L. (2014). "Knowledge-intensive entrepreneurship: sectoral patterns in a sample of European high-tech firms", *Technology Analysis & Strategic Management*, Vol. 26, pp. 751-764.
- Carlos Pinho, J. and Sampaio de Sá, E. (2014). "Personal characteristics, business relationships and entrepreneurial performance: some empirical evidence", *Journal of Small Business and Enterprise Development*, Vol. 21, pp. 284-300.
- Cassar, G. (2014). "Industry and startup experience on entrepreneur forecast performance in new firms", *Journal of Business Venturing*, Vol. 29, pp. 137-151.
- Chattopadhyay, R. and Ghosh, A.K. (2008). "Entrepreneurial Intention Model-Based Quantitative Approach to Estimate Entrepreneurial Success", *Journal of Small Business & Entrepreneurship*, Vol. 21, pp. 1-21.
- Chen, D.Q., Mocker, M., Preston, D.S. and Teubner, A. (2010). "Information systems strategy: reconceptualization, measurement, and implications", *MIS quarterly*, Vol. 34, pp. 233-259.
- Chorev, S. and Anderson, A.R. (2006). "Success in Israeli high-tech start-ups; Critical factors and process", *Technovation*, Vol. 26, pp. 162-174.
- Conradie, P. and Choenni, S. (2014). "On the barriers for local government releasing open data", *Government Information Quarterly*, Vol. 31, pp. S10-S17.

Eveleens, C.P., van Rijnsoever, F.J. and Niesten, E.M. (2017). "How network-based incubation helps start-up performance: a systematic review against the background of management theories", *The Journal of Technology Transfer*, Vol. 42, pp. 676-713.

Estay, C., Durrieu, F. and Akhter, M. (2013). "Entrepreneurship: From motivation to start-up", *Journal of International Entrepreneurship*, Vol. 11, pp. 243-267.

Fisher, R., Maritz, A. and Lobo, A. (2014). "Evaluating entrepreneurs' perception of success: Development of a measurement scale", *International Journal of Entrepreneurial Behavior & Research*, Vol. 20, pp. 478-492.

Grabowski, S., Grzenda, M. and Legierski, J. (2015). "The Adoption of Open Data and Open API Telecommunication Functions by Software Developers", in Abramowicz, W. (eds.), *Business Information Systems BIS 2015. Lecture Notes in Business Information Processing*, Springer International Publishing, pp. 337-347.

Groenewegen, G. and de Langen, F. (2012). "Critical success factors of the survival of start-ups with a radical innovation", *Journal of Applied Economics and Business Research*, Vol. 2, pp. 155-171.

Hansemark, O.C. (2003). "Need for achievement, locus of control and the prediction of business start-ups: A longitudinal study", *Journal of economic Psychology*, Vol. 24, pp. 301-319.

Harms, R., Kraus, S. and Reschke, C.H. (2007). "Configurations of new ventures in entrepreneurship research: contributions and research gaps", *Management Research News*, Vol. 30, pp. 661-673.

Harrison, T.M., Pardo, T.A. and Cook, M. (2012). "Creating open government ecosystems: A research and development agenda", *Future Internet*, Vol. 4, pp. 900-928.

Hui-Chen, C., Kuen-Hung, T. and Chen-Yi, P. (2014). "The entrepreneurial process: an integrated model", *International Entrepreneurship and Management Journal*, Vol. 10, pp. 727-745.

Immonen, A., Palviainen, M. and Ovaska, E. (2014). "Requirements of an open data based business ecosystem", *IEEE Access*, Vol. 2, pp. 88-103.

Immonen, A., Palviainen M. and Ovaska, E. (2014). "Towards open data based business: Survey on usage of open data in digital services", *International Journal of Research in Business and Technology*, Vol. 4, pp. 286-295.

Jaakkola, H., Mäkinen, T. and Eteläaho, A. (2014). "Open data: opportunities and challenges", in *Proceedings of the 15th International Conference on Computer Systems and Technologies in Ruse, Bulgaria 2014*, pp. 25-39

Janssen, M., Charalabidis, Y. and Zuiderwijk, A. (2012). "Benefits, adoption barriers and myths of open data and open government", *Information Systems Management*, Vol. 29, pp. 258-268.

Jetzek, T., Avital, M. and Bjorn-Andersen, N. (2014). "Data-driven innovation through open government data", *Journal of theoretical and applied electronic commerce research*, Vol. 9, pp. 100-120.

Johnson, P. and Robinson, P. (2014). "Civic Hackathons: Innovation, Procurement, or Civic Engagement?", *Review of Policy Research*, Vol. 31, pp. 349-357.

Jourdan, Z., Rainer, R.K. and Marshall, T.E. (2008). "Business intelligence: An analysis of the literature", *Information Systems Management*, Vol. 25, pp. 121-131.

Juell-Skielse, G., Hjalmarsson, A., Johannesson, P. and Rudmark, D. (2014). "Is the Public Motivated to Engage in Open Data Innovation?", in Janssen, M., Scholl, H.J., Wimmer, M.A. and Bannister, F. (eds.), *Electronic Government*, Springer: Berlin Heidelberg, pp. 277-288.

Kassen, M. (2013). "A promising phenomenon of open data: A case study of the Chicago open data project", *Government Information Quarterly*, Vol. 30, pp. 508-513.

Kamariotou, M. and Kitsios, F. (2017). "Information Systems Phases and Firm Performance: A conceptual Framework", in Kavoura, A., Sakas, D. and Tomaras, P. (eds.), *Strategic Innovative Marketing*, Springer Proceedings in Business and Economics, pp. 553-560.

Kamariotou, M. and Kitsios, F. (2017). "Open Data Hackathons: A Strategy to Increase Innovation in the City", in *Proceedings of International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD 2017)* in Thessaloniki, Greece, pp. 231-238.

Kitsios, F. and Kamariotou, M. (2018). "Open Data and high-tech startups: Towards nascent entrepreneurship strategies", in Mehdi Khosrow-Pour (ed.), *Encyclopedia of Information Science and Technology*, 4th Edition, IGI Global Publishing, chapter 265, pp. 3032-3041.

Kitsios, F. and Kamariotou, M. (2016). "Critical success factors in service innovation strategies: An annotated bibliography on NSD", in *Proceedings of British Academy of Management (BAM), Conference 2016 in Newcastle, UK*, pp. 1-28.

Kitsios, F. and Kamariotou, M. (2016). "The impact of Information Technology and the alignment between business and service innovation strategy on service innovation performance", in *IEEE Proceedings of 3rd International Conference on Industrial Engineering, Management Science and Applications (ICIMSA 2016) in Jeju Island, Korea*, pp. 247-251

Kitsios, F., Papachristos, N. and Kamariotou, M. (2017). "Business Models for Open Data Ecosystem: Challenges and Motivations for Entrepreneurship and Innovation", in *19th IEEE International Conference on BUSINESS INFORMATICS (CBI'17)* in Thessaloniki, Greece, pp. 398-408.

Kokfai, S., Pratoom, K. and Muenthaisong, K. (2015). "A CONCEPTUAL MODEL OF STRATEGIC ENTREPRENEURIAL CAPABILITY AND SERVICE SUCCESS", in *Proceedings of the Allied Academies International Conference in New Orleans*, pp. 32- 46

Komssi, M., Pichlis, D., Raatikainen, M., Kindstrom, K. and Jarvinen, J. (2015). "What are hackathons for?", *Software, IEEE*, Vol. 32, pp. 60-67.

Lakomaa, E. and Kallberg, J. (2013). "Open data as a foundation for innovation: The enabling effect of free public sector information for entrepreneurs", *Access, IEEE*, Vol. 1, pp. 558-563.

Lasch, F., Le Roy, F. and Yami, S. (2007). "Critical growth factors of ICT start-ups", *Management Decision*, Vol. 45, pp. 62-75.

LeBrasseur, R., Zanibbi, L. and Zinger, T.J. (2003). "Growth momentum in the early stages of small business start-ups", *International Small Business Journal*, Vol. 21, pp. 315-330.

Lee, M., Almirall, E. and Wareham, J. (2015). "Open data and civic apps: first-generation failures, second-generation improvements", *Communications of the ACM*, Vol. 59, pp. 82-89.

Li, X., Shen, J., Ma, W. and Zhang, W. (2016). "The effect of business ties and government ties on new IT venture growth: an empirical examination in China", *Information Technology and Management*, Vol. 17, pp. 245-261.

Lindman, J., Kinnari, T. and Rossi, M. (2014). "Industrial open data: Case studies of early open data entrepreneurs" in *Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS)*, in Waikoloa, HI, USA, pp. 739-748.

Mas-Tur, A., Pinazo, P., Tur-Porcar, A.M. and Sánchez-Masferrer, M. (2015). "What to avoid to succeed as an entrepreneur", *Journal of Business Research*, Vol. 68, pp. 2279-2284.

Meijer, R., Conradie, P. and Choenni, S. (2014). "Reconciling contradictions of open data regarding transparency, privacy, security and trust", *Journal of theoretical and applied electronic commerce research*, Vol. 9, pp. 32-44.

Moghavvemi, S., Mohd Salleh, N.A. and Standing, C. (2016). "Entrepreneurs Adoption of Information System Innovation: The Impact of Individual Perception and Exogenous Factors on Entrepreneurs Behavior", *Internet Research*, Vol. 26, pp. 1181 – 1208.

Mutuku, L. and Mahihu, C. (2014). "A suggested framework for impactful open data applications in developing countries", in *Proceedings of the 8th International Conference on Theory and Practice of Electronic Governance in Guimaraes, Portugal*, pp. 498-499

Piccoli, G. and Ives, B. (2005). "Review: IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature", *Mis Quarterly*, Vol. 29, pp. 747-776.

Pope, J.A. and Greene, W.E. (2003). "Developing a Model of Entrepreneurship Style", *Journal of Business and Entrepreneurship*, Vol. 15, pp. 64-74.

Rosell, B., Kumar, S. and Shepherd, J. (2014). "Unleashing innovation through internal hackathons", in *Proceedings of the Innovations in Technology Conference in Warwick, RI, USA*, pp. 1-8.

Schmidt, B., Gemeinholzer, B. and Treloar, A. (2016). "Open Data in Global Environmental Research: The Belmont Forum's Open Data Survey", *PLoS ONE*, Vol. 11, pp. 1-29.

Shan, B., Cai, L., Hatfield, D.E. and Tang, S. (2014). "The relationship between resources and capabilities of new ventures in emerging economies", *Information Technology and Management*, Vol. 15, pp. 99-108.

Sieber, R.E. and Johnson, P.A. (2015). "Civic open data at a crossroads: Dominant models and current challenges", *Government Information Quarterly*, Vol. 32, pp. 308-315.

Song, M., Podoyunitsyna, K., Van Der Bij, H. and Halman, J.I. (2008). "Success factors in new ventures: a meta-analysis", *Journal of product innovation management*, Vol. 25, pp. 7-27.

Tello, S., Yang, Y. and Latham, S. (2012). "Nascent entrepreneurs access and use of network resources in a technology incubator", *Journal of Small Business & Entrepreneurship*, Vol. 25, 375-397.

Van Gelderen, M., Thurik, R. and Bosma, N. (2005). "Success and risk factors in the pre-startup phase", *Small Business Economics*, Vol. 24, pp. 365-380.

Waters, L., McCabe, M., Kiellerup, D. and Kiellerup, S. (2002). "The role of formal mentoring on business success and self-esteem in participants of a new business start-up program", *Journal of business and psychology*, Vol. 17, pp. 107-121.

Webster, J. and Watson, R. T. (2002). "Analyzing the past to prepare for the future: Writing a literature review", *MIS quarterly*, Vol. 26, pp. 13-23.

This is the pre-print version. The final paper is available at: Kitsios, F. and Kamariotou, M. (2018). Open Data Hackathons: An Innovative Strategy to Enhance Entrepreneurial Intention, *International Journal of Innovation Science*, 10 (4), pp. 519-538. [see: <https://www.emerald.com/insight/content/doi/10.1108/IJIS-06-2017-0055/full/html>]

Zapkau, F.B., Schwens, C. and Kabst, R. (2017). “The role of prior entrepreneurial exposure in the entrepreneurial process: a review and future research implications”, *Journal of Small Business Management*, Vol. 55, pp. 56-86.

Zhao, S., Sun, Y. and Xu, X. (2016). “Research on open innovation performance: a review”, *Information Technology and Management*, Vol. 17, pp. 279-287.

Zhou, W., Hu, H. and Zey, M. (2015). “Team composition of new venture founding teams: does personality matter?”, *International Journal of Entrepreneurial Behavior & Research*, Vol. 21, pp. 673-689.

Zhu, F., Burmeister-Lamp, K. and Hsu, DK. (2017). “To leave or not? The impact of family support and cognitive appraisals on venture exit intention”, *International Journal of Entrepreneurial Behavior & Research*, Vol. 23, pp. 566-590.

Zuiderwijk, A., Janssen, M. and Dwivedi, Y.K. (2015). “Acceptance and use predictors of open data technologies: Drawing upon the unified theory of acceptance and use of technology”, *Government Information Quarterly*, Vol. 32, pp. 429-440.

Zuiderwijk, A., Janssen, M., Poulis, K. and van de Kaa, G. (2015). “Open data for competitive advantage: insights from open data use by companies”, in *Proceedings of the 16th Annual International Conference on Digital Government Research in Arizona, USA*, pp. 79-88.