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The financing of entrepreneurial projects in emerging industries: the drone case

Supervisor: Prof. Butticè Vincenzo

Dissertation with discussant

Riccardo Cominotto 905435

Susanna Gilardi 900150

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Abstract

This thesis investigates the financing of entrepreneurial projects related to one specific emerging technology. We reviewed the literature on this topic and developed a set of testable hypotheses on the likelihood of receiving financing through crowdfunding. In our theoretical model, we distinguish between service and product related to this emerging technology. Our empirical analysis focuses on the case of drones, which are a technology that started diffusing in the last decade thanks to its several possible applications. We show that drones are less likely to receive financing through crowdfunding than other kinds of projects in general and also when only compared to other technology-related projects. Moreover, when distinguishing between product and service, we show that, counterintuitively, the latter has more probability of receiving financial support when relying on this kind of platform.

We finally discuss the implications for theory, practice, and policy.

Abstract

Questa tesi esplora il finanziamento di progetti imprenditoriali relativi a una specifica tecnologia emergente. Abbiamo esaminato la letteratura relativa a questo argomento e abbiamo sviluppato una serie di ipotesi verificabili attraverso un modello econometrico riguardo alla probabilità di ricevere finanziamenti attraverso il crowdfunding. Inoltre, relativamente alla tecnologia emergente in questione, abbiamo studiato attraverso il nostro modello teorico le performance distinguendo tra servizio e prodotto. La nostra analisi empirica si concentra sul caso dei droni, una tecnologia che ha iniziato a diffondersi nell'ultimo decennio grazie alle sue molteplici applicazioni. Dai nostri risultati possiamo concludere che i droni possiedono meno probabilità di ricevere finanziamenti attraverso il crowdfunding rispetto ad altri tipi di progetti in generale, ma anche quando confrontati unicamente con altri progetti relativi alla tecnologia. Inoltre, nel distinguere tra prodotto e servizio, dimostriamo che, contrariamente a quanto suggerito dalla teoria scientifica, quest'ultimo ha maggiore probabilità di ricevere supporto finanziario quando ricorre a questo tipo di piattaforma.

Discutiamo infine le implicazioni riguardanti la teoria accademica, la pratica e la legislazione riguardante questa specifica tecnologia.

Executive Summary

The aim of our research is to assess the likelihood of emerging technologies to be financed through an innovative tool: crowdfunding. These technologies have a high degree of innovation, reason why they are able to open up many opportunities in many different industries and markets. This characteristic is appealing for many stakeholders, making emerging technologies interesting for academics, practitioners, and policymakers. Despite their high potentialities and application possibilities, this kind of innovation finds it quite difficult to look appealing to investors because of the high risks and hurdles that are related to the uncertainty intrinsic of emerging technologies. In addition to this issue, new ventures have to face information asymmetries deriving from the lack of data that are able to prove the quality of their idea and the lack of collaterals, both fundamental when dealing with professional investors and banks. Due to these hurdles, new ventures developing emerging technologies related businesses rely on more innovative ways of getting funds such as crowdfunding. This instrument, consisting of an online platform on which anyone from all over the world can decide to support business projects also with a small amount of money, allows entrepreneurs to get in touch with a big audience that evaluates investments in an unstructured way. In this way, it is possible to decrease uncertainty and information asymmetries, raising the possibilities to get funded and succeed.

We decided to focus our attention on the drone industry, one very promising emerging technology that has been diffusing in the last decade. This market is gaining a lot of attention because of its potential impact on several different aspects of society and its wide range of applications. On the other hand, drones are characterized by significant

information asymmetries because they are based on knowledge deriving from several scientific fields. Moreover, they generate the skepticism of the public because of the many ethical security and privacy issues that their inappropriate usage could arise.

After a deep analysis of the current literature, useful to draw our hypotheses, we realized that drone-related projects will have fewer probabilities of success than other projects because of the many issues they suffer from. Moreover, when considering the distinction between product-related and service-related projects, we assumed that the higher degree of information asymmetries suffered by the latter, due to their intrinsic characteristics, would negatively influence their likelihood of success when compared to product-related projects.

In order to test our hypotheses, we built a database using data coming from Kickstarter.com, one of the main reward-based crowdfunding platforms, and performed an econometrical analysis using a probit model in order to derive the success likelihood of projects.

The outcome of our model confirmed our first hypothesis, showing that drone-related campaigns find it harder to get financed both when compared to all kinds of projects and when compared to only other technological campaigns. On the other hand, our second hypothesis was confuted by the model which provided evidence of the better performance of service-related campaigns rather than product-related ones.

After the discussion of the main possible explanations supporting these outcomes, we highlight the main limitations of our study and its implications for academics, entrepreneurs and policymakers.

Executive Summary

Lo scopo della nostra ricerca è valutare la probabilità che le tecnologie emergenti vengano finanziate attraverso uno strumento finanziario innovativo: il crowdfunding. Questo particolare tipo di tecnologie ha un alto livello di innovazione, motivo per cui sono in grado di aprire molte opportunità in svariati settori e mercati. Questa caratteristica li rende molto allettanti per gli svariati stakeholders interessati al loro avvento, rendendo le tecnologie emergenti attraenti per accademici, professionisti e legislatori. Nonostante le loro elevate potenzialità e le varie possibili applicazione, a causa degli alti rischi e ostacoli legati all'incertezza intrinseca delle tecnologie emergenti, queste riscontrano molte difficoltà nell'attrarre gli investitori. Oltre a questo problema, le nuove imprese devono affrontare asimmetrie informative a causa dell'assenza di dati in grado di dimostrare la qualità della loro idea e la mancanza di garanzie, entrambe fondamentali quando si tratta con investitori professionisti e banche. A causa di questi ostacoli, le nuove imprese che sviluppano attività legate alle tecnologie emergenti si affidano a modi più innovativi di ottenere fondi tra cui il crowdfunding. Questo strumento, che consiste in una piattaforma online alla quale chiunque, a tutto il mondo, può accedere e supportare progetti, anche attraverso una piccola quantità di denaro, consentendo agli imprenditori di entrare in contatto con un vasto pubblico che valuta gli investimenti in modo meno strutturato. In questo modo è possibile superare l'incertezza e le asimmetrie informative, aumentando le possibilità di ottenere finanziamenti e avere successo.

Abbiamo deciso di focalizzare la nostra attenzione sul settore dei droni, una tecnologia emergente molto promettente che si è diffusa nell'ultimo decennio. Questo mercato sta guadagnando molta considerazione grazie al suo potenziale impatto su diversi

aspetti della società e della sua vasta gamma di applicazioni. D'altra parte, i droni sono caratterizzati da significative asimmetrie informative perché si basano su conoscenze riguardanti diversi campi scientifici. Inoltre, generano lo scetticismo del pubblico a causa delle molte questioni di etica, sicurezza e privacy che potrebbero derivare dall'uso inappropriato del prodotto.

Dopo un'analisi approfondita dell'attuale letteratura, utile per trarre le nostre ipotesi, abbiamo dedotto che i progetti relativi ai droni avranno meno probabilità di successo rispetto ad altri progetti a causa delle molte problematiche che affliggono questa tecnologia. Inoltre, distinguendo tra i progetti relativi ai prodotti e quelli relativi ai servizi, abbiamo ipotizzato che il grado più elevato di asimmetrie informative che interessa questi ultimi a causa delle loro caratteristiche intrinseche, avrebbe influenzato negativamente la loro probabilità di successo rispetto ai progetti relativi ai prodotti.

Al fine di testare le nostre ipotesi, abbiamo creato un database utilizzando i dati provenienti da Kickstarter.com, una delle principali piattaforme di reward-based crowdfunding, ed eseguito un'analisi econometrica utilizzando un modello probit al fine di calcolare la probabilità di successo dei progetti.

I risultati del nostro modello hanno confermato la prima ipotesi, dimostrando che le campagne relative ai droni trovano più difficile ottenere finanziamenti sia rispetto a tutti gli altri tipi di progetti che rispetto ad altre campagne riguardanti la tecnologia. D'altra parte, la nostra seconda ipotesi è stata confutata dal modello che ha fornito prove della migliore performance delle campagne relative al servizio piuttosto che a quelle relative al prodotto.

Dopo aver discusso le possibili spiegazioni a sostegno di questi risultati, evidenziamo i principali limiti del nostro studio e le sue implicazioni per accademici, imprenditori e legislatori

Introduction

The aim of our research is to better understand how crowdfunding can contribute to the financing of emerging technologies. Emerging technologies have always attracted attention among innovation scholars (Robinson et al., 2013). These technologies have the potential to create new industries, transform existing ones (e.g. Hockerts et al., 2010), and open up entire new areas of technology and science (Pavitt, 1998). For this reason, emerging technologies have also drawn the interest of a wide range of stakeholders. These include: i) governmental agencies seeking the most promising ideas; ii) incumbent firms who are interested at managing technological changes to avoid that the emerging technology threatens their core products (Anderson and Tushman, 1990); iii) professional investors seeking returns from early investments in key innovators (Petkova et al., 2013); iv) start-ups hoping to gain a foothold in rapidly emerging fields. Yet, emerging technologies typically suffer from a significant financing gap, due to the high information asymmetries that characterize them (Berger & Udell, 1998).

Crowdfunding is an innovative way of financing new ventures during their pre-seed phase. As a matter of fact, during this stage, entrepreneurs may try to appeal to unconventional source of finance because of the information asymmetries caused by the lack of financial documents and collaterals that they are not able to provide to professional investors to prove their quality and ability to create profit. Through the usage of crowdfunding platforms, entrepreneurs are able to get in touch with a large amount of people that could decide to contribute, also with a relatively small amount of money, to the financing of their new innovative project. The above-mentioned problems are still present and relevant to backers but, since the contribution can be

also very minor, they might suffer less because of them, deciding to accept them more light-heartedly.

Emerging technologies, on the other hand, are those technologies that are currently under development and/or will be developed in the next few years. According to Nelson and Gorichanaz (2019), their intrinsic characteristics are: radical novelty, relatively fast growth, coherence and conceptual autonomy, prominent impact and uncertainty, and ambiguity. Even if many of these characteristics are also proper of conventional products in their introductory stages (Moor, 2005), in this specific case they are particularly enhanced, feeding people's fear of the unknown.

For the purposes of this thesis, we selected one particular emerging technology that caught our attention because its potential impact on several different aspects of society: drones. We believe drones are an interesting emergent technology for our purposes, since this technology bases and/or generates knowledge from different fields (physics, aerodynamics, fluidics, engineering, chemistry, etc.), thus it is characterized by significant information asymmetries that make receiving financing from traditional founding sources unlikely. Moreover, the technological ferment around drones ensures a sufficiently large projects stock related to this technology. More in details, talking about drones, we discovered from many studies that have been performed in the last few years regarding UAVs (Unmanned Aerial Vehicles) that people are very skeptical and adverse to this specific technology because of some additional issues: first of all, security and safety, because of the correlation that many people make between drones and military strikes, privacy, because people worry about others and the government spying on them, and unethical usage, deriving from the concerns of other people using this technology immorally and inappropriately to take advantage of others.

We decided to combine these two topics because we wanted to test if the crowdfunding environment, that is supposed to be more prone to innovation and to accept the risks that exist when financing a stranger, could be more welcoming to this kind of projects, despite the many problematical features characterizing emerging technologies.

Thtough our study, our goal is to contribute to the existing theory that regards the technology of drones, in order to uncover problems that are linked to it and prevent them from being financed, try to provide an explanation, and finally to be useful in understanding how to increase the acceptance of this technology and how to create campaigns more prone to success.

In fact, we think that it is important to encourage the development and the evolution of drones because they can be employed in many different applications, and among them they could be able to impact the seventeen sustainable development goals (listed in *Figure 1*) in a very relevant way, contributing to their actual realization. These objectives have been set by the United Nations General Assembly in 2015 to be reached

by 2030, and all the nations worldwide need to make their best effort to contribute to their fulfillment.

Figure 1- The seventeen global sustainable goals

In particular, drones can contribute to the second goal, zero hunger, thanks to their ability to transport and deliver food to locations that are hardly reachable by land transportation such as when locations are hit by a natural disaster (e.g., Haiti 2016) and the possibility to enhance precision farming, which could definitely increase the production of food. This applies also to the goal of good health and well-being, since drones could carry not only food, but also drugs and vaccines that are not currently available in certain parts of the world. Moreover, drones can be employed in order to clean and purify water thanks to the usage of filters or other equipment. In fact, even

if we often think about drones as vehicles that fly, they can actually move in any fluid, and therefore also water. Furthermore, drones are often employed to perform maintenance in a more efficient and green way and to clean energy production plants, e.g., solar panel fields and wind turbine blades. When performing these kinds of activities, but also in other circumstances, using drones can also reduce risky and indecent jobs, e.g., cleaning and maintaining solar panels that are located in high settings that could put a human operator in danger. With regard to goal number nine, this technology brings innovation into many industries and applications: it is creating a new separate market while also improving existing ones, providing more energy efficiency and new opportunities through the simplification of complex operations and jobs. One particular industry that could benefit from the usage of drones and has indeed been investing in this technology, developing many proofs of concept, is logistics. The usage of drones to deliver goods, for instance, could decrease traffic and pollution, which would make cities and communities more sustainable and greener, therefore reducing the impact on climate change. As already mentioned above, drones can be employed also in the water, and, besides cleaning it to make it drinkable, they can be useful for safeguarding sea life, both in terms of flora and fauna, contributing in reaching goal fourteen. This task can be done also on land (goal fifteen), monitoring wildlife and intervening whenever it's needed, e.g., wildfire.

All these different possible applications make this technology a topic which potentially concerns everyone, anywhere in the world and which is worth investing in.

In order to deepen our understanding of existing knowledge and theories, we analyzed the current literature about many topics that could be interesting for the purpose of our study. We looked for papers regarding new venture financing, crowdfunding, innovation, emerging technologies, signaling theory, and information asymmetries.

We found that there has been a substantial change and evolution regarding the financing of new ventures, and crowdfunding is one of the outcomes of this progress. Through this tool entrepreneurs are able to receive not only monetary contribution, but also feedback and advices following an open innovation paradigm, which makes this innovative way to get funded even more value-adding. As a matter of fact, from this paradigm entrepreneurs are able to increase their network of acquaintances and knowledge, enlarging their portfolio of know-how and having the support of people with heterogeneous backgrounds and capabilities.

Moreover, given the radical novelty of emerging technologies, we thought it could be interesting and useful to understand, from existing academical knowledge, which characteristics differentiate radical from incremental innovation, how they are perceived from crowdfunding platform users, and how they perform. From this review, we understood that backers, even though they rely on such an innovative and modern form of financing, favor what they know, and therefore prefer to finance incremental innovation rather than the radical one.

One gap we identified in the existing literature and that we were interested in filling was an analysis of emerging technologies in the context of crowdfunding and of the different performances of product-related and service-related innovation on these platforms. This interest originates from our willingness to contribute to the spread of the knowledge related to this matter, also helping entrepreneurs in addressing their effort towards projects with an higher probability to success and, consequently, enlarging the drone market that could impact in many positive ways several different field as already mentioned above. In order to do so, we analyzed articles published on scientific journals, especially the ones about signaling and information asymmetries. From these papers, we drew that the intrinsic characteristics of services impact the

quality of the signals they are able to deliver during the screening phase every decision maker faces, decreasing their strength.

In conclusion, combining all the knowledge acquired and the gaps identified, we hypothesize that, not only drone-related campaigns perform worse than other projects, but also that, among them, the ones concerning service innovation are less prone to success.

We aim to address these questions developing an econometrical model based on statistical evidences gathered from real life data derived from Kickstarter.com, one of the most important crowdfunding platforms. To garner these data we conducted several researches, firstly using the searching tool of the website to identify drone-related campaigns. Through this method, we were able to find many different projects that concern our topic of interest but, contemporaneously, we realized the impossibility to identify all of them using only one technique. This issue arose from the fact that on Kickstarter there is not a category dedicated only to drones. For this reason, we decided to combine this searching tool provided by the web platform to a scraper code built with python. Through this means, we were able to download descriptions useful to train a classificatory algorithm able to identify additional drone-related campaigns that increased our database. Once this file was completed, after the analysis of meaningfulness of the variables we chose to build the model, we were able to test our hypothesis through our econometrical model which applies logistical regression, whose dependent variable is success, to a sample made of campaigns that are both drone and non-drone related.

What we found is that drone-related campaigns do have less probabilities to be successfully financed, i.e. reach the financial goal the creator set. This result is

analogous even when considering only the category technology, which we assumed is the one that comprehends most of the drone campaigns, but in this specific case the negative influence is a little less relevant, probably because the uncertainty factor is more proper of campaigns belonging to this category. We identified different reasons for these results, ranging from the distinctive characteristics of drones to the gaps that exist in the law that regulates this technology. Apparently, even the crowdfunding environment, which is supposed to be more prone to innovation and openminded, is not able to overcome these issues, as it's noticeable also from the low percentage of success rate of technological projects on the platform we are considering (*Table 1*).

Category	**Launched Projects**	**Total Dollars**	**Successful Dollars**	**Unsuccessful Dollars**	**Success Rate**
All	467,598	$4.66 B	$4.17 B	$453 M	37.41%
Dance	4,199	$14.61 M	$13.59 M	$996.53 K	61.94%
Theater	12,117	$46.35 M	$41.55 M	$4.70 M	60.06%
Comics	15,140	$104.27 M	$97.06 M	$6.21 M	58.48%
Music	61,190	$242.18 M	$221.53 M	$19.95 M	49.98%
Art	36,723	$122.22 M	$109.11 M	$12.46 M	43.64%
Games	48,847	$1.15 B	$1.06 B	$78.76 M	39.73%
Design	39,263	$1.05 B	$953.03 M	$83.96 M	37.84%
Film & Video	73,129	$459.45 M	$390.54 M	$67.49 M	37.60%
Publishing	48,255	$172.64 M	$151.16 M	$20.06 M	32.86%
Photography	12,149	$47.09 M	$40.94 M	$5.60 M	32.01%
Fashion	30,207	$180.53 M	$158.39 M	$21.24 M	27.54%
Food	29,190	$155.94 M	$131.62 M	$23.73 M	25.28%

Crafts	10,944	$19.10 M	$15.74 M	$3.26 M	24.87%
Journalism	5,590	$17.29 M	$15.07 M	$2.19 M	22.54%
Technology	40,655	$881.23 M	$768.95 M	$102.33 M	20.56%

Table 1- Current Kickstarter's statistics

On the other hand, our analyses proved that campaigns that bring to product innovation related to drones perform worse than the ones bringing to service innovation. Also in testing this hypothesis, we found that, when narrowing our focus to the technological category, the influence of being a product innovation-related campaign is a little less negative, impacting less the success rate. Even though our analysis of the literature brought us to different conclusions, we found several explanations that justify this outcome. Among these, we presume that the most impacting ones could be related to the low variety of innovation that product-related campaigns are able to offer, favoring the wider portfolio of service applications, and the importance of the involvement of backers, who might not feel confident in contributing to the development of such a technological device such as drones, but value this opportunity to be a very important part of the crowdfunding experience.

What we were able to derive from these two different analyses is that people still struggle in accepting drones and consequently in financing them. This issue is present on Kickstarter, meaning that even more openminded people are not ready for this technological innovation yet.

What we can conclude and suggest to practitioners is that the probability to reach success with a drone-related campaign is very low, leading us to disincentivize these kinds of projects for now. We are positive that the future evolution of legislation will decrease the fears and concerns that people have about drones at the moment, filling

all the gaps that are now creating reluctance and skepticism against this technology. Still, drone enthusiasts shouldn't be despondent and should try to focus on developing a good service proposal rather than a product one in order to have more possibility to get funded.

Lastly, if the service proposal is developed with an eye pointed towards the seventeen global sustainable goals, it could be more appreciated by backers and foster the campaign success.

Additionally, this research is relevant for academics because it demonstrates that, in this specific context and technology, the weakness of signals sent by service is mitigated by other factors that backers value more, leading them to accept the higher uncertainty and information asymmetry that derive from services. Moreover, we demonstrate the high failure rate that drone-related campaigns face, as the representation of an emerging technology that is going through its pre-seed financing stage.

Literature review

In this thesis, we are interested in deepening our knowledge of how new innovative ventures are financed. In order to have a comprehensive overview of the topic, we read and analyzed several papers. In this section we start by exploring the recent historical evolution of the new venture financing, highlighting the main milestones that brought to the definition of the current economic scenario. Through this analysis, we reach the definition of the funding solutions present nowadays and we analyze the related characteristics and peculiarities. Among these, we focus on crowdfunding, given that it's the most recent and innovative form of early-stage funding. Crowdfunding, thanks to the usage of online platforms, gives the possibility to raise a huge amount of money from a disperse and heterogeneous crowd. This characteristic is very interesting because in this solution people can play a dual role: on one hand, each individual contributes to the financing of a project, sometimes even with a small amount of money, while, on the other hand, they can provide valuable feedback and suggestions to help the entrepreneur develop a better product in an open innovation paradigm. Therefore, we analyze the main features of this innovative model to understand which of them can be found in the crowdfunding community. Doing so, we identify the three pillars of open innovation and explain them in practice. At this point, we highlight the other important roles played by backers, understanding how their involvement is a further strength of crowdfunding. As a matter of fact, the possibility of reaching such a broad public enables a strong word of mouth and the creation of ambassadors at no/low cost. Afterwards, we address whether backers feel more confident in contributing to a campaign that involves incremental or radical innovation, analyzing how the lack of information deeply impacts people's decisions. We then focus on one specific emerging technology, which is the focus of our paper: drones. As emerging

technology, they have characteristics such as uncertainty, but they bring to further specific issues such as privacy and ethics. Afterwards we highlight the main risks and hurdles that such an innovative form of financing could bring to both entrepreneurs and backers, underlining the differences between product and service and discussing their singular characteristics, how these can influence backers' decisions, and how services could be able to prevent not being funded due to the uncertainty that characterizes them in general.

To build a comprehensive and solid knowledge about all these topics we read forty-five papers about emerging technologies, from which we understood both their main characteristics and the issues they have to tackle in early stages and then sixty papers about crowdfunding and innovation, which were useful to draft a complete picture of how these platforms work and of the importance of the role backers play, while also adding new information about the types of innovation that can be found on crowdfunding and how this tool can be considered a paradigm of open innovation. Moreover, to deepen our knowledge on drones, we analyzed both scientific papers and regulation documents, useful to understand the characteristics of this emerging technology and how it is being regulated all over the world. Additionally, we went through several papers regarding the information asymmetries theory, focusing on the differentiation between products and services and how they are able to send signals. To conclude we used information coming from all the previously read papers to derive the main hurdles emerging technologies and, more in particular, drones have to face when dealing with early stage financing and crowdfunding.

Startup financing history

In the past, venture capital firms were the main funders of technology new ventures (Kenney 2011). In the late 1990s, the U.S. stock market saw a rapid rise of the prices of internet-based company shares. This trend was caused by two main reasons: on one hand investors were afraid of losing the possibility to buy stocks of companies that in the future would have ruled the new markets and, on the other hand, companies raced to become as big as possible by spending more in marketing than in R&D and operations (Investopedia.com). In 2000, the Dot.com bubble burst and, as consequence, the Nasdaq index lost 76.81%. After this event, the venture capital firms investment decreased as well as the new ventures' IPOs (Kenney and Zysman,2019). For this reason, startups took their distance from the stock markets, looking for alternative funding partners.

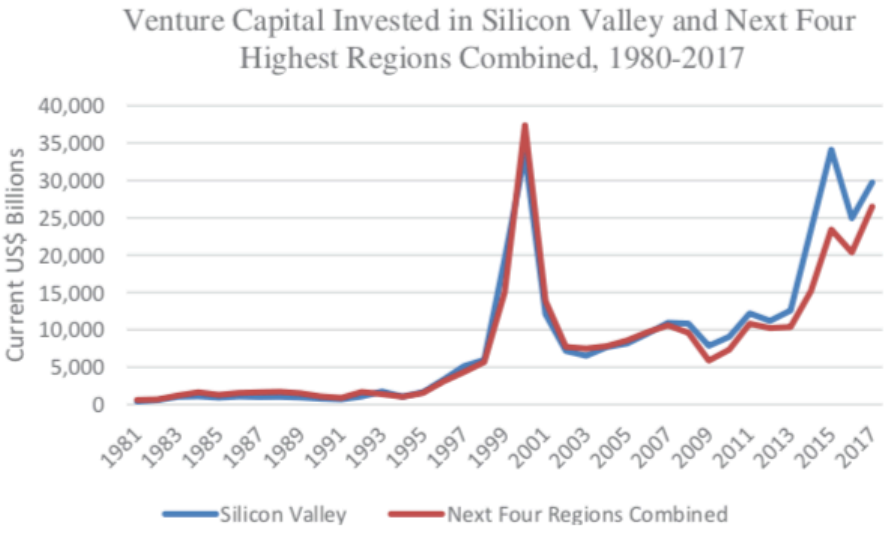

Figure 2- Venture capital invested in Silicon Valley and next four highest regions combined, 1980–2016.

Source: Compiled from VentureXpert and PricewaterhouseCoopers MoneyTree

After a period in which investments in new venture were quite constant, besides a drop in 2009, in 2014 the venture investment growth re-started thanks to the shared trust

in new technology-based startups (NTBS) possibility of disrupting markets and, gaining a quasi-monopolist position, driving huge profits for themselves and, obviously, for their investors (Kenney and Zysman, 2016; Zysman and Kenney, 2018). This is also the period in which companies defined "Unicorns" start to rise. These Unicorns are companies that are not listed in the stock exchange but are valued by analyst for $1 billion or more. As the elite venture capital firms became more successful, many of them became capable of raising and managing funds for billions of dollars (e.g. Sequoia Capital, elite VC of Silicon Valley, raised $8 billion in 2018, Marinova, 2018). For this reason, nowadays Venture Capitalists target new venture that reached their growth stage and need big capitals to scale up. Thus, all the screening activities to evaluate companies' potentialities are worth (Kenney and Zysman,2019).

According to this, a financing gap has been created between early stage new ventures and growing stage companies that has been addressed in many different ways, resulting in six main funding solutions.

1. Angel groups or syndicates, and on occasion individual "super-angels", emerged. This groups were able to invest up to a few million dollars in a firm's early stages, particularly in Silicon Valley (Manjoo, 2011). Many of these angels were successful entrepreneurs that, once sold their company, decided to invest the yielded money in new entrepreneurs. Business angels normally adopt an unstructured approach to evaluate companies, establishing a personal relationship with the entrepreneurs.
2. Accelerators provide small amounts of capital and significant amounts of coaching in return for a small tranche of equity. Their goal was to assist in the growth of the entrepreneurs' idea to the point that they could "graduate" and

raise money from angel groups or venture capitalists (Radojevich- Kelley and Hoffman 2012).

3. A wide variety of digital platforms for crowdfunding have been established ranging from Indiegogo and Kickstarter – where funds are contributed to a project, but the funders receive no equity – to other platforms, such as AngelsList – where only certified investors invest in return for equity (Belleflamme, Lambert, and Schwienbacher 2014).
4. Smaller, seed-stage VC firms have created a functional segmentation of the VC industry.
5. Open-ended mutual funds and sovereign wealth funds are making massive late-stage investments. For example, as Chernenko and colleagues show, initially Uber was funded by angels and venture capitalists, but, in the later stages, where it secured massive tranches of capital, it was mutual funds and sovereign wealth funds that committed capital (Chernenko, Lerner, and Zeng 2017).
6. The emergence of Initial Coin Offerings based on block chains to raise capital. Whether this is a significant innovation that will impact startup funding, or a new form of blue-sky financing with promises of great returns, but also an even higher likelihood of resulting in complete losses, is uncertain (Kenney and Zysman,2019).

This growth in number of actors willing to give capitals to new venture was complemented by an easier market entry, made possible by digital platforms, cloud computing and open source software. In fact, previously, a startup needed a big capital to build an IT infrastructure and create their own software on which they could work. This is not true anymore, companies can rent servers and software, shifting all the IT investments from capital investment to variable cost (Murray, 2014).

These two trends result in an increased number of new ventures, especially internet platform-based companies, experimenting their ideas on the market. If they experiment rapid adoption (the number of users or the extent of use), it is imperative to grow as quickly as possible to occupy the space before other competitors can introduce a competitive product. During this phase, profitability is not as important as growth that captures the market. At some point, angels and incubators can no longer provide the capital necessary to support such growth, and thus the start-up must secure much larger investments for example from VC firms.

In their growth stage, startups are obviously cash-flow negative and the current funders are fine with this idea. In fact, what funders expect is not a company that finds a fast way to make profit, but one that pushes incumbents off of the market, disrupting it, while the economic losses are absorbed by the funders (Kenney and Zysman,2019). This situation according to Kenney and Zysman (2019) will lead the market to another bubble if these companies are not able to eventually start making profits.

Crowdfunding

Crowdfunding (CF) represents a new source of funding in which, through the usage of an online platform, a large amount of people can contribute also with a relative small

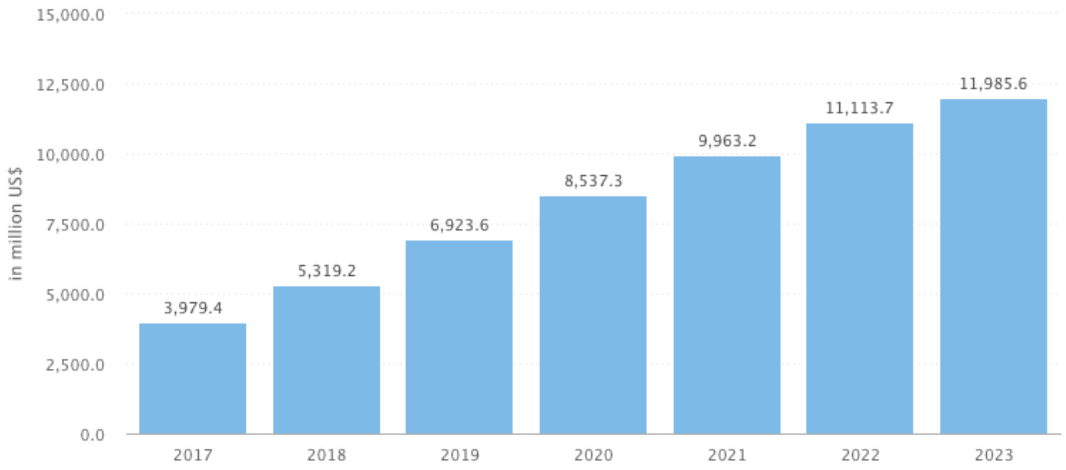

Figure 3– Transaction value forecast (Statista)

amount of funding to finance a new company or an innovative project, it is ”a way to raise money by asking the crowd (or many individuals) to contribute funds to a business for expansion of operations or advancing innovations” (Mollick, 2014). In particular, CF falls within the general categories of micro-finance because most of the projects financed are small, and fintech because it uses an internet-enabled platform technology as intermediary between entrepreneur and providers (Gutiérrez-Urtiaga and Sáez-Lacave, 2018). With its huge growth worldwide, CF increased from 21% to 143% from 2007 to 2011, thanks also to the social network engine diffusion that helped increase the interest in CF. According to Statista (survey August 2019), the CF market is continuing to grow, forecasting a total amount of transactions in 2019 of USD 6,923.6 million.

In China, the CF market is very big, also because Chinese people are the world’s biggest online spenders and they are very keen to micro-invest online in projects they want to support. As second, we find the US market while UK is the biggest player in Europe.

Top 5	
China	US$5,576m
United States	US$718m
United Kingdom	US$88m
France	US$79m
Canada	US$43m

Table 2- Total transactions values 2019 (Statista)

To sum up, crowdfunding platforms are attracting a lot of attention and, consequently, money. Still, this is not the only thing provided by backers to the entrepreneur. They usually have an active role in the innovation conversation (Mollick, 2016; Stanko and Henard, 2016), giving feedbacks and advices through the dedicated area of the platform, leading to the improvement of the final product/service.

There are different crowdfunding platforms operating worldwide on the web. They can be differentiated into four primary categories: reward based, charity based, debt and equity based (Belleflamme et al., 2013). In 2015 these categories had different performances, the reward-based model amounted to $601.2 million in the US and €139.27 million in Europe, quite similar to the debt and equity CF (that amounted to $590.9 million in the US and €159.32 million in Europe) and bigger than the donation model amounting respectively to $139.7 million and €21.71 million. (Cambridge Centre for Alternative Finance, 2016, 2017)

In rewards-based CF, companies collect funds from many individuals in return for a promised future reward from the company. Creators usually decide to use CF obviously to raise funds but also to create awareness of the product and

himself/herself (Boylan, 2018). The CF campaign can also be used to test the market, retrieve an idea of the product demand and as a signal of the company/product quality (Lehner and Grabmann, 2015). On the other hand, people donate money to a project/product or even to a person they believe in, expecting the creator to do his/her best to deliver a certain reward, if he/she can't there is no penalty or given right to the backer. This point represents the main difference between pre-sale or pre-order contract and CF, in fact in advance selling or pre-sale contracts we refer to a scenario in which a buyer purchases a product before its release at some particular conditions (Xie and Shugan 2009) and, in the case in which the product is not delivered, these contracts envisage money refunds. But this is not true in reward-based CF in which typically there are no penalties for the creator nor reimbursement for backers. The no-penalty mechanism raised a dilemma in the academic environment, but it was exhaustively addressed by a paper published in 2018 by Gutiérrez-Urtiaga et al. that we will discuss later on in the Risk chapter.

In debt and equity CF, the backers contribute with money to a business in exchange of either debt or equity securities. Because of the securities involved and the higher risk that funders are exposed to, debt and equity CF is subject to federal and state securities laws in order to regulate how the campaign should be done (e.g. JOBS Act in US). Moreover, creators are really challenged by the number of details and documents they have to prepare ahead of the campaign but, nevertheless, the attention gained from a successful campaign raise also the interest of business angels and venture capitalists. Funders, on the other hand, are happy to invest in small business in which they can feel involved.

In our research we focus on the reward-based model because, ultimately, this is the most innovative model where people try to contribute to a small project because they deeply believe in it without expecting big returns (Butticè et al., 2018).

In fact, they usually have an active role in the innovation conversation (Mollick, 2016; Stanko and Henard, 2016), giving feedbacks and advices through the platform, and, moreover, they consider the involvement to be a very important part of their reward (Agrawal et al., 2014; Gerber et al., 2012). This continuous interaction between backers and project creators is very useful to improve the final product/service through the open innovation paradigm.

Open innovation and crowdfunding

Open innovation is a paradigm that assumes that firms should simultaneously use both internal and external ideas and paths to market in order to overcome boundaries and obstacles and to be able to think outside the box. Thus, to seek such paradigm, it's necessary to leverage on external knowledge flows to accelerate internal innovation and commercialization opportunities across corporate boundaries (Di Pietro et al., 2017). Whereas, considering the crowdfunding context, Chu et al. (2019) defines open innovation as the creative ideas and/or behaviors collectively generated and conducted by all stakeholders that benefit from collaborative innovation or the co-creation of products, projects, and any aspect of multiple–partner collaborations.

If we examine crowdfunding only considering the purpose it was born for, it is a means for raising funding for a project by collecting several small amounts of money from many people. In this case we can consider money as the critical resource. On the other hand, looking at it under the open innovation perspective, crowdfunding can be seen as the link between customers and project creators, a platform that connects them and where customers' thoughts and feedback, other professionals' knowledge, third-party information, etc., could interact with the project initiators' ideas (Chu et al., 2019) so as to enhance and add value to them.

In order for the open innovation approach to really bring creativity, uniqueness and success to the crowdfunding initiative, three pillars need to be present. Diversity is the first one, which is considered as an important source of innovative activities (Frenken et al., 2007). Moreover, distinct ideas are likely to be sourced through crowdfunding initiatives since it gives access to various different perspectives. It is important that the sample of people the information and ideas are coming from is heterogeneous, as

the success of particular crowdfunding initiatives and crowdfunding as a whole relies on how diverse the customer demographic attributes are: the more diverse the customer demographic attributes, the higher the level of co-creation for new ideas (Chu et al., 2019).

It's also important that a firm can rely on different levels of expertise, which makes the crowd of investors even more heterogeneous. Thus, it's not enough to gather concepts and viewpoints only from professionals, but it's necessary to consider also those who are just interested in the specific project/firm, because these are the ones that can really provide perception and insight. Having a wide pool of investors willing to support the product development process provides strong market validation of the business (Di Pietro et al., 2017).

We can therefore say that the heterogeneous crowd of equity investors provides knowledge to the projects' creators, and this is in fact the second pillar that characterizes open innovation. Knowledge is defined by Chu et al., (2019) as the set of intellectual resources possessed by different stakeholders who interact on the crowdfunding platform. Of course, the quality, innovativeness, originality and the variety of the ideas are directly proportional to the level of knowledge of the crowd that accesses the platform.

The third pillar is networking; a good exhibits network externality when the positive change in the utility a consumer derives from it raises as the number of consumers that purchases the same product increases. In the case of crowdfunding platform as open innovation, we can consider knowledge as the good, which brings value and therefore attracts more consumers, in this case stakeholders. We can talk about direct network externalities as the value of the network good (knowledge) increases as the

number of users (backers) increases. Therefore, if the level of knowledge was to be too low, more knowledgeable people wouldn't be motivated to join the platform, and once again knowledge wouldn't be brought to the projects.

Networking also means that backers are able to extract wholeness from the personal, social and/or professional interactions on the platform, and consequently it is value adding to the open innovation performance. People come together to make up a network with the purpose of ensuring the innovativeness and success of a crowdfund project. Thanks to the networking characteristic, the experience that individual platforms offer fundraisers has been a major factor in determining how successful the crowdfunding campaigns can be (Chu et al., 2019).

After these considerations, we can say that crowdfunding can be viewed as an embodiment of the open innovation paradigm (Stanko and Hennard, 2016), but this is not general: we must distinguish between the different kinds of crowdfunding.

If we consider the debt-based type, which is by far the most important form of crowdfunding worldwide (Rau, 2017), financers are not motivated to collaborate as their contribution is only monetary in the perspective to collect a return, which is too short-term to support innovation. For these reasons, loan-based crowdfunding doesn't represent an opportunity to promote open innovation, whereas in the case of equity-based crowdfunding, the investors' expertise, competences, and vested interest in the firm's long-term success make investors a valuable source of knowledge for startups (Di Pietro et al., 2017). Thus, this kind is more prone to bring to innovativeness that generally requires time and effort.

Considering instead reward-based crowdfunding, pledges by the crowd lead to an aggregation of individual preferences (Schwienbacher, 2018), as financers are

interested in the reward, which is usually the outcome of the project. Generally, backers will be exposed to the product development process through ongoing updates and have the opportunity for direct communication with the innovating entrepreneurs (Agrawal et al., 2014; Gerber et al., 2012). Hence, they have the opportunity and are willing to participate and provide ideas that can bring to the accomplishment and spread of the product.

We can then conclude that both equity- and reward-based crowdfunding allow the adoption of the open innovation paradigm, and it is fundamental to embrace a user-centered perspective as the crowd also actively participates in selling and commercializing innovative ideas and doing so it brings more diversity into the open innovation system (Lee, 2019).

Backers as a value-adding resource

Looking at crowdfunding, backers are the main source of information that can shape, modify and improve a project. They can be fundamental in order for a project to be successful: user-centered innovation has attracted considerable attention worldwide as a consequence of it being an effective mechanism through which to source innovative ideas (Li et al., 2016) and crowdfunding represents such user-centered innovation.

Backers are central to understanding crowdfunding's potential innovation effects (Stanko and Hennard, 2016). However, traditional open innovation paradigms do not clarify whether nascent organizations benefit from such interactions since they do not yet possess the knowledge stocks to absorb and organize the information extracted from a large group of individuals effectively (Cohen and Levinthal, 1990; Lüthje and Herstatt, 2004).

Still, the actual advantage that crowdfunding holds is that the access to information and the interaction with customers (backers) happens before market entry and through a digital platform. This means that information comes from someone who is sincerely interested in the output of the project and its success (still considering only equity- and reward- based), and therefore backers are motivated to give a real contribution.

Furthermore, crowdfunding digital platforms can solve a problem which is common to young firms: the lack of resources and of sufficient network they can utilize for joint creation (Eiteneyer et al., 2019).

Backers are the core element of open innovation for crowdfunding organizations: knowledge creation through interactions with backers (and other external parties) is a key factor in understanding subsequent innovation. Specifically, backers are typically engaged, early adopters who offer advice, design ideas and even criticism throughout the product development process (Stanko and Hennard, 2016), providing feedback and ideas. The crowd possesses a capacity to evaluate projects that is similar to experts (Schwienbacher, 2018).

So, even though these platforms were born as a means to look for financing for a project, the contribution of crowdfunding to innovation goes beyond the providing of funds: they represent an opportunity to access a huge network of people that can be interested and value-adding to such projects, bringing together information and ideas from several, different participants (Eiteneyer et al., 2019).

An existing dilemma still is whether backers are only a source of information that brings to an effective innovation, while the firm/start-up itself takes care about design and development of the product, or they are also co-developers, and are therefore involved in the following stages too.

Studies show that crowdfunding, the reward-based type in particular, offers involvement opportunities as backers frequently turn into “avid fans” (Ryu and Kim, 2016). This makes them willing and motivated to offer not only their money, but also their opinions, participating to co-developing activities, even when this is time consuming, as they want to be as much involved and close to the project as possible. Backers often want to become engaged in product development alongside the innovating entrepreneur, as that experience is typically considered by backers to be a rewarding part of the process (Agrawal et al., 2014; Gerber et al., 2012).

Backers involvement also brings to cost reduction in many areas: first, the search and selection of a suitable target, then the costs associated with information transfer thanks to the strong engagement of backers in certain projects, which may also increase the knowledge quality because backers also possess technical know-how (Lüthje and Herstatt, 2004). Finally, crowdfunding platforms are social online networks, which allow instant information exchange with backers (Bruton et al., 2015; Butticè et al., 2017).

As already mention, and for reward-based crowdfunding in particular, crowdfunding can come from potential customers and can therefore indicate a proxy of demand, as backers can be considered as the earliest possible adopters. As such, another important role that backers play is the one of promoters and ambassadors of the product: information about the product is spread through word-of-mouth, which has been shown to be a useful tool in marketing (Kozinets et al., 2010) and in finance (Hong et al., 2005). Several studies have further shown the usefulness of using social networks by entrepreneurs for their crowdfunding campaigns (Ahlers et al., 2015; Butticè et al., 2017).

One more reason to involve and include backers in product development is that the frequent interaction between backers and projects' initiators can influence the performance of the campaign: for example, frequent updates by the creator are associated with greater crowdfunding performance (Kunz et al., 2017; Mollick, 2014; Xiao et al., 2014), and the number of posted comments also has a positive effect on a project's funding performance (Kim et al., 2017; Kunz et al., 2017; Li and Jarvenpaa, 2015; Xiao et al., 2014).

Incremental and radical innovation

After the analysis of the platform and the effects of continuous interactions between the entrepreneur and his/her backers, as crowdfunding is an important tool to fund innovation, we study which kind of innovation brings to more successful campaigns, comparing it in term of incremental and radical.

The involvement of backers into the product development could be risky under certain perspectives: we said that heterogeneity is important in order to gather as many different ideas as possible, but at the same time continual interaction with specific individuals leads to increasingly similar knowledge stocks (Coleman, 1988) and obtained information might become incompatible, redundant, or even irrelevant. So on the one hand there is the possibility that variety decreases due to the continuous interactions among backers, which could lead to less radical innovation, and on the other hand there is the risk that incremental ideas coming from consumers might be too close to what already exists on the market.

Incremental innovation represents the cumulative improvement of existing knowledge, capabilities or technologies at a low rate growth, refining existing characteristics with a step by step approach (Anderson et al., 2014; Chandy & Tellis, 1998; Madjar, Greenberg, & Cheng, 2011; Rubera & Kirca, 2012). Radical innovation, instead, is something that is breakthrough, revolutionary, and creates new knowledge, capabilities or technologies. As such, considering a consumer point of view, we can see how backers would be more prone to contribute to a project that involves incremental innovation: it is more familiar, easier to adopt and therefore requires less effort and implies less risks (Schwienbacher, 2018). Since incremental innovation means dealing with little changes of what is already known, backers feel more comfortable in

providing feedback and ideas. Incremental innovativeness is likely to boost consumption benefits for crowdfunders, increasing their willingness to contribute as their consumer role prompts them to perceive these campaigns as familiar, beneficial, and feasible (Chan, 2017). In fact, research has found that consumers feel more comfortable with familiar products, which offset their fear of the unknown (Park & Lessig, 1981; Prakash & Thukral, 1984). These campaigns aim at improving effectiveness and efficiency of something that already exists, implying not only low effort and risk but also low learning costs and change in consumer behavior. This means that incrementally innovative campaigns are more likely to get funded (Menguc et al., 2014; Veryzer, 1998; Zhao, Hoeffler, & Dahl, 2009).

Still from the consumer side perspective, it is difficult to assess the benefits they can draw from a radical innovation as it concerns with the unknown, creating a sense of risk. So, contrary to the other kind of innovation, the radical one requires high learning costs and effort to really give a contribution to the project through feedback. Radically innovative crowdfunding campaigns usually require specific knowledge and crowdfunders have only limited access to information about campaigns through the campaign website, making them less willing to contribute (Chan, 2017), also because they are seen as too challenging for entrepreneurs to complete (Branscomb & Auerswald, 2002; Dimov & Murray, 2008), meaning an even riskier investment.

However, even though we used to believe that radical and incremental innovation both coexist and are independent of each other, in that each is influenced by different antecedents (e.g., Jansen, Vera, & Crossan, 2009) and leads to distinct performance outcomes (e.g., Menguc et al., 2014; Rubera & Kirca), recent literature recognizes that a product, individual, or company may have elements of both (e.g., Menguc et al., 2014; Rowley, Baregheh, & Sambrook, 2011; Rubera & Kirca, 2012). Therefore, there

is no longer the need to distinguish between them, but we can talk about campaigns that combine radical and incremental innovation, which may overcome consumer resistance by reducing the learning costs and uncertainty related to radical innovation (Ellen et al., 1991). The combination of the two can reduce the uncertainty that backers perceive from radical innovation, the learning costs and also increase familiarity. These campaigns are not too puzzling or intimidating and are therefore able to intrigue backers enough to catch their interest.

Generally, different kinds of platforms favor one kind of innovation rather than the other: as equity-based crowdfunding concerns long-term projects, it is mostly used by entrepreneurs whose mind is projected towards radical innovation, which most certainty takes a long time to develop. On the other hand, entrepreneurs who turn to reward-based crowdfunding want the product to be ready in the short run, as backers expect the project to be concluded quite fast. Therefore, reward-based crowdfunding does not favor radical innovation as it doesn't usually grant enough time for the development of something that is groundbreaking (Schwienbacher, 2018). If entrepreneurs are interested in radical innovation that they want financed through a reward-based platform, then they should focus on interacting with as many categories of innovative outsiders as feasible (Stanko and Hennard, 2016): the high number and variety of external actors participating to co-development encourages risk taking and experimentation in future efforts, which can lead to the development of breakthrough products (Mascitelli, 2000). As a matter of fact, although generally backers are more likely to be involved into incrementally innovative campaigns, studies have shown that when entrepreneurs use open search (term used to describe the process by which organizations actively seek out ideas from outsiders), open search breadth (the number of different external sources of innovative ideas that a firm draws upon in its

innovative activities) is positively related to an organization's radical innovation focus (Stanko and Hennard, 2016). This is even more effective when a part of the product has already been developed and backers can give comments, suggestions and feedback about something that is already concrete.

Drones

For the purpose of our research, we decided to focus on one specific radical innovation: UAS. This is an emerging technology that is attracting a lot of attention nowadays because of the wide portfolio of possible applications. In this paragraph we go through drone evolution, delineating the main hurdles in social, ethical and political terms.

Emerging technologies are so called as they are technologies which are currently being developed and/or will be developed in the next few years. They are defined by their radical novelty, relatively fast growth, coherence and conceptual autonomy, prominent impact and uncertainty, and ambiguity (Nelson and Gorichanaz, 2019). By definition, emerging technologies are uncertain, and especially in the introductory stages of the technology (Moor, 2005). People fear the unknown, and in the case of emerging technologies little (if any) information is provided, and therefore people make up opinions based on what they know or what they think they know, which means that judgements are based on what founders and creators of the new technology want society to see. Another source of information is mass media, which serves a crucial role in providing scientific and technological information to the public. Media delineations can be a significant influence on the images formed around emerging technologies and may contribute to the interpretation given to an emerging technology's uses and impact (Freeman and Freeland, 2016). We can therefore draw that mass media can play a much influential position over people's opinion.

Rather than the technology itself, it is our use of it that affects our perception, and thus our behavior (Schultze and Orlikowski, 2004), since the advent of new and emerging technologies has broad economic, social and personal impacts (Bijker and Law, 1992), and they influence practice, the way we do things, perform tasks, achieve goals, etc.,

while creating new capabilities and possibilities for action (Mackay and Gillespie, 1992).

Emerging technologies evolve rapidly, and one of today's emerging technologies with extensive growth potential is the unmanned air systems (UAS) (Rosal, 2015), which is what we commonly call drones.

We can essentially talk about UAS, which includes the aircraft and its associated elements or UAV (unmanned air vehicle), which includes only the aircraft, yet excludes the sensors and other add-ons (Aydin, 2019), but they are often considered as synonyms, together with the term ‘drone’. UAS are currently getting stronger with private consumers as well as in the government and private companies (Anania et al., 2019), so we can claim that the previous definition of drones is quite broad. This is easy to realize also if we consider the wide range of configurations that exist. In practice, any aerial vehicle that does not rely on an on-board human operator for flight, either autonomously or remotely operated, is considered a UAV (Newcome, 2004).

Thus, even though we can state that drones are an emerging technology, if we consider the latter definition of UAVs, we could go back to 1782, when in France the Montgolfier brothers firstly experimented using unmanned balloons in France, in preparation for manned balloons flights (Kindervater, 2016). Then, in 1806, kites were flown from a 32-gun frigate to spread propaganda leaflets over the French coast. The civil intention of the Montgolfier brothers took a dramatic turn in 1849, when the Austrians weaponized lots of unmanned balloons to be launched against Venice. In 1862, a patent for a flying machine that could hold bombs was registered in Massachusetts. Seven months later, another patent was lodged in New York for a hot-air balloon that carried a basket with a timing mechanism that tipped the bomb out. This became a

defining moment in the history of UAVs for reconnaissance, surveillance and targeted killings (Attard, 2017). The evolution of the technology towards the military direction continued until the 1940s, when it was used by the United States during World War II and later on during the Vietnam war of 1964. Throughout the Cold War, the CIA deployed several drones over China, North Korea and Cuba for reconnaissance and surveillance (Central Intelligence Agency, The CIA World Fact book, Skyhorse Publishing, Inc, New York, 2015, p. 2015). The very first time that the CIA used an unmanned predator drone in a targeted killing was in Afghanistan in 2002 (Kindervater, 2016).

So, even though UAVs weren't properly originally conceived as a weapon, they have rapidly become one, while if we consider the modern drone technology, it was conceived as a weaponized vehicle for the purpose of reducing the risk to human operators in hostile territory. There has been a shift from exclusively military drones to civilian application that can be traced to Hurricane Katrina in 2005, due to the shock and severe consequences that it brought (Robinson, 2006). Since then, the technology, capabilities, and use of UAVs have rapidly and radically evolved to include surveillance and the collection of data (Cumming et al., 2007).

Rao et al., (2016), define commercial drones as those that are designed, built and used by individuals, businesses, and organizations, further stating that as the use of drones continues to proliferate, they will impact industries, ranging from entertainment (e.g., Hollywood film production) to agriculture (e.g., crops and land surveying (Finn and Wright, 2012) or crops spraying in large farms, thanks to their ability of carrying heavy equipment (Newcome, 2004)), and from construction to delivery markets (e.g., their ability to carry heavy equipment has been leveraged also for delivering food, medical supplies and drugs to inaccessible locations (Newcome, 2004)).

Drones technology is evolving both from the manufacturing side, in terms of physical platform, and from the service side. In the first case, progress is being made thanks to two main reasons: drone manufacturers, who have invited the open source community to their design process (Marks, 2011) and 3D printers, as they allow rapid prototyping and manufacture of drone components (Ahmed and Page, 2013). Open source is fundamental, because it gives access to the passion and expertise of the community, so as to create a technology that better serves and satisfies their needs (Maza et al., 2010). Under a drone-related service perspective, instead, new businesses were born, such as drone assembly, maintenance, repair (Ping et al., 2012), and also rental services, that can be exploited for television, real estate marketing, inspection etc. (Maza et al., 2010).

Aydin (2019) drafted Table 2 where he lists current and potential/future applications of drones, the latter being applications that are in prototyping, designing or initial testing stages. These show that the technology is emerging into various commercial and civilian platforms. Several organizations already exist to either design drones or to support their integration with existing infrastructure, so as to develop new and unique market-focused applications and service platforms (Rao et al., 2016).

Drone Applications	**Current/Future (As of November 2017)**
Recording sport events	Current
Monitoring nuclear plants for nuclear spills	Future
Drone racing	Current
Recording personal/family events	Current
Military applications	Current
Search and rescue	Current

Track suspected criminals or terrorists	Current
Home Security Systems	Future
Building Firefighting	Current
Photogrammetry	Current
Monitoring wildfire and forest fire	Current
Disaster early detection and disaster relief	Current
Construction surveying	Current
Thermal monitoring for detecting poor insulation and air leakage, and water leaks	Current
Highway and bridge inspection	Current
Control illegal immigration (border control)	Current
Control drug trafficking	Current
Transport deliver and deliver cargo	Future
Passenger transportation	Future
Traffic patrol	Current
Emergency response (first aid)	Future
Insurance claims	Current
Reforestation (planting trees)	Future
Treatment of agricultural fields	Current
Monitoring crop health and growth	Current
Pesticide spraying	Current
Herding cattle	Current
Surveying wild animal ecosystem	Current
Monitoring the impacts of global warming (e.g., monitoring icebergs)	Current
Tracking poaching (illegal trade of wildlife and natural resources)	Current
Monitoring air pollution	Current
Early detection of oil spills and pipeline damages or failure	Current

Delivering flotation equipment (e.g., life jackets) to the victims to aid lifeguards on beaches	Current
Disease spread control	Future
Meteorology measurement	Current
Archeological surveys	Current
Supplying connectivity via wireless signals	Future
Underwater missions to monitor ocean ecosystems	Future
Food delivery (e.g., pizza drones)	Future
Railway infrastructure monitoring	Future

Table 3- Drone Applications (Aydin, 2019)

Hence, Drones are currently being implemented in a wide variety of contexts ranging from personal hobbyists to military reconnaissance (Anania et al., 2019). However, a text analysis of 2015 that considered 1948 news drone-related articles in Australia and New Zealand showed that the highest association made with the concept of 'drone' in print media was 'military strikes' (82% of the articles) (Clothier et al., 2015). This association might be one of the causes that brings to lack of trust.

This is a problem that occurs when dealing with the unknown and this includes emerging technologies in general. Trust is critical for their societal acceptance. Without it, individuals have a hard time seeing past the risks, especially when they involve threats to individual liberties. When a technology has the potential to violate individual liberties (e.g., privacy), people won't probably be willing to trust that such technology will be used responsibly (Nelson and Gorichanaz, 2019).

Nelson and Gorichanaz (2019) define trust in emerging technologies as "a person's acceptance of the truth or beneficence of something to the extent that the person does not need to investigate the grounds for their belief".

Trust can interest different fields and we noticed that older drone-related papers are more concerned with safety and security, probably due to the association of drones and military strikes. For instance, back in 2013, Straub quoted some concerns, including potential interference with manned aircraft (Awad, 2013), UAV detectability and avoidability, and the drones causing injury (Weibel and Hansman, 2005).

He also mentioned potential privacy violations by members of the public (Villasenor, 2013) or the government (Roberts, 2008), because privacy and ethical issues have existed since the beginning, but they certainty predominate over safety and security in more recent papers. This shift was mainly caused by a few scandals e.g., when the picture of an Australian woman sunbathing topless in her backyard was taken by a drone and used by a real estate company in their advertising listing, it triggered many ethical questions about drone use (Turner, 2014). When UAV are used commercially in a society, a number of unique ethical and technical questions must be asked because of public safety and privacy issues (Clabough, 2014). Furthermore, public is worried about government agencies (law enforcement) monitoring the society secretly with drones (Aydin, 2019).

Individuals hold different perceptions about UAS usage by law enforcement due to a number of factors such as personal ideologies, situational factors (Anania et al., 2019), perceived benefits, perceived risks, area of residence, and individual differences (Yoo et al., 2018). Literature indicate that, basing on the usage of drones (e.g. drones, hobbyists or emergency), individuals expect different regulation policies, e.g. an investigation performed by Lidynia et al. (2017) showed that participants largely believe that hobbyist drones should permanently be under human control, but that emergency drones should have the capability for temporary autonomous flight. The same research also found that one critical factor is whether a person is a drone or non-

drone user: the latter have higher barriers to acceptance and different perceptions of the system.

The use of UASs in law enforcement can be very useful and groundbreaking, but can also bring to a further issue: ethics, that is the field of philosophy dedicated to investigating and systemizing what is good and bad, right and wrong, etc. (Nelson and Gorichanaz, 2019). Drones enable access to area that cannot be reached by humans, they could be lifesaving in certain dangerous situation, preventing an actual officer to get hurt or worse, they provide various additional tactics and search types. Like other police tools and powers, UAV use should be regulated and a framework for their appropriate and effective use developed (Straub, 2013).

The impacts of a technology on applied ethics are practically considered on a case-by-case basis when the well-being of a society's population is threatened. Safety, privacy, and ethical concerns are fewer when talking about recreational drone use, as these devices are usually flown by confident and expert hobbyists in confined areas controlled by regulations (Luppicini, 2016), but as device endurance improves and their costs decrease, more individuals have the opportunity to access the technology, engaging in episodic or persistent surveillance at the expenses of others' "reasonable expectation of privacy" (Rao et al., 2016). Still, privacy becomes a bigger issue for UAS operated by law enforcement, military, and government entities than for other entities such as real estate and construction (Rice et al., 2018).

Drones disrupt the expectations of reasonable privacy: they are operated in a public place yet can capture images and sound that aren't usually accessible. Hence, this arises the new issue of airspace over private property, something that nobody had been worrying about before this technology, and there is therefore a gap in the law. Current

privacy laws state that it is illegal to record the interior of a home or a privately-owned building, even if the camera is placed outside, but drones provide a monitoring capability that law hasn't dealt with yet and if we look back at the scandal of the Australian girl sunbathing topless in her backyard, this gap creates the opportunity of unwarranted surveillance without fear of repercussion (Rao et al., 2016).

Overall, many factors seem to be of concern specifically in regard to UAS usage, including physical safety, ethical concerns, legal concerns, privacy issues, and air space regulations (Luppicini, 2016).

From this previous analysis, we can conclude that people are reluctant towards the unknown. This is true also for innovation in general, in fact we previously discussed that people are more prone to fund incremental rather than radical innovation. This issue can be also applied to emerging technologies, which are characterized by radical novelty and are uncertain by definition. We can therefore imagine that drone campaigns will face more hurdles in getting funds compared to other projects because of this uncertainty that characterizes emerging technologies. *Moreover, we believe that* all the privacy, ethical, and safety issues that arise with such a technology will negatively affect the outcome of the drone-campaigns.

> ***Hypothesis H1****: given their characteristics, drone-related campaigns will have less success than other campaigns.*

Risks and difficulties of new venture financing

To continue our study, we highlight the main hurdles that new ventures undertake in trying to secure funds in their pre-seed/seed stage and delineate the main risks that both backers and entrepreneurs face when dealing with crowdfunding.

The financing of new venture has always been difficult mainly because of information asymmetry. This happens when in a transaction a party lacks information about how the other party intends to behave, meaning that one party doesn't know ahead if the other will behave opportunistically (Williamson, 1985). There are two main types of information where asymmetry is especially significant (Stiglitz, 2000). One is related to behavioral intentions, when "one party is concerned about another party's behavior" (Connelly et al., 2011, p. 42), while the other is related to quality, or the unobservable underlying characteristics of another party. Information asymmetry causes adverse selection and moral hazard. In particular, adverse selection causes all the good projects to exit the market because institutions ask high interest rate to compensate the high risk they sustained financing a project of which they have no track record or collaterals. On the other hand, moral hazard suggests that there is the risk that once the entrepreneur has received funds, he would act opportunistically reducing his/her effort on the project. To these problems, we have to add the consideration that, after a global financial crisis, traditional finance institutions resized their investments and loans, making it even more difficult to raise funds to finance new ventures.

The main problem of crowdfunding is trust. Donors have to trust a person they don't know and the little information this person provides to convince them to give him/her money. On the other side, entrepreneurs have to trust people when disclosing information about their idea on an internet public platform that, obviously, makes

details available publicly, bringing to the risk of seeing their idea stolen. Summing up, the trust problem creates risks for both creators and backers.

More in details, adopting a creator-centered perspective, a problem called "Double Trust Dilemma" (Cooter and Edlin, 2013; Hornuf and Schwienbacher, 2016) or the "Paradox of Arrow" (Arrow, 1962) may arise. This problem is typical when searching for external finance. As anticipated before, the creator must reveal information about his/her project to convince investors, or in this case backers, that it's worth investing in it. Doing so, he/she risks that the idea is stolen and developed by someone else who could become a competitor or, worse, the only one present in the market because the original creator can't complete his/her campaign. Obviously, since the information is published on internet, it's even more probable that someone takes it and tries to replicate the product. This problem could prevent entrepreneurs with good and easily imitable ideas from using CF platforms. This can also shape a little bit the kind of campaign reaching CF: radically innovative projects are the ones more prone to copycat because the idea itself is the source of the value and, therefore, it's more probable to find more incrementally innovative projects in the CF platforms (Herve, 2018). Schwienbacher (2017) showed that there are some possibilities to reduce the impact of copycat. Indeed, entrepreneurs may seek to raise more money than needed to develop the project as a way to capture some value before competing in the aftermarket in the wake of replication.

From the backers' side, in a one-shot game like a crowdfunding campaign, in which there is no penalty if the creator doesn't respect the agreement, the creator is expected to behave opportunistically, taking the money and not delivering. As already anticipated before, this problem was addressed by the paper written by Gutiérrez-Urtiaga: "The promise of reward crowdfunding "of 2018. In the paper, reward

crowdfunding is modeled as a two-stage game. In the first, the creator is discovered to be talented when his/her campaign is supported and successful, and a second stage in which the creator can capitalize his/her fame selling the product to the market, benefiting from the goodwill generated by delivering to early adopters. This goodwill would be significantly weaker as a signal of the creator ability if a penalty was introduced. The paper establishes that there is no need for a penalty to motivate creators to deliver if the possibility of scaling up is high. Moreover, the good reputation deriving from the delivery and the creator talent signaled from the crowdfunding campaign success could be enough to self-enforce the one-shot game.

Another concern for backers is that the low entry barriers create great difficulties in discerning the high-quality projects. Mostly in debt and equity crowdfunding, backers can't accurately evaluate the benefits and risks of complex crowdfunding projects because it involves companies and complex market mechanism that could be unknown to them. In fact, in contrast to traditional investors who have the capabilities to study and assess potential investment opportunities, backers are more amatorial and their ability to compare a number of projects and selecting an optimal one is weak (Ahlers et al., 2015; Bayus, 2013), and face the risk of making a bad investment (Akerlof, 1970). For this reason, the JOBS act (2012) regulated the equity-based crowdfunding, establishing investment limits and must-have disclosure documents to prepare before issuing a campaign.

Another topic which is interesting to highlight is the one raised by Lehner (2015). The main objective of CF is to raise enough money to allow the entrepreneur to develop the product, but no one can ensure that that money is not used to sustain normal day by day expenses like management expenses.

Copycat, effort and trust are not the only concerns when relying on external financing. For the purpose of our study, it is also fundamental to understand more in depth the role that information asymmetries play when distinguishing between product and service, and how their characteristics can influence backers' decisions and feelings. Our objective is to grasp which one is more successful and why.

Information asymmetries: products and services

At the beginning of the 20th century, with the second industrial revolution, manufacturers were in the spotlight thanks to the production chain that allowed great efficiency. Since then, there has been an evolution, passing from mass production to mass customization.

Nowadays services are gaining more and more importance worldwide, generating more that 70% GDP (Gustafsson et al., 2016). As a matter of fact, this paradigm is affecting also manufacturers that are trying to add complementary services to products in order to increase their revenues, proposing a more complete offer (Baines, Lightfoot, Benedettini, & Kay, 2009; Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018).

Services are characterized by four unique aspects:

- Inseparability: production and consumption of a service, differently from the case of products, happens simultaneously (Capar and Kotabe, 2003; Dunning, 1989; Erramilli and Rao, 1993; Habib and Victor, 1991; Li and Guisinger, 1992). Depending on the degree of inseparability, we can classify services as hard or soft (Stevens et al., 2015). The first ones are more standardized and less bound to the production location (e.g., music, insurance), while the latter have a higher degree of inseparability and are therefore more related to the place in which they are provided (e.g., hotels, restaurants) (Brouthers and Brouthers, 2003).
- Intangibility: services are intangible by definition. (Berthon et al., 1999; Boddewyn et al., 1986; Capar and Kotabe, 2003; Merchant and Gaur, 2008; Zeithaml et al., 1985). Also this characteristic can vary, and, according to

Contractor et al., (2013), it's possible to distinguish between the more intangible knowledge-based services (e.g., consultancy), and capital-intensive services (e.g., restaurants).

- Heterogeneity: service quality can change among different interactions due to the intangible nature of services. In fact, they are affected by the interaction between provider and consumer, that can differ every time, leading to different outputs and performances (Stevens et al., 2015).
- Perishability: services can almost never be inventoried, saved or stored (Brouthers and Brouthers, 2003; Ekeledo and Sivakumar, 1998; Zeithaml et al., 1985). In some rare cases they are not as perishable (e.g., education, entertainment).

On the other hand, products are tangible items, for which production and consumption happen separately, and that are easily storable and deliverable. Due to these characteristics, moving from tangible towards knowledge-based and intangible resources, it becomes increasingly difficult for clients and investors to evaluate quality and potential economic benefits (Sanders & Boivie, 2004).

The quality creation process can be divided into three phases: ex-ante, during and ex-post (Lapierre, 1997; Løwendahl, 2005). The ex-ante phase is the most important one, since it is the one in which the client decides which is the best service, the best provider and the best offer (Bowman & Ambrosini, 2000). This is also the phase which is most relevant for the purpose of our study, given that we want to analyze the ability of crowdfunders to attract backers, who have low/no information about the campaign creator.

To decide which is the best product/service provider, organizations face the challenge of information asymmetries and uncertainty (Bergh et al., 2014), which are the main problems of the ex-ante phase. One way to overcome this issue is through signaling. Signals are the actions insiders take to communicate positive information about their unobservable qualities to the outsiders (e.g. certifications, or degrees from prestigious universities (Connelly et al., 2011)). For signals to be effective, they need to be observable by the receivers and costly to send for those who do not possess the quality, and they must make the receivers believe the signalers are qualitatively different from other actors in the field (Connelly et al., 2011; Gomulya & Mishina, 2017; Spence, 1973). On the other hand, screening theory is the mirroring image of the signaling theory (Bergh et al., 2014). It concerns how receivers of such signals filter, interpret, and prioritize among them, and how they try to uncover information the sender might not wish to disclose (Sanders & Boivie, 2004).

Combining these two theories, we can understand that, in order to overcome information asymmetry and to convince clients, or in the case of crowdfunding backers, it's important to understand firstly which is the information they value the most, and secondly provide them with signals that can address this issue (Connelly et al., 2011).

In particular, an important signal that is always appreciated is reputation (Connelly et al., 2011). A firm's reputation can be an indicator of how a firm will act in the future (Globerman and Nielsen, 2007; Lange et al., 2011). Reputation is particularly important for service providers because of the difficulty in assessing the quality of something as intangible as a service (Cloninger, 2004; La et al., 2005; Meuleman et al., 2010). Of course, a good reputation is not an infallible predictor of future behavior. However, a reputation built upon prior transactions takes a great deal of time and

effort to build, and so firms are often highly motivated to maintain that reputation (Herbig and Milewicz, 1995; Washington and Zajac, 2005). As a result, research has demonstrated that reputation may be used for the purposes of screening and prediction when the potential for adverse selection and moral hazard exists (Weigelt and Camerer, 1988). Butticè et al., 2017 have already studied the impact of reputation on crowdfunding, analyzing the success rate of campaign created by serial crowdfunders, and demonstrated that it has a positive impact on the campaigns outcome.

What we want to concentrate on is the differences among services and products: from previous considerations, as products are more tangible, they make quality more assessable, and we can therefore presume that they are able to deliver more robust and relevant signals that can better solve information asymmetry. This ability can bring to product-based campaigns the ability to attract more backers than service-based campaigns and, therefore, to have more success. This is also true considering the drone-context. Therefore, we can hypothesize that the drone-related campaigns concerning product innovation will be more successful than the ones concerning service innovation.

> ***Hypothesis H2**: given their characteristics, drone campaigns that generate product innovation have more probability to be funded rather than the ones that generate service innovation.*

Methodology

In this chapter we will illustrate the method we followed to develop our study, explaining how data were gathered and analyzed and how we built our econometrical model.

Data gathering

To meet the aim of the paper, we have used a quantitative approach to study the performance of drone-related campaigns on crowdfunding platforms and to understand if, as we expect, product-related innovation is more backed than service-related innovation because of their characteristics that lead people to easily evaluate their quality level. In order to derive data about crowdfunding campaigns, we decided to rely on the website Kickstarter.com, one of the most important crowdfunding platforms, which has been operating worldwide since 2009 and has been able to collect over $ 4 billion successfully funding about 172000 campaigns. Moreover, it represents a reward-based crowdfunding platform, which is the most suitable kind for the aim of our research. In fact, this kind of platform attracts people more interested in the campaign success than in the economic reward that, especially when the economic contribution of the single backer is not very significant, is quite nonessential (e.g. the backer can receive, according to the amount given, a t-shirt, a thank you note or the possibility to have one of the products named after him/her).

Firstly, we searched for drone-related campaigns on the website, using the keyword: “drone”. From this research we found 605 campaigns and, after having downloaded the related links, we retrieved their descriptions through a Python code we developed.

At this point, we manually cleaned the resulted dataset from all the campaigns that didn't actually regard drones but still contained the word "drone" in their description, reason why they popped up in our research. During this operation, we decided to consider that a campaign was of our interest if, obviously, it was related to drones, and if it was able to bring innovation, through its peculiar usage of this technology or through its unique development. This latter point brought us to dismiss from our selection campaigns such as those aiming at publishing photo-books of aerial photography or movies that were realized using drones for filming. Moreover, we were not interested in videogames, action figures and many other products that were found under the keyword "drone".

This operation brought to the definition of a list made up of 358 drone-related campaigns that we called "Drone_List_1".

During this cleaning operation, we also manually distinguished between product and service innovation, furtherly dividing the product-related ones into platform and payload. This additional distinction was made to separate campaigns aiming at developing a new drone from scratch with particular characteristics from campaigns that were looking to build products related to drones e.g. new apps, cameras, stabilizer and other equipment that can be fixed on them in order to enhance their performance or enable new ones. This way, we got Drone_List_1 to be made of 262 product-related and 96 service-related campaigns.

Total campaigns	Drone-related	Product	Service
605	358 (59,17%)	262 (73,18%)	96 (26,82%)

Table 4- Drone_List_1's details

Looking at these results and at how much our data was reduced (- 40,83%), we realized that using the keyword “drone” could bias our research, and it wasn’t enough to find all the drone-related campaigns. This concern arose also because there is not a category that circumscribes all the drone-related campaigns, either on Kickstarter or on other platforms and, additionally, we acknowledged that there were also other words that could identify interesting projects (e.g. UAV, unmanned air vehicle).

Mainly for this reason, we understood that we needed to build a Python code able to classify all the Kickstarter campaigns as drone-related or non-related. In order to teach the classificator to distinguish which were the campaigns we were interested in, we needed 3 major elements: first, a list of drone-related campaigns representing our positive instances, second, a list of campaigns not concerning drones embodying our negative instances, and, ultimately, a list comprising several Kickstarter campaigns concerning several different kinds of projects. Eventually, the classificator will identify in the latter which campaigns are drone-related and which not. We worked together with the School of Management in order to build such a database, containing the links of 259042 campaigns belonging to Kickstarter, from which we were able to download the related descriptions through the same Python code used to define Drone_List_1 (which represents our positive instances). In the end, we created a dataset containing 3000 non-drone campaigns taken from the major database, representing the negative instances of the classificatory code we are going to use.

Finally having all the data we needed, we were able to use our classificatory Python code to find all the campaigns we were interested in.

Through our classificator, as the start of our analysis, we coded drone campaigns with the number 1 and non-drone ones with the number 0 by creating a variable and appending these numbers on the two respective documents.

In order to classify our data within the dataset containing the Kickstarter campaigns, we decided to employ a tree-based method because it is a simple and useful interpretation tool that involves stratifying or segmenting the predictor space into a number of simple regions containing similar observation.

Trees are very easy to explain to people because they more closely mirror human decision-making than the other regression and classification approaches. Moreover, trees can be displayed graphically, and are easily interpreted even by a non-expert. Unfortunately, trees do not generally have the same level of predictive accuracy as some of the other regression and classification approaches and, additionally, they can be very non-robust. This means that even a small change in the data could cause a large change in the final estimated tree.

Tree-based methods can be applied to both regression and classification problems. In regression trees, what is meaningful is the measurement of the dependence between the mean value of one variable and the corresponding values of the other variables. Classification trees are very similar to the previous ones, except that they are used to predict a qualitative response rather than a quantitative one. In other words, what is meaningful here is to analyze to which of the most commonly occurring class of training observations in the region each observation belongs. Given the qualitative nature of our database, we opted for the latter method.

Among the different tree-based classification methods we chose Random Forest. In general, decision trees suffer from high variance, meaning that, if we split the training

data into two parts at random and fit a decision tree to both halves, the results that we get could be quite different. However, using this method it's possible to reduce variance because the approach to build classification trees makes them decorrelated.

Random Forest starts by using the Bootstrap tool in order to reduce variance. This is a widely applicable and extremely powerful statistical tool that can be used to quantify the uncertainty associated with a given estimator or statistical learning method. The Bootstrap is able to generate different dataset by repeatedly sampling observations from the original dataset with replacement. Each of these bootstrap datasets is the same size as the original, so some observation can appear more than once and some not at all.

Once the bootstrapped training samples are built, a number of decision trees are built on them: each time a split in a tree is considered, a random fresh sample of m predictors is chosen as split candidates from the full set of p predictors. The split is allowed to use only one of those m predictors. This is what brings to decorrelated trees: e.g. if there was one very strong predictor in the data set, along with a number of other moderately strong predictors, in the collection of trees most or all of them will use this strong predictor in the top split. Consequently, all of the trees will look quite similar to each other and so they will be highly correlated. As a result, averaging many highly correlated trees gives rise to a solution with high variance.

The output of our classificatory code was a file containing a list of 0s and 1s whose positions correspond to the position of the campaigns in the complete database. In order to clean the results and have a new dataset containing only drone-related campaigns, that we called "Drone_List_2", we manually verified the 680 campaigns

that the classificator identified and classified them into product and service, furtherly distinguishing product-related ones into platform and payload.

Total campaigns	Drone-related	Product	Service
680	289	212 (73,36%)	77 (26,64%)

Table 5- Drone_List_2's details

Analyzing this final outcome, we noticed, as expected, that the classificator found some new drone-related campaigns that we hadn't found with our previous research on Kickstarter but missed some others that we had caught. Therefore, in order to have a unique complete list of drone-campaigns, we merged the two lists ("Drone_List_1" and "Drone_List_2"). To do so, we used the program "Stata/SE" to make them more homogeneous and erased misspellings.

Through this operation we obtained a complete list of drone-related campaigns that we called "Final_Drone_List".

Drone_List_1	Drone_List_2	Duplicates	Actual new campaigns
358	289	34	258

Table 6- Final_Drone_List's details

We would like to highlight that the implementation of a statistical tool such as Random Forest was meaningful for the collection of new data because we found that only 34 campaigns were present in both lists. This brought to the addition of 258 campaigns deriving from "Drone_List_2" that, otherwise, wouldn't have been identified. To sum up, on one hand, we are satisfied with this result because we were able to almost double

our data but, on the other hand, we are a little disappointed that our statistical tool wasn't able to identify lots of campaigns that were present on "Drone_List_1".

In order to have a more clear and complete database, we also renamed the variables composing "Final_Drone_List":

1. *Url*: it represents the unique web-link belonging to each campaign.
2. *Drone_type*: it explains the type of innovation brought by the campaign. It can be equal to either product or service.
3. *Product_type*: it characterizes only the campaigns where the previous variable is equal to product. It denotes whether the campaign outcome concerns a platform or payload innovation.

Having defined this list of drone-campaigns with all the characterizing variables useful to distinguish the different kinds of innovation they create, we needed a more complete database containing variables suitable to build a statistical model that is able to define the probability of success of a certain campaign. Therefore, we built a new database called "Kickstarter_16/17" containing all the campaigns running during 2016 and 2017. We chose these two years because they are recent enough to allow us to have a good picture of the diffusion of an emerging technology such as drones but not too recent so that we are able to have plenty of information about their outcome.

We downloaded all the information provided by Kickstarter about the campaigns running during those two years and renamed all the variables using Stata/SE and, matching these campaigns with the ones belonging to "Final_Drone_List" with the relative *url,* we added also the other two variables *Drone_type* and *Product_type.* Moreover, we created a new binary variable "*drone*" that assumes the value 1 when correlated to a drone-campaign. This operation brought to the composition of a

database containing a wide portfolio of variables ranging from the number of backers to the nationality of the creator and very specific details about his/her country such as workforce, birthrate and so on. This database is certainly very accurate and specific but a lot of the contained information fall outside the purview of our research. For this reason, we selected only the ones that, in our opinion, were more probable to affect the outcome of a drone-related campaign, considering also the type of innovation brought by such campaigns, with the aim of building an econometric model.

Model variables

First of all, following a long-lasting tradition in crowdfunding studies (e.g. Colombo et al., 2015; Mollick, 2014), we defined as the dependent variable the dummy variable "*success*", which equals 1 if the crowdfunding campaign was able to reach or exceed its financial goal. We defined the success of a campaign this way because the reaching of such a target is the requirement that Kickstarter.com sets in order for the entrepreneur to be able to collect backers' contributions.

We included also some control variables that might be influential in our model.

As we read while performing our literature review, social capital plays a particularly important role in determining the success of a crowdfunding campaign (Colombo et al., 2015; Butticè et al., 2017). For this reason, we collected information about it. Particularly, similar to Butticè et al., (2017), we decided to include in our model a variable indicating the social capital developed by the entrepreneur, recording the number of comments that he/she had posted on other campaigns at the time of the launch (*int_soc_capital_comment*). We decided to represent the social capital acquired using the number of the comments posted on other campaigns because it indicates an interaction that happens on the platform, both with other backers and entrepreneurs, that create a network of acquaintances useful to create new knowledge through discussions and confronts.

Afterwards, we decided to include two more variables, one concerning the target capital of the campaign, expressed in dollars (*ln_target*), and the other one indicating the number of visual elements (videos and images) within the Kickstarter.com project description (*ln_visuals*). The latter was chosen because it has been highlighted by

prior literature as a measure of the quality of the campaign (Mollick, 2014), the first one because we hypothesized that it is more difficult to reach success when the required amount of money is very high. Due to high skewness, we computed the logarithm of these two variables. Moreover, we found it useful to also insert a variable that keeps track of the length of the biography of the entrepreneur (*ln_text*), considering it as a measure of intimacy that can be created between campaign creators and backers. Even in this case, we used the logarithm in order to reduce asymmetry in the data distribution. Furthermore, we considered the duration of the crowdfunding campaign (*duration*) in days, for a reason similar to the one of the variable *ln_target*. In order to furtherly control the quality of the campaign, we considered the campaigns that Kickstarter had selected as "project we love". This characterizes those campaigns which, according to the Kickstarter blog, excelled in their design by including all the information relevant for backers. We therefore included a dummy variable (*d_staffpick*), that assumes the value 1 when belonging to this category. In order to consider the possibility to have access to capital coming from other sources, we created a set of dummy variables indicating whether the crowdfunding campaign was located in one of those metropolitan areas that are most active for VC investments. More in details, since the biggest and most important VC hubs are located in the U.S. (Chen et al., 2010), we created three dummy variables that assume the value one when the campaign was located in the San Francisco Bay Area (*d_sanfrancisco*), in the Los Angeles area (*d_losangeles*) and in the New York area (*d_newyork*). Moreover, in order to also include Europe in the study, we considered the largest VC hub of the continent, which is located in London (Bertoni, Colombo and Quas, 2015), and we created one more dummy variable (*d_london*), which assumes a value equal to one for campaigns located there. Furthermore, we included categories dummies to control for

the industry according to the Kickstarter taxonomy ($d\_category_i$) and the year dummies to control when the campaign was launched (d_year_i).

In order to consider the competition that a campaign must face when posted on the platform, we used the variable *competition*. This represents the number of campaigns running simultaneously, not differentiating between categories.

To conclude, we want to explain a variable which is not directly used in the model but whose value could bias our results: *state*. This variable indicates the status of a campaign and can assume five different values: “cancelled”, if the entrepreneur removed the campaign before the deadline of its financing, “failed”, if the campaign didn’t reach its monetary target, “live”, if the campaign is running beyond the interested moment, “successful”, if the campaign reached its financial goal and finally “suspended” if Kickstarter ended the campaign because the team “Trust and Safety” uncovered evidence that it was in violation of any rule of the platform.

Model

To build our econometric model we worked on Stata/SE. First of all, we applied logistic regression since we used as dependent variable a binary one: *success*. As a matter of fact, when implementing this model, the response default falls into one of two categories, yes or no. In this case, successful or unsuccessful. Differently from Linear Regression, which models the response of the dependent variable, this model computes the probability that the dependent variable belongs to one of the two particular categories.

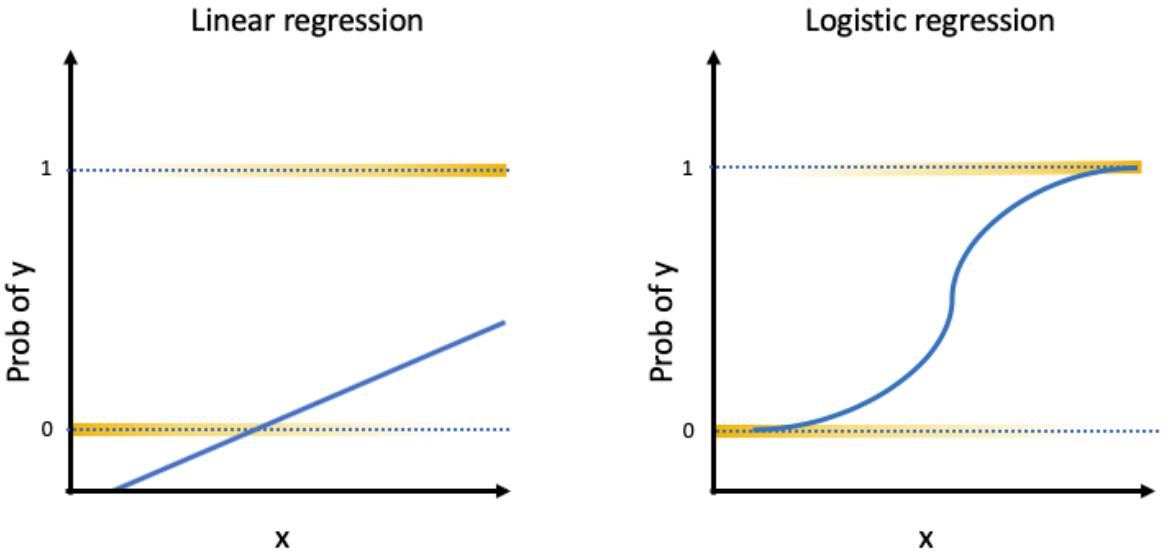

Figure 4- Linear and logistic regression

By default, the model considers 0,5 as a threshold: above this value it gives back 1, and 0 otherwise. This threshold can be moved based on the specific case: if it is important not to have false positives (false negatives) it will be increased (decreased). This is very important when misclassification costs are high (e.g., in the medical context).

Once the model to be used was selected, we firstly applied it to the database "Kickstarter_16/17" to verify if the selected variables were all meaningful. To do so we

included only the control variables and considered the p-value of each variable. If this latter value is lower than 0.05, it means that we are able to reject the null hypothesis, which states that there is no relationship between the dependent variable and the control one, and to accept the alternative hypothesis, which instead states that the variable under consideration does affect the dependent variable, and the results are significant in terms of supporting the theory being investigated.

To implement the Logistic Regression model, we used the following Stata/SE command:

```
logit success $controls if state!="live", vce(cluster location_type) asis
```

As we can see from this command, we applied the logit model, to analyze the success only using our control variables. In doing so we excluded campaigns that were still running at the time, meaning those whose expiration date was after the end of 2017 (if state!=”live “), in order to not have missing information. The last part of the command was used to cluster errors of the variable *location_type*, in order to avoid that its heteroscedastic effect biased our estimation. Going more in depth into this last concept, when using a regression model the objective is to approximate a cloud of observations into a line/plane. In doing so, generally a hypothesis of homoscedasticity is made. With this, we refer to the circumstance in which the variability of a variable is equal across the range of values of a second variable that predicts it. When this hypothesis is rejected, the model has an inaccurate prediction ability. For this reason, it is necessary to apply this command to the variable *location_type*, that indicates where the campaign creator is located (e.g., town, country, estate, etc.). As a matter of fact, we verified that campaigns created by people located in “*town*” were more successful, creating the above-mentioned heteroscedasticity.

This analysis brought to the conclusion that all the variables considered are significant for estimating the success of a certain campaign (the results will be discussed more in depth in the *Results* chapter).

Once we verified the meaningfulness of the control variables, we started our actual analysis.

Hypothesis H1

As first step, we tested our first hypothesis adding to the previous model the variable "*drone"* in order to examine if the probability of success of a campaign is positively or negatively impacted by the fact that it concerns drones. This was done through the command:

---

logit success drone $controls if state!="live", vce(cluster location_type) asis

---

Then, in order to have more detailed and complete results, we decided to verify if drone-related campaigns perform better or worse compared only to other technological projects, considering therefore only category 14, which represents technology. This was accomplished through a small addition to the previous command:

---

logit success drone $controls if state!="live" & d_category14==1, vce(cluster location_type) asis

---

After a brief check of the p-values obtained by implementing this command, we noticed that the value corresponding to d_year1 was 0.854, which is very much above the threshold indicating the statistical relevance of the variable. For this reason, we excluded it from our model by declaring a new set of variables *control2* and re-ran the command:

```
global controls2="int_soc_capital_comment ln_target ln_visual duration staff_pick1
ln_text competition d_san d_los d_new d_lond  d_cat* "

logit success drone $controls2 if state!="live" &d_category14==1, vce(cluster
location_type) asis
```

Hypothesis H2

After the previous analysis, we shifted our focus on the second hypothesis. In order to do so, we used the same approach as before.

First of all, we added the ad hoc created dummy variable *d_drone_type1* and *d_drone_type2* to the model. The first variable is equal to 1 when the drone-campaign is related to product innovation, while the second one is equal to 1 when the drone-campaign is related to service innovation.

```
logit success d_drone_type1 $controls if state!="live", vce(cluster location_type) asis
```

After checking the p-values of the control variables, we noticed that the one corresponding to *d_category5* was 0.16, so we excluded it from the model changing the control variables list in the model.

```
global controls3="int_soc_capital_comment ln_target ln_visual duration staff_pick1
ln_text competition d_san d_los d_new d_lond  d_category9 d_category12 d_year

logit success d_drone_type1 $controls3 if state!="live", vce(cluster location_type) asis
```

Through the previous command, we were able to check if product innovation is more successful than service innovation when considering only the drone market. For this purpose, we firstly tested only drone-related campaigns. We implemented the model only including *d_drone_type1* because in doing so we are able to understand the comparison of performance between product-related campaigns and the ones that are not considered, which are the service-related ones. This means that if the effect of the

considered variable on success is positive, the probability of product innovative campaigns to get funded is higher than the one of service innovative campaigns.

Also in this case we tested our hypothesis considering only the category “technology”, for the same reasons previously explained.

---

logit success d_drone_type1 $controls if state!="live" &d_category14==1, vce(cluster location_type) asis

---

Once again, we found that the variable *d_year1* had a high p-value, reason why we had to exclude it as we did when we were testing the hypothesis 1 only in the category 14. For this reason, we used the same set of control variables (control2).

---

global controls2="int_soc_capital_comment ln_target ln_visual duration staff_pick1 ln_text competition d_san d_los d_new d_lond d_cat "*

logit success drone $controls2 if state!="live" &d_category14==1, vce(cluster location_type) asis

---

Curious of the obtained results, we also analyzed how the two types of drone-related innovation perform when considering the whole database. Therefore, we assigned the value 0 to the variables *d_drone_type1* and *d_drone_type2* belonging to campaigns not concerning drones, whose field was empty before.

---

replace d_drone_type1=0 if d_drone_type1==.

replace d_drone_type2=0 if d_drone_type2==.

Once all the fields of the database contained a value, we got three different cases identified by the *drone_type* variable: drone-product, drone-service and non-drone.

In the first case we have the dummy *d_drone_type1* equal to 1 while the other is 0, in the second one the configuration is inverted while in the latter case both the dummies are equal to 0. In order to consider this situation, we needed to change our code and to consider both the dummies. The new command is:

```
logit success d_drone_type* $controls if state!="live", vce(cluster location_type) asis
```

While analyzing the performances only considering the category 14, once again we had to exclude *d_year1* due to its high p-value. For this reason, we used the same set of control variables (control2) to compare the performances of service and product within this category.

```
logit success d_drone_type* $controls2 if state!="live" & d_category14==1, vce(cluster location_type) asis
```

Results

After the complete and detailed description of the procedure that we followed in order to perform our analysis, we now explain and briefly discuss the results that we obtained from it.

Statistical significance of control variables

As mentioned before, in order to assess the statistical significance of the control variables that we selected on the dependent variable "*success*", we look at the p-values.

As we can see in *table 7*, the p-values of our control variables are all very low and, more importantly, below the threshold 0.05, that is the maximum rate that this value can reach in order to indicate that a variable is influential on the dependent variable and therefore relevant for a certain model.

There is actually one variable, *d_category4*, whose p-value equals 0.063. This value exceeds the threshold of such a little amount that we have decided to not discard this variable from the model, also because we think that it is interesting, from an empirical point of view, to study the impact of all the categories that Kickstarter proposes on its website.

Lastly, we can notice that *d_year2* and *d_category15* are omitted by Stata due to collinearity. This happens because their value is consequent upon the others (e.g. if all the category dummies equal 0, then d_category15 will obviously equal 1).

Since this occurs every time that we apply our model, in the following tables we will omit all the collinear variables.

success	**Coef. (Std. Err.)**	**z**	**P>|z|**	**[95% Conf. Interval]**	
int_soc_capital_comments	0,5640 (-0,0043)	131,29	0,0000	0,5556	0,5724
ln_target	-0,6643 (-0,0041)	-163,66	0,0000	-0,6723	-0,6564
ln_visual	1,5088 (-0,0142)	106,38	0,0000	1,4810	1,5366
duration	-0,0171 (-0,0002)	-95,49	0,0000	-0,0175	-0,0168
staff_pick1	1,5470 (-0,0175)	88,22	0,0000	1,5126	1,5813
ln_text	0,0582 (-0,0031)	18,51	0,0000	0,0521	0,0644
competition	0,0001 (0,0000)	10,04	0,0000	0,0001	0,0002
d_sanfrancisco	0,7971 (0,0223)	35,74	0,0000	0,7534	0,8408
d_losangeles	0,4481 (0,0265)	16,89	0,0000	0,3961	0,5001
d_newyork	0,8176 (0,0311)	26,32	0,0000	0,7567	0,8785
d_london	0,8092 (0,0355)	22,80	0,0000	0,7396	0,8788
d_category1	-1,8222 (0,0797)	-22,87	0,0000	-1,9783	-1,6661
d_category2	-2,1003 (0,0705)	-29,81	0,0000	-2,2384	-1,9622
d_category3	-2,6129 (0,0731)	-35,76	0,0000	-2,7562	-2,4697
d_category4	0,1033 (0,0556)	1,86	0,0630	-0,0058	0,2123
d_category5	-2,4978 (0,0712)	-35,10	0,0000	-2,6373	-2,3583
d_category6	-2,6371 (0,0595)	-44,31	0,0000	-2,7537	-2,5204
d_category7	-0,9168 (0,0592)	-15,50	0,0000	-1,0327	-0,8009
d_category8	-1,2660 (0,0691)	-18,33	0,0000	-1,4014	-1,1306
d_category9	-2,9496 (0,0481)	-61,30	0,0000	-3,0439	-2,8553

d_category10	-1,5910 (0,0607)	-26,20	0,0000	-1,7100	-1,4719
d_category11	-0,1797 (0,0663)	-2,71	0,0070	-0,3096	-0,0498
d_category12	-1,6014 (0,0791)	-20,25	0,0000	-1,7564	-1,4465
d_category13	-1,2648 (0,0576)	-21,96	0,0000	-1,3777	-1,1519
d_category14	-2,7548 (0,0738)	-37,34	0,0000	-2,8994	-2,6102
d_category15	0,0000 (omitted)				
d_year1	-0,0688 (0,0048)	-14,40	0,0000	-0,0782	-0,0594
d_year2	0,0000 (omitted)				
_cons	2,9076 (0,0715)	40,68	0,0000	2,7675	3,0477

Table 7- Outcome of the model considering only control variables

Having understood that all the control variables that we chose have an impact on the success of a campaign, we start to analyze the magnitude of the impact of each variable.

Impact of control variables on *success*

We find as the most positively impacting control variable *staff_pick1*. We consider this result quite predictable. In fact, this distinctive tag is assigned by Kickstarter itself and denotes campaigns that are characterized by superior design and completeness in terms of information and details provided to the public. For this reason, this kind of campaigns will be the first one that backers notice and the one they pay more attention to because, the fact that they are a "project we love", is a sort of quality indicator that signals their superiority, diminishing the impact of another important issue that arises during the campaign screening phase that is that backers don't own all the tools that professional investors do to assess quality and opportunities of a project (Ahlers et al., 2015; Bayus, 2013). This tag, being a signal for quality, is able to increase trust while decreasing the fear of the unknown, because backers do trust the qualified Kickstarter's employees that screen the campaigns. The number of visuals in a campaign description has a similarly positive impact on the success, as demonstrated by the similarity of their coefficient. This similarity is, in our opinion, justified by the fact that the number of photos and videos included within a project is one of the factors contributing to the attribution of the "project we love" tag and, moreover, if a description incorporates multimedia, it will be clearer and more appealing. Just a little bit below we find the 4 variables indicating the creator location (*d_newyork, d_london, d_sanfrancisco,* and *d_losangeles*). Since the bigger VC hubs are located in these cities, it is plausible that these campaigns are at a more advanced stage because of the support of other external funds, which supposedly makes them completer and more interesting.

On the other hand, we see that almost all the category-related variables have a strong negative influence on the success factor. Among the most negative ones we find *d_category14* that indicates the technology category. The reason behind this phenomenon might be identified among the adverse characteristics of emerging technologies that make backers more reluctant in financing them.

Hypothesis H1

Hypothesis H1 suggests that drone-related campaigns are less successful than other matters-related campaigns. From our research, we find that, according to the logit model we implemented, drones actually have a negative impact on success.

Comparing *table 8* to *table 7*, we can notice that, the model remains quite stable, despite the addition of the new variable *drone*. In fact, the coefficients of all the control variables present in the previous analysis change only by a minimum amount: the biggest changes are *d_sanfrancisco* which decreased by 0,0018 and *d_category14* which increased by 0,0084. This can be interpreted as a signal of the statistical robustness of our model. Consequently, these small changes don't modify which are the most impacting variables of the model.

Focusing more in detail on the purpose of our research, we can notice that the *drone* variable is highly significant, still considering its p-value, which is very close to 0, and its coefficient, which is approximately equal to -0.7717. With the introduction of this new variable, the most negative impacting variable, right after the category-related ones, is no longer *ln_target* but *drone*.

From this outcome we can conclude that: first, the fact that a campaign concerns drones really does affect its performance, and second that this impact is actually negative and relevant. This model provides support for hypothesis H1, confirming that drone-related campaigns will have less probability of success than campaigns concerning other kinds of products and services.

success	**Coef. (Std. Err.)**	**z**	**P>|z|**	**[95% Conf. Interval]**	
drone	-0,7717 (0,0941)	-8,20	0,0000	-0,9561	-0,5874
int_soc_capital_comments	0,5642 (0,0043)	131,68	0,0000	0,5558	0,5726
ln_target	-0,6643 (0,0041)	-162,97	0,0000	-0,6723	-0,6563
ln_visual	1,5090 (0,0142)	106,45	0,0000	1,4812	1,5368
duration	-0,0171 (0,0002)	-94,86	0,0000	-0,0175	-0,0168
staff_pick1	1,5488 (0,0174)	88,79	0,0000	1,5146	1,5829
ln_text	0,0580 (0,0031)	18,42	0,0000	0,0518	0,0642
competition	0,0001 (0,0000)	10,07	0,0000	0,0001	0,0002
d_sanfrancisco	0,7953 (0,0223)	35,59	0,0000	0,7515	0,8391
d_losangeles	0,4485 (0,0264)	16,97	0,0000	0,3967	0,5003
d_newyork	0,8167 (0,0310)	26,31	0,0000	0,7559	0,8775
d_london	0,8091 (0,0355)	22,81	0,0000	0,7395	0,8786
d_category1	-1,8224 (0,0796)	-22,88	0,0000	-1,9786	-1,6663
d_category2	-2,1009 (0,0704)	-29,85	0,0000	-2,2388	-1,9629
d_category3	-2,6132 (0,0731)	-35,77	0,0000	-2,7564	-2,4701
d_category4	0,1032 (0,0556)	1,86	0,0640	-0,0058	0,2123
d_category5	-2,4983 (0,0711)	-35,14	0,0000	-2,6377	-2,3590
d_category6	-2,6375 (0,0594)	-44,38	0,0000	-2,7540	-2,5210
d_category7	-0,9170 (0,0591)	-15,51	0,0000	-1,0329	-0,8011
d_category8	-1,2664 (0,0690)	-18,34	0,0000	-1,4017	-1,1310

d_category9	-2,9504 (0,0479)	-61,57	0,0000	-3,0443	-2,8565
d_category10	-1,5912 (0,0607)	-26,21	0,0000	-1,7102	-1,4722
d_category11	-0,1798 (0,0663)	-2,71	0,0070	-0,3097	-0,0500
d_category12	-1,6009 (0,0791)	-20,24	0,0000	-1,7560	-1,4458
d_category13	-1,2650 (0,0576)	-21,97	0,0000	-1,3778	-1,1522
d_category14	-2,7464 (0,0741)	-37,06	0,0000	-2,8916	-2,6011
d_year1	-0,0685 (0,0048)	-14,18	0,0000	-0,0779	-0,0590
_cons	2,9082 (0,0715)	40,69	0,0000	2,7681	3,0483

Table 8- H1 tested on Kickstarter_16/17

In order to have a deeper understanding of this phenomenon, we also tested our model only considering campaigns belonging to category 14, which represents technology. As mentioned in the methodology chapter, this further analysis brought us to the exclusion of the variable *d_year1,* due to its elevated p-value (0.854).

This new model changed a lot how much the control variables influence campaigns outcome.

As shown in *table 9*, which represents the outcome of the new model and the differences between the new coefficients and the old ones, the most positively influential variable is still *staff_pick1*, which changes only by about 0.05. Without the category-related variables, *ln_target* is the most negatively influential control variable, which decreases by about 0.14. This effect, combined with the increase of the *drone* variable, results in the fact that the characteristic of being drone-related becomes less relevant than the monetary amount the entrepreneur asks for when

considering only the technology category. Nevertheless, it remains negative and quite relevant in determining the success of a campaign.

We can notice in the table on the right that the two locations San Francisco and New York are the two variables that increase the most, becoming more positively influential, while the other two locations (Los Angeles and London) are the two that decrease the most, becoming less influential. A reason why this occurs could be that in the first two cities we have two bigger VC hubs, even when compared to Los Angeles and London, which might catch the most appealing and promising technological projects. For this reason, we can assume that the projects that are published on Kickstarter have already received some funds and are therefore in a more advanced stage of development. This could create stronger signals of quality because of the higher probability of completion and the higher amount of visuals they are able to provide, resulting in a higher probability of success.

Moreover, *ln_visual* still remains one of the most positively impacting one, probably due to the fact that in a technological context posting photos of prototypes, videos of how they work, and showing the progress of the project can be important and determining for the involvement of backers. Nevertheless, it is the most decreasing variable probably due to the fact that, for technological projects that haven't received previous funds, it can be difficult to provide these kinds of visual evidence because of the early stage of development they are in.

	Coef.
drone	-0,7259
int_soc_capital_comments	0,7441
ln_target	-0,8057
ln_visual	1,2225
duration	-0,0057
staff_pick1	1,4961
ln_text	0,1313
competition	0,0002
d_sanfrancisco	0,9939
d_losangeles	0,1810
d_newyork	1,2551
d_london	0,6256

	Δ
d_newyork	0,4384
d_sanfrancisco	0,1986
int_soc_capital_comments	0,1800
ln_text	0,0733
drone	0,0459
duration	0,0114
competition	0,0001
staff_pick1	-0,0526
ln_target	-0,1414
d_london	-0,1835
d_losangeles	-0,2675
ln_visual	-0,2865

Table 9- H1 tested on Kickstarter_16/17 only considering category 14 and comparison with previous results

According to these results, we can conclude that, even when considering only the category technology, the variable *drone* still negatively influences the outcome of a campaign, even if a little bit less.

Hypothesis H2

Hypothesis H2 suggests that product innovation-related campaigns will have more probability to succeed rather than those that are service innovation-related. From our research, we find that, according to the logit model we implemented, our second hypothesis is not supported, as service-related innovation is more successful than product-related innovation. As a matter of fact, as we can see from *table 10*, the focal variable, *drone_type_1,* influences negatively the success of campaigns, with a coefficient equal to -1.63168300. This figure represents the most negatively impacting one and it is lower than *d_category_9* (which has the second most negative coefficient) by circa 0.649. For this reason, we can conclude that besides being negative, it represents a crucial factor in determining the outcome of a campaign.

Going more in depth in our analysis, we can notice that *staff_pick* is still in the top position, being the most positively impacting variable. Just below it we can find *ln_visual* and the location-related variables. This is another signal of the robustness and stability of our model.

Looking instead to the variables that negatively impact *success*, we still find, besides *d_drone_type_1*, *d_category9* that in all the previous models had the most negative coefficient, and *ln_target,* confirming that campaigns that require a high economic contribution are less prone to success.

success	**Coef. (Std. Err.)**	**z**	**P> |z|**	**[95% Conf. Interval]**	
d_drone_type1	-1,6317 (0,0944)	-17,28	0,0000	-1,8168	-1,4466
int_soc_capital_ comments	0,4688 (0,0058)	80,46	0,0000	0,4574	0,4802
ln_target	-0,6550 (0,0021)	-319,31	0,0000	-0,6590	-0,6509
ln_visual	1,1034 (0,0113)	98,05	0,0000	1,0814	1,1255
duration	-0,0174 (0,0002)	-106,21	0,0000	-0,0177	-0,0170
staff_pick1	1,7410 (0,0191)	91,20	0,0000	1,7036	1,7784
ln_text	0,1849 (0,0084)	22,00	0,0000	0,1685	0,2014
competition	0,0002 (0,0001)	12,28	0,0000	0,0001	0,0002
d_sanfrancisco	0,7439 (0,0332)	22,44	0,0000	0,6789	0,8089
d_losangeles	0,6469 (0,0331)	19,53	0,0000	0,5820	0,7119
d_newyork	1,0779 (0,0369)	29,18	0,0000	1,0055	1,1503
d_london	0,9381 (0,0358)	26,22	0,0000	0,8679	1,0082
d_category9	-0,9826 (0,0180)	-54,62	0,0000	-1,0179	-0,9474
d_category12	-0,0742 (0,0305)	-2,43	0,015	-0,1341	-0,0144
d_year1	-0,0608 (0,0039)	-15,75	0,0000	-0,0684	-0,0533
_cons	1,1091 (0,0268)	41,43	0,0000	1,0566	1,1615

Table 10- H2 tested only on drone-related campaigns

As we did during the testing of hypothesis 1, we focused our analysis considering only category 14.

The output is very similar to the previous one: the most influential variables are still the same, but we can affirm that *d_drone_type1* has a much lighter effect, even though it still has a negative coefficient. Also compared to the analogous analysis run during the testing of hypothesis H1, the changes that occur are quite similar. This is a further signal of the robustness of our statistical model.

	Coef.
d_drone_type1	-0,9114
int_soc_capital_comments	0,7442
ln_target	-0,8056
ln_visual	1,2237
duration	-0,0058
staff_pick1	1,5007
ln_text	0,1308
competition	0,0002
d_sanfrancisco	0,9926
d_losangeles	0,1847
d_newyork	1,2545
d_london	0,6258

	Δ
d_drone_type1	0,7203
int_soc_capital_comments	0,2754
d_sanfrancisco	0,2487
d_newyork	0,1765
ln_visual	0,1203
duration	0,0115
competition	0,0001
ln_text	-0,0541
ln_target	-0,1507
staff_pick1	-0,2403
d_london	-0,3123
d_losangeles	-0,4622

Table 11-H2 tested on drone-related campaigns in category 14 and comparison with previous results

In order to conclude the analysis of the impact of the variable *d_drone_type*, we extended our research considering not only the drone-related campaigns, but the whole database "Kickstarter_16/17".

From *table 12* we notice that both the product-related campaigns and the service-related campaigns have a negative coefficient, meaning a negative effect on the probability of success of the drone campaigns in general, confirming the hypothesis 1. Analyzing the single coefficients, the product-related campaigns still perform worse than the service-related ones, even if their disadvantage is a little less severe.

Staff_pick1 is still the most positively impacting variable of *success*, together with *ln_visual*. Instead, category-related variables are, once again, the ones that have the most negative influence on the outcome of campaigns.

We decided not to discard d_category4 from the model because its p-value exceeds the threshold indicating statistical significance by just a little amount.

success	**Coef. (Std. Err.)**	**z**	**P>|z|**	**[95% Conf. Interval]**	
d_drone_type1	-0,9397 (0,1007)	-9,33	0,0000	-1,1370	-0,7423
d_drone_type2	-0,1662 (0,0460)	-3,61	0,0000	-0,2564	-0,0759
int_soc_capital_comments	0,5642 (0,0043)	131,76	0,0000	0,5558	0,5726
ln_target	-0,6643 (0,0041)	-162,81	0,0000	-0,6723	-0,6563
ln_visual	1,5092 (0,0142)	106,44	0,0000	1,4814	1,5369
duration	-0,0171 (0,0002)	-94,63	0,0000	-0,0175	-0,0168
staff_pick1	1,5492 (0,0174)	89,11	0,0000	1,5151	1,5832
ln_text	0,0579 (0,0032)	18,39	0,0000	0,0518	0,0641
competition	0,0001 (0,0000)	10,08	0,0000	0,0001	0,0002
d_sanfrancisco	0,7952 (0,0223)	35,60	0,0000	0,7514	0,8390
d_losangeles	0,4488 (0,0264)	16,99	0,0000	0,3971	0,5006
d_newyork	0,8167 (0,0310)	26,31	0,0000	0,7558	0,8775
d_london	0,8092 (0,0355)	22,80	0,0000	0,7396	0,8787
d_category1	-1,8226 (0,0796)	-22,88	0,0000	-1,9787	-1,6665

d_category2	-2,1011 (0,0704)	-29,86	0,0000	-2,2390	-1,9632
d_category3	-2,6134 (0,0730)	-35,78	0,0000	-2,7565	-2,4702
d_category4	0,1032 (0,0556)	1,85	0,064	-0,0058	0,2123
d_category5	-2,4985 (0,0711)	-35,15	0,0000	-2,6378	-2,3592
d_category6	-2,6377 (0,0594)	-44,39	0,0000	-2,7542	-2,5212
d_category7	-0,9171 (0,0591)	-15,51	0,0000	-1,0330	-0,8012
d_category8	-1,2665 (0,0690)	-18,34	0,0000	-1,4018	-1,1311
d_category9	-2,9506 (0,0479)	-61,62	0,0000	-3,0445	-2,8568
d_category10	-1,5913 (0,0607)	-26,21	0,0000	-1,7103	-1,4723
d_category11	-0,1798 (0,0663)	-2,71	0,007	-0,3097	-0,0500
d_category12	-1,6016 (0,0790)	-20,27	0,0000	-1,7565	-1,4468
d_category13	-1,2651 (0,0576)	-21,98	0,0000	-1,3779	-1,1522
d_category14	-2,7460 (0,0741)	-37,05	0,0000	-2,8913	-2,6007
d_year1	-0,0685 (0,0048)	-14,18	0,0000	-0,0780	-0,0590
_cons	2,9085 (0,0715)	40,70	0,0000	2,7685	3,0485

Table 12- H2 tested only on Kickstarter_16/17

When applying the same model to only the category 14, regarding technology, we notice some interesting changes. While *d_drone_type1* doesn't change much, the *type2* dummy becomes positive, indicating a positive impact on the campaign success probability of the decision to develop a service related to drones rather than a product-oriented project.

	Coef.
d_drone_type1	-0,9112
d_drone_type2	0,1323
int_soc_capital_comments	0,7442
ln_target	-0,8057
ln_visual	1,2239
duration	-0,0058
staff_pick1	1,5006
ln_text	0,1309
competition	0,0002
d_sanfrancisco	0,9929
d_losangeles	0,1849
d_newyork	1,2547
d_london	0,6260

	Δ
d_newyork	0,4381
d_drone_type2	0,2985
d_sanfrancisco	0,1977
int_soc_capital_comments	0,1800
ln_text	0,0729
d_drone_type1	0,0285
duration	0,0113
competition	0,0001
staff_pick1	-0,0485
ln_target	-0,1414
d_london	-0,1831
d_losangeles	-0,2639
ln_visual	-0,2852

Table 13- H2 tested on Kickstarter_16/17 only considering category 14 and comparison with previous results

Discussion

In this section, we are going to review the results obtained through our econometrical model. In fact, it is very important to analyze the reasons why our first hypothesis was supported by the model, while the second one wasn't, even if both were strongly based on the solid academical knowledge we acquired during our literature review. We are also going to check the performances of the variables we chose to examine the performances of drone-related campaigns on the crowdfunding platform Kickstarter, in order to be able to clarify why and how they are important in explaining the success rate and to detect how their impact change throughout the study.

From our preliminary analysis, we are puzzled by the negative impact on the success of the majority of the categories, the only one that has a positive coefficient is *d_category4* which is related to dance. Looking more in depth into this topic, we looked for data able to uncover this matter, so we drafted *table 14* from our database "Kickstarter_16/17". This table represents the number of campaigns that were running throughout years 2016 and 2017 and their relative performance, considering the 15 categories, proposed by Kickstarter, that we are considering. As we can see from the success rate column, the percentage of campaigns that have actually succeeded in getting funds is quite low, as it is for each single category. This leads us to the conclusion that most of the campaigns fail independently from the category they belong to and it is therefore plausible that all the coefficients related to the single categories are negative: they represent the fact that in each category the majority of the campaign fails.

Categories	Launched Projects	Success	Success Rate
All	61407	22899	0,37290537
1. Art	3737	1483	0,39684239
2. Comics	2565	1578	0,61520468
3. Crafts	1275	323	0,25333333
4. Dance	461	261	0,56616052
5. Design	6482	2875	0,44353595
6. Fashion	4786	1352	0,2824906
7. Film & video	7415	2734	0,36871207
8. Food	3666	841	0,22940535
9. Games	8753	4149	0,47400891
10. Journalism	906	163	0,1799117
11. Music	4942	2074	0,41966815
12. Photography	1425	518	0,36350877
13. Publishing	6331	2308	0,36455536
14. Technology	7443	1584	0,21281741
15. Theatre	1219	655	0,53732568

Table 14- Kickstarter categories success rate in 2016-2017

The positioning of the categories in the general model seems to mostly resemble the success rates in *table 14*: in both cases, the most successful one is dance (category 4) while technology (category 14) is very bad performing. Comparing their positioning in the two different cases (as shown in *table 15*), it is quite noticeable that the two rankings are not exactly the same. This happens because our model is multivariate, meaning that success is influenced by more than just one variable. For this reason, the values of the coefficients belonging to the model are influenced also by the values of the other variables, resulting in a more precise prevision of success.

Categories	Success Rate
2. Comics	61,52%
4. Dance	56,62%
15. Theatre	53,73%
9. Games	47,40%
5. Design	44,35%
11. Music	41,97%
1. Art	39,68%
7. Film & video	36,87%
13. Publishing	36,46%
12. Photography	36,35%
6. Fashion	28,25%
3. Crafts	25,33%
8. Food	22,94%
14. Technology	21,28%
10. Journalism	17,99%

Categories	Coef.
15. Theatre	omitted
4. Dance	0,1033
11. Music	-0,1797
7. Film & video	-0,9168
13. Publishing	-1,2648
8. Food	-1,266
10. Journalism	-1,591
12. Photography	-1,6014
1. Art	-1,8222
2. Comics	-2,1003
5. Design	-2,4978
3. Crafts	-2,6129
6. Fashion	-2,6371
14. Technology	-2,7548
9. Games	-2,9496

Table 15- categories success rate and coefficients of the general model decreasingly ordered

One important result that we can draw from our model is that *staff_pick1* is the most impactful variable on the success of a campaign. This tag, that is assigned by the staff of Kickstarter, denotes campaigns that stand out from the rest because of their superior design and completeness in terms of information and details provided to the public. The attribution of this award creates a filter gathering campaigns from all the different categories, that people can use during their screening process. In this way, a campaign displaying this tag is able to send a quality signal to possible backers who don't need to read and analyze it in order to assess its quality. This, indeed, is a distinctive characteristic that defines signals, which are able to decrease the information asymmetry and the uncertainty people face when making decisions (Bergh et al., 2014), reducing the effort they have to sustain during this phase. This uncertainty, that is present in every transaction, in crowdfunding occurs specifically because, in crowdfunding, occurs because the ones that decide to finance projects

using this innovative kind of platforms are not professional investors, so they don't own all the tools and knowledge that would be necessary to assess the risks, but also the opportunities, that a campaign beholds (Ahlers et al., 2015; Bayus, 2013). Being able to reduce such uncertainty, this tag is also able to reduce the fear of the unknown, that, according to Park & Lessig (1981) and Prakash & Thukral (1984), is intrinsic in people, and make them feel less confident with unknown items and, in our specific case, with campaigns that concern unfamiliar products. This effect could be very important especially for campaigns relating to drones because being an emerging technology makes them particularly uncertain (Moor, 2005). For this reason, according to the results of our research, a campaign creator, in general but especially a drone-related one, should invest time and effort when creating a campaign, inserting all the useful and important information and details and taking care of the design of the campaign, in order to obtain this label and to communicate effectively the quality of the campaign. The effort required to accomplish all the requisites that are needed in order to receive the "project we love" tag, makes this a costly signal to acquire and, according to Connelly et al., (2011), Gomulya & Mishina (2017) and Spence (1973) a more robust one.

Moreover, in order for a signal to be recognized as valuable, the authority that releases it must be a trustful and respected one: for instance, in the case of a degree coming from a university, people give their trust to the more high ranking ones, and therefore, the more prestigious the school is, the stronger is the signal. For this reason, we can affirm that people do trust Kickstarter as an authority that is able to assess quality and consequently create robust signals. This trust probably derives from the fact that, throughout time, the website has been capable of developing relationships with its

"clients", both campaign creators and backers, that make the service it offers to be recognized as respected.

Another variable that could be related to *staff_pick1* and which is always positive and highly influential is *ln_visual*. We claim that the two variables are related because in order to be picked by Kickstarter to be part of "project we love" a high number of visuals is required. We think that this is true also and especially for drone-related campaigns because, to attract people for financing a technology, it is necessary to provide images and videos that represent prototypes and that are able to better explain their usage. This is particularly true when dealing with a public that is not an expert in the field of technology, as it is the one of Kickstarter.

On the other hand, even though it's true that a high number of visuals and information provided can attract a wider audience, it is also true that it could increase the risk of forgery. Schwienbacher (2017) affirms that this risk is particularly present on crowdfunding platforms because of the high number of people that can access the published information. Nevertheless, it is important to bear this risk in order to increase a lot the probability of success of a campaign.

Another important factor influencing the outcome of a campaign is the campaign creator location. In fact, as we previously saw, the variables that indicate the four cities that are closer to the biggest VC hubs in the world are always positively impacting *success*. One reason behind this occurrence could be the access to a bigger number of alternative sources of investment. This could result in products or services that are at a more advanced stage of development, which could be more appealing for potential backers, who see their reward more likely to be completed and delivered in a shorter amount of time (in fact, most of the campaigns put the product itself as the reward).

On the other hand, if backers feel that the campaign is nearer to its realization, it will be amused because of the higher possibility of success, that is another very important factor they value independently from the reward offered, since the financing happens usually just in case of projects that supporters really care about and want to be realized.

After this preliminary discussion, we now want to focus on the main topic of our research. From our analysis, we confirmed the first hypothesis we made, establishing that drone-related campaigns are really less successful than the others.

As already discussed, the main reason for this phenomenon is linked to the fact that drones are an emerging technology, which makes them uncertain and have a high degree of novelty by nature. This characteristic makes people more skeptical about them and the ways in which people could use them. As a matter of fact, people are afraid that others could use this technology to take advantage of others, not only from a personal perspective, but also from an economic and social point of view (Bijker and Law, 1992). This reasoning is true for all emerging technologies in general, and therefore drones too. Considering this latter technology, those problems are translated into security, ethical and privacy issues. There are concrete examples of problems created by the unscrupulous usage of unmanned air vehicles (UAV) from all over the world: in Australia the picture of a woman sunbathing topless in her backyard was taken by a drone and used by a real estate company in their advertising listing, in Italy the Malpensa airport was shut down for about 20 minutes because of an unidentified drone flying near the landing strips.

The issues related to drones scare the vast majority of the population, as demonstrated by many studies that investigate the correlated popular opinion. For example, a study carried out in December 2017 by Pew Research Center reported that 54% of the public

don't want drones to be flown near their homes, while from another one run in Australia and New Zealand we discovered that in the 82% of the cases, in the articles used to perform a study about this matter, the highest association to the concept of 'drone' was 'military strikes'. From these examples, we can derive that people are not just skeptical, as said before referring to emerging technology in general, but also quite hostile towards the technology of drones.

We personally noticed, while performing our research, that many crowdfunding projects on Kickstarter that try to finance drone services aiming at providing surveillance and vigilance fail, often not receiving any funds. This occurrence is a proof that people are really concerned about their privacy and personal space violations. We found the majority of these campaigns when analyzing older projects. More recent campaigns, on the other hand, try to offer different kinds of services, probably because entrepreneurs have understood the reluctance of people towards the financing of that kind of projects, and moreover because the concept of drone has evolved during the years: from the main purpose of surveillance and security to a tool more dedicated to entertainment and to provide services to the community in an innovative way (e.g. delivery, crop surveying, etc.).

The evolution of this technology is also the result of changes in laws and regulations, that still have to fill some gaps that have been created due to the introduction of UAVs. For instance, nowadays the issue of airspace over private properties is very discussed, leading to some restrictions as the need of a license for professional usage, maximum distances from the pilot, both vertical and horizontal, and the prohibition to fly them in certain areas and meteorological conditions.

When focusing our attention only on the category technology, we find, in our results, that projects concerning drones are less prone to failure when compared only to campaigns belonging to this category rather than when compared to the ones regarding all the other classes. Supposing that people who look into this category are already interested in technology, this outcome could be explained by the fact that this kind of backers are more prone to innovation and less adverse to the unknown and to uncertainty. Nevertheless, since we are considering a category that is the second most numerous one, it can be very difficult to stand out from the others, explaining why the coefficient improves just by little, still remaining below zero.

While we were quite confident about the outcome of the analysis regarding the first hypothesis, we are very surprised about the results we obtained from the study of the second one.

From the literature review, we assumed that it is much more difficult to obtain the trust of consumers when offering services due to their intrinsic characteristics, especially intangibility. Our conclusion was that these characteristics increase the information asymmetry and uncertainty that already exist in general transactions. This is particularly true in the crowdfunding context, where you usually deal with a single unknown entrepreneur who often has a little amount of collaterals and no reputation, if not when considering a broader sense, that could indicate that they are capable of offering a high-quality service. Moreover, our assumptions about hypothesis H2 were strengthened when considering our preliminary analysis, where we discovered the importance of providing visuals to possible backers in order to convince them about the quality of your project and to prove that it is at a good stage of development. In fact, we consider that products should probably be able to provide

a larger amount of visuals and therefore deliver a stronger signal of quality able to convince people to back.

Finally, besides the fact that our hypothesis H2 was grounded upon theory and logical reasoning, as already mentioned in the Results chapter, it was confuted. As a matter of fact, from our analysis we conclude that campaigns displaying product-related innovation perform worse than the ones displaying service-related innovation, reaching with less probability their financing goal.

Trying to identify the reason behind this outcome, we identify some motivations that we think could explain why the deductions we derived from the review of the literature don't fit this context.

The first reason we identified as an explanation of this phenomenon is the fact that product-innovation related to drones is often focused on developing faster, cheaper or easier-to-build UAVs. This results in many campaigns that are similar to each other, thus, it is not easy to have one particular campaign that stands out among the others. Moreover, we personally noticed, during the screening phase of the campaigns we performed in order to classify the ones that were really concerning drones, that often many products share very similar characteristics, both technical and design-wise. This brings to a little differentiated offer, which could be also caused by the "Double Trust Dilemma" (Cooter and Edlin, 2013; Hornuf and Schwienbacher, 2016): the information that is publicly posted on the platform can easily be taken from other actors that use it to replicate the product. On the other hand, this causes the proliferation of this kind of campaigns, bringing to higher competition that, since the products are not differentiated, can bring the single backer to pick only one campaign almost randomly, leaving the others unfinanced. At the end, if this happens, the funds'

distribution is even among all the campaigns, that are therefore hardly able to reach their financial goal, especially if it is high. Instead, we noticed that the portfolio of services that is possible to finance on Kickstarter is very wide: the offering ranges from online courses about how to pilot a drone to drone racing, from humanitarian driven services to more practical services (e.g., delivery). This wideness lets the offer address many different needs and problems in new and innovative ways, allowing the involvement of a higher number of backers. This is less true for product innovation, which seems to be focused on just a few features. Moreover, the fact that services are very differentiated could stimulate backers to contribute to more than just one campaign, even because many of them are complementary to one another.

Another explanation could derive from this very last concept, the contribution that backers give to more than one campaign. Considering the assumption of Agrawal et al., (2014) and Gerber et al., (2012) that backers consider the involvement in the development of a project as part of the reward, taking part to more campaigns can make backers feel more satisfied. Moreover, it is probably more difficult to give a real contribution to the development of a very technological product such as drones, which require very technical knowledge, while in the context of services backers can feel more confident in sharing their opinion, also through more down-to-earth advice. This way the concrete reward that could come from financing a product-related campaign is replaced by a more fulfilling and intangible one. This feeling of gratification is even more enhanced when dealing with humanitarian projects. In our opinion, since we noticed many of the successful service-related campaigns concerned this topic, this could be another reason why services more easily reach success. These services do not only concern humanitarian matters in a strict sense, but, as already mentioned, the drone industry could have an impact on many of the seventeen global sustainability

goals drawn up by ONU, that comprise many different ways to solve the many problems affecting the humankind worldwide together with the environment.

Shifting to a different point of view, we figured that financing services could, in a certain way, reduce the concerns that are linked to the inappropriate usage of this technology that many studies have highlighted. We could assume that when offering only the product, this could be used by whoever purchases it in many different ways, both proper and not. On the other hand, when financing a drone that is aimed at a specific usage and purpose, backers feel safer and more comfortable. Moreover, an entrepreneur that offers a service can earn the trust and respect of his/her backers through the information shared, declaring the purpose of the usage of this technology and providing evidence of his/her goodwill to stick to it. Instead, when an entrepreneur develops a campaign that aims to develop a product, which is usually also the reward that every unknown backer receives, the latter has no information about each other, who might not be trustful. This brings back the issue of inappropriate usage.

After these considerations, we can conclude that the higher weakness of signals sent by services, in order to prove quality, is overcome by other factors, that are proper of this context and technology. In fact, even though inseparability, intangibility, heterogeneity, and perishability that characterize services negatively influence the screening phase that backers face when they are trying to decide which campaign(s) to finance, our statistical analysis has proven that this is not so crucial when comparing services to products. As a matter of fact, innovation regarding drones is actually more appealing when concerning services. Indeed, as mentioned before, they grasp a larger amount of problems, solving them in many different and original ways. On the contrary, product innovation, in the context of drones, nowadays is very limited and

little various, producing an environment of similar offerings that result less interesting and fascinating. Moreover, the intangible benefits that backers derive from contributing to the development and actualization of a new innovative service persuade them to accept a higher level of information asymmetry, deriving from the presence of weaker signals. In this specific case, they become more risk-takers, because the journey shared with the entrepreneur is more important than the possibility of not being able to eventually achieve the final goal.

Conclusions

After an exhaustive and meticulous discussion of the results obtained in our analysis and the factors that explain its outcome, we now state the main limitations that narrowed our research and that could be addressed by academics in future researches, the implications for practitioners, academics and policymakers, and conclude our study wrapping up our findings.

Study limitations and potential future research

To our knowledge, this study represents the first research to focus on the performance of drone-related campaigns in crowdfunding, furtherly differentiating between product and service innovation. Nevertheless, there are limitations that require mentioning and ample opportunity for related future research.

First of all, focusing our research only on two years (2016-2017) certainly reduced the number of drone campaigns we were able to use in our study. For this reason, a potential future study could be able to gather more campaigns about drones because this emerging technology is gaining more attention year after year and we are therefore positive that this number will increase. Furthermore, since this technology is not fully regulated yet, it is not possible to exploit it at its full potential, leaving space for future improvement and additional diffusion.

Another way to collect more data is to garner information from more than one crowdfunding platform. We decided to focus only on Kickstarter because of its world-class results that make it, in our opinion, the most interesting one and, moreover, because it represents a reward-based platform which denotes the most suitable kind of crowdfunding for the purpose of our research. Finally, we also discussed our idea

with the School of Management, which focuses its research on crowdfunding on this platform. They agreed with us that a reward-based platform could be the most appropriate kind for our study because it is able to attract people that are really fascinated by the possibility of involvement in the development and consecutive success of the campaign(s) they finance, which indicates that they are moved by a real interest in the topic rather than by a financial return. Moreover, also the School of Management thinks that Kickstarter is the best source of data because of its popularity and the high number of campaigns published on it. Nevertheless, this study could be replicated combining data deriving from different crowdfunding websites in order to have a wider and more differentiated set of data, containing also information about those platforms whose backers are more interested in real investments and financial returns.

In order to perform our research, we decided to use only a tree-based method, random forest, to classify campaigns as drone or non-drone related. We took this decision only based on our statistical knowledge, favoring the easiness of interpretation of tree-based methods and the ability of random forest to decrease the high variance that characterizes these tools. Further studies could try to apply a performance analysis to determine which method is the best performing, before making their choice. Some possible alternatives we considered, when deciding, but excluded are: support vector classifier (SVC), multinomial naive Bayes and nearest centroid.

Future possible studies could also furtherly focus their attention on the distinction between platform and payload when considering product-based innovation concerning drones. Initially, we made this distinction thinking that it could be useful in our study but, at the end, it resulted to be out of our scope because it was not able to add any valuable insights to our research.

Finally, another possible study that could deepen the understanding of the hurdles of drones in getting funded could consider the possibility to compare this technology with another emerging one. From this analysis, it could be possible to draw further conclusions on the reasons why drone-related campaigns hardly reach success in crowdfunding: whether it is linked to the intrinsic characteristics of this technology or if it is something that emerging technologies share in general.

Implications for academics, practitioners, and policymakers

Considering academics, our study highlights that the weakness of services' quality signals deriving from their intrinsic characteristics doesn't always result in a lower probability to be chosen. As a matter of fact, in our specific situation, we find that there are several external factors that not only mitigate the information asymmetries that exist, but also are able to overcome this issue making services more prone to success compared to products. Moreover, we demonstrate the high failure rate that drone-related campaigns face, as the representation of an emerging technology that is going through its pre-seed financing stage.

What we can conclude and suggest to practitioners from the outcomes of our analysis is that the probability to reach success with a drone-related campaign is very low. For this reason, they should carefully evaluate the decision of investing their time, creativity, and monetary assets in drone-related campaigns. Nevertheless, we believe that in the future many issues that are related to drones will be solved, resulting in a more positive opinion of this technology, an increase in its usage, and consequently in a higher level of interest from the public, both in general and more specifically in crowdfunding. Still, drone enthusiasts should now try to focus on developing a good service proposal rather than a product one in order to have more possibilities to get funded.

Considering instead policymakers, we would suggest to focus on filling all the gaps that are now creating reluctance and skepticism against drones, because of their many applications in several different fields, that create value not only economically and socially, but also when considering sustainability issues, as already discussed in the introduction chapter when mentioning the seventeen global sustainability goals. Once

these gaps will be filled, people will better accept drones, feeling safer thanks to an ad-hoc created regulation able to erase the possibility of unpunished immoral and non-ethical usage.

Concluding remarks

In summary, our study argues that drones, as representative of emerging technologies, still struggle in being accepted by the big public, resulting in many difficulties in getting funds in the pre-seed phase of the related projects. These hurdles are mitigated when comparing them only to other technologies, proving how this sector is competitive and uncertain when considering the crowdfunding context. Moreover, a further mitigation happens when considering service-related drone campaigns. In fact, projects that focus on developing innovative services provided through drones are more prone to success, even if the signals that they are able to deliver are, according to theory, supposed to penalize them. This is the result of the influence of many external factors, such as the higher variety of service offers, the fewer concerns about the inappropriate usage of the product, and the possibility for backers to give a real contribution to the development of the campaign.

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