

Crowdlending Campaigns for Renewable Energy: Success Factors

Faten Ben Slimane*. Université Paris-Est, IRG (EA 2354), UPEC, UPEM, Pôle du Bois de l'Étang, 5 Bd Descartes, F-77454, Marne-la-Vallée, France.

* Corresponding author. Tel: +33 1 60 95 71 08. Fax: 01 60 95 70 60. E-mail address: faten.benslimane@u-pem.fr.

Antoine Rousseau. Université Paris 1 Panthéon-Sorbonne, 12, place du Panthéon 75005 PARIS, France.

Crowdfunding Campaigns for Renewable Energy: Success Factors

Abstract

Crowdfunding is becoming an alternative way of funding start-ups and small and medium enterprises (SMEs) in various sectors, including renewable energy, a sector with major difficulties in financing. It consists in financing projects, through specialized platforms, by a large number of individuals (the crowd). But despite the growing popularity of crowdfunding, its usage and functioning in the renewable energy sector remain misunderstood. This paper addresses this lack of clarity by exploring empirically the factors that contribute to the success of crowdfunding campaigns in renewable energy sector. The study uses data collected from the three most important crowdfunding platforms dedicated to renewable energy in France. The results support the importance of the economic characteristics of the project, including its interest rate, the amount requested, the size of the firm and its financial performance as the major contributors to the success of campaigns. Subjective criteria, mainly the age, and, to a lesser extent, the size of the social network and the gender of the entrepreneur, also contribute to collecting funds. These findings are relevant for entrepreneurs and platforms, helping to identify the most important elements to provide to the crowd in order to facilitate the success of campaigns in renewable energy.

Keywords

Renewable energy, Crowdfunding, financing projects, lending decision making.

Crowdfunding Campaigns for Renewable Energy: Success Factors

Introduction

Climate change and environmental pollution have become one of the most complex challenges faced by governments around the world. Their main purpose is to offer cleaner and more efficient energy systems in the future (IEA and IRENA, 2017). This objective was reinforced in 2015 by the implementation of both the Sustainable Development Goals and the Paris Agreement, whose objective is to limit the rise in global temperature to well below two degrees Celsius (2°C). Renewable energy is at the heart of this global transformation but requires significant investments (IRENA, 2016). This investment totaled about 286 billion USD in 2015 and is expected to reach 500 billion USD in 2020 and around 900 billion USD by 2030 (IRENA, 2015). According to the IRENA report, private finance “*will have to supply the lion’s share*” of this investment. However, the literature points out that investments in the renewable energy sector can be uncertain, costly and risky (Bento et al., 2019), creating difficulties in financing (Vasileiadou et al., 2016). The financing problems this sector encounters increased with the financial crisis of 2008 as financial support from many governments and banks dried up (Eleftheriadis and Anagnostopoulou, 2015; Yildiz, 2014). In this tight environment, recent studies suggest that crowdfunding could be considered a viable solution to financing such projects and can contribute to greater investments in the sector (Dilger et al., 2017; Hörisch, 2015; Vasileiadou et al., 2016).

Crowdfunding is a relatively new way of financing SMEs and innovative projects (Maier, 2016). It consists in financing individual or firm projects by a large number of individuals (the crowd), each making a relatively minor contribution (Mollick, 2014). The literature usually distinguishes four models of crowdfunding: donate (Mollick, 2014), reward (Belleflamme et al., 2014), equity (Ahlers et al., 2015) and lending (e.g. Herzenstein et al., 2011). The global crowdfunding market was valued at 10.2 billion USD in 2018 and is expected to reach 28.8 billion USD by the end of 2025 (Valuates Report, 2019). Due to the increasing importance of crowdfunding, many studies investigate the determinants of funder motivations (the crowd) and the factors contributing to the success of crowdfunding (e.g. Cai et al., 2016; Calic and Mosakowski, 2016; Lin et al., 2013; Mollick, 2014; Mollick and Robb, 2016; Short and Anglin, 2019).

Surprisingly, despite the increasing popularity of crowdfunding, research focusing on renewable energy projects is limited (Cumming et al., 2017). Some studies investigate the business model and its ability to help financing energy transitions and increase societal support (Vasileiadou et al., 2016), while other researchers suggest dynamics models to promote crowdfunding of renewable energy (Lu et al., 2018). More recently, other studies analyze the level of risk (Bento et al., 2019) and the post-funding phase (Hörisch, 2019) to investigate whether the projects implement the environmental goals.

Cumming et al. (2017) is, to the best of our knowledge, the only paper that investigates the information asymmetries in cleantech energy projects and whose findings provide valuable information on the factors contributing to campaign success. The authors explore reward-based campaigns published by Indiegogo, one of the most popular US-crowdfunding platforms.

Our study contributes to the literature by investigating factors that affect crowdfunding for renewable energy projects. Unlike Cumming et al. (2017), we focus on a lending-based model, considered the most popular form of crowdfunding, representing more than 72.6 percent of the global crowdfunding market (Leboeuf and Schwienbacher, 2018).

In this article we examine all renewable energy projects published by the three leading crowdlending platforms specializing in financing renewable energy and environmental projects in France. This study focuses on France due to its specificities. The country is ranked second in Europe in terms of peer-to-peer market-funded volumes (KPMG Report 2016). France is considered, according to the Renewable Energy Country Attractiveness Index and the Global Energy Architecture Performance Index, one of the most attractive nations in the world in terms of investment in renewable energy projects. Moreover, the crowdfunding French market in renewable energy sector is increasing exponentially. It totaled 20.5 million EUR in 2017 (+78% in comparison with 2016) (Greenunivers, 2018).

Our results suggest that financial aspects of the project are the main factors affecting campaign success. Lenders also consider characteristics of the entrepreneur, usually his age and to a lesser extent the size of his social network and his gender.

This article contributes to the literature in several ways. First, it extends the research on the success factors for crowdfunding campaigns by considering specific projects. Renewable energy projects are unique in two ways. They are particularly risky because they can be rapidly disrupted or become obsolete (Cumming et al., 2017). Investors in renewable energy must evaluate both the viability of such projects and their market opportunity and prospects, making information asymmetries one of the most important challenges that funders face, which can affect their funding decisions (Cumming et al. 2017).

The second unique quality of renewable energy projects is that they are sustainable. They embrace public and social goods since they may increase societal and political support and awareness of energy and environment issues (Vasileiadou et al., 2016; Lam and Law, 2016). Investor motivations can be different from those for other projects, affecting the success of campaigns.

Second, this article fills a gap in the literature by considering a lending-based model of crowdfunding whereas previous studies investigate the reward-based model. Funder motivations can differ according to the type of crowdfunding (Mollick, 2014). For a reward-based model, for example, the funder is not motivated by monetary benefits (Cholakova and Claryss, 2015). However, for a lending model, the funder expects a return on the capital invested (Belleflamme et al., 2015). Studying the determinants of funder decisions and the success of campaigns is complex and should take into account not only the nature of the project but also the type of crowdfunding (Calic and Mosakowski, 2016; Mollick, 2014).

Research on these different elements is still scarce and deeper analysis is needed to learn more about success factors for campaigns in specific sectors.

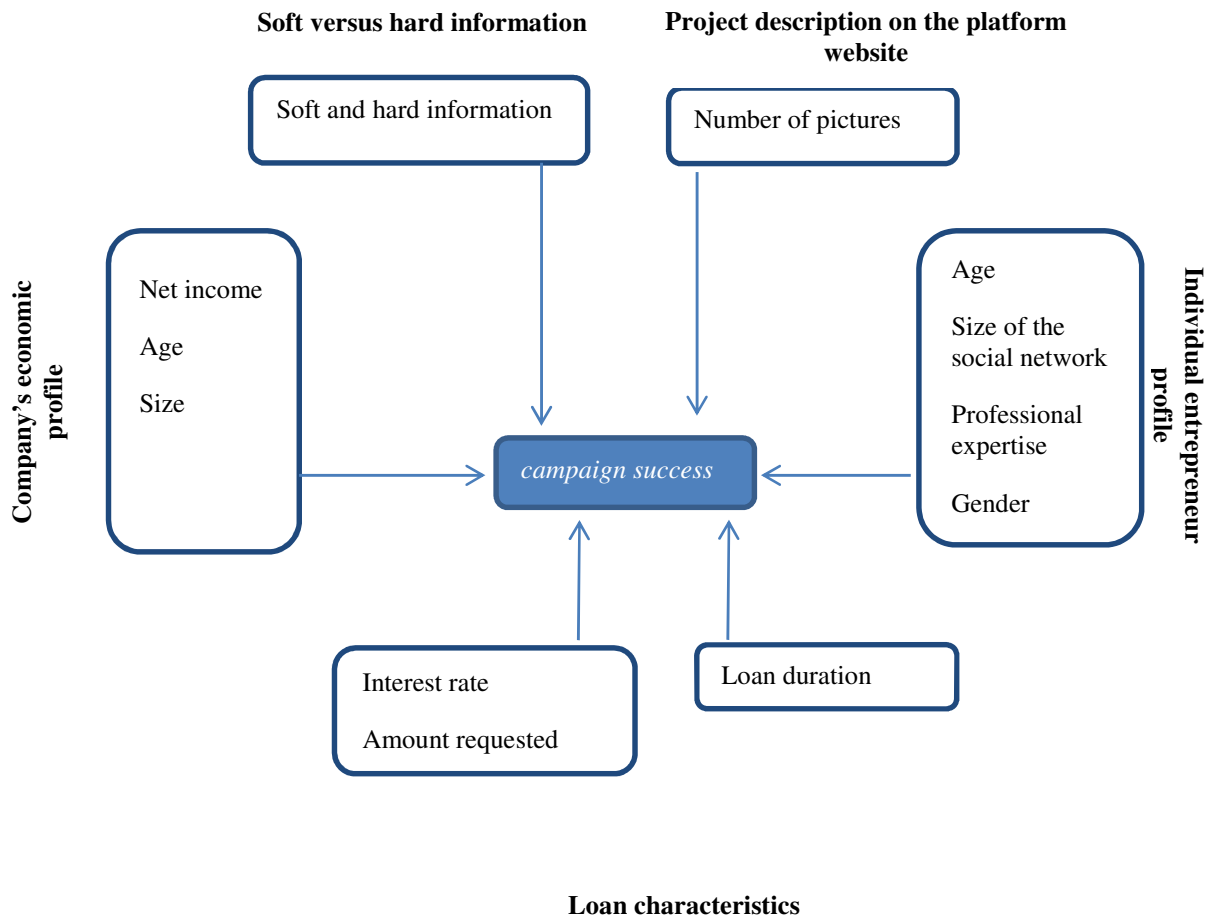
Third, this article provides useful information to firms on how to access other sources of funding and on the determinants of success for crowdlending campaigns in the renewable energy sector. Consequently, our study has valuable implications for the renewable energy sector. In addition to financial support, crowdlending contributes to promoting the entire sector. By publishing projects online, platform users can discover renewable energy products which may lead them to experiment with new tools that in turn reach new customers.

1. Hypotheses development

Crowdlending depends on the interaction of three entities: founders, funders and platforms (Belleflamme et al., 2015). Founders (borrowers) can be individuals (peer-to-peer lending) or entrepreneurs (peer-to-business) who need funds to finance a project. To raise money, they usually contact a crowdfunding internet-based platform. If the platform accepts the project, it is published on its website. Funders (lenders), by connecting on the platform website, then have access to information on all the projects published by the platform. In cases where the funder finds an attractive prospect, he can decide to help the founder by giving him a small amount of money via the website. These platforms act as financial intermediaries by underpinning the interaction between lenders and borrowers and allowing fund collection (Belleflamme et al., 2014). However, even though the platforms in most cases verify the credibility of the borrower before posting the project on line, the final evaluation of risk of default of each project posted by the platform is left to the individual lenders who usually have no expertise in risk management (Yum et al. 2012). The literature reports that crowdlending has a high degree of information asymmetry (e.g. Belleflamme et al., 2015; Feng et al. 2015, Yum et al. 2012).

Investigating how to deal with the information asymmetry problem in crowdlending is essential since the development and success of this type of funding depend on lenders continuing to lend money to risky borrowers (Yum et al. 2012). Many studies analyze the mechanisms that can contribute to increasing the trustworthiness of borrowers and support campaign success. Most of these studies emphasize the need to reduce the information gap between lenders and borrowers. The latter have to provide the market with valuable and different information in order to help potential lenders assess the level of risk of default (e.g. Greiner and Wang, 2010). The literature usually distinguishes four sets of information: information on financial performance of the borrower, on loan characteristics, on entrepreneur profile and on the pitch presentation. Many studies try to identify elements among these sets of information that have the most significant effect on the campaign success. In this study, we examine some of these elements that could affect the lender decision in the renewable energy sector. The specific relationships that we hypothesized and empirically tested are summarized in figure 1.

Fig1. Contribution of various information to campaign success in renewable energy sector



Note: The arrows are hypothesized and empirically tested.

Company's economic profile

In the literature, it is often shown that economic variables of the company affect lending decision. Lenders are especially interested in the size of the firm. The literature on information asymmetry reports that small firms traditionally encounter problems in collecting funds from external financing sources (Berger and Udell, 1998; Cenni et al., 2015) because lenders have incomplete information on the quality of the project and on firm management, giving rise to adverse selection (Stiglitz and Weiss, 1981). Moreover, there is a problem of moral hazard since uncertainty on management capability exists. According to these studies, younger and smaller firms have more difficulty in financing their projects through external sources.

Studies on crowdfunder projects indicate that borrowers with good financial performance records are more likely to collect funds. A solid financial performance reassures lenders about the trustworthiness of the borrower (Greiner and Wang, 2010) and consequently on the funds collected for the project. Financial performance is the most important criterion affecting lender decisions (Cai et al., 2016; Greiner and Wang, 2010) because it clearly shows

repayment ability and the risk of default. Considering Prosper.com, an online US peer-to-peer lending platform, Iyer et al. (2016) provide evidence that standard financial information typically used by banks including the amount requested, the debt-to-income ratio and the annual income affects lending decisions. These results are in line with those of Duarte et al. (2012) who find a positive effect of borrowers' financial resources on the funding probability. Hence, the hypothesis is set up as follows:

H1: Even in the renewable energy sector, the company's economic profile (net income, company age and size) positively affects campaign success.

Loan characteristics

Besides financial information about the company, the literature considers information on the loan as a criterion for lender decisions (Bodie et al., 2012). These measures include interest rate, loan amount, and loan duration. Freedman and Jin (2017), Pope and Sydnor (2011) and Cai et al. (2016), among others, report a strong relationship between the loan interest rate and listing outcomes (default, probability of funding). The interest rate indicates not only the potential financial return to the lender but also the monetary cost that the borrower will pay. It sends a signal to the market on the economic performance of the project.

Considering the amount requested previous study results are not conclusive and depend on the form of crowdfunding. Focusing on reward-based crowdfunding, many studies show that a high amount requested by borrowers is negatively associated with the campaign (e.g. Mollick, 2014). Belleflamme et al. (2014) confirm this finding and add that considering equity crowdfunding, larger amounts are preferable because funders are more likely to gain larger financial return when capital requirements are high. Lukkarinen et al. (2016) investigate success drivers of equity crowdfunding campaigns and find that the funding goal is positively associated with the number of investors but not significantly related to the amount raised. Regarding the lending-based model, most of the studies find that smaller loan requests are more likely to receive funding (e.g. Lin et al. 2013; Yum et al., 2012; Greiner and Wang, 2010). But all these studies consider an *all-or-nothing* platform model. In such cases, the higher the amount requested, the higher the risk that the funds will not be fully collected and the campaign will not succeed. Due to this risk, larger loan requests negatively affect the number of lenders and funding the project becomes difficult. In the case of a model of keep-what-you raise, regardless of the amount collected, the founder retains the funds. The size of the amount requested may positively influence the likelihood of funding because larger loans need to attract more lenders and motivate them to give more funds.

Renewable energy projects are often more sophisticated and complex than other projects, increasing information asymmetries that lenders encounter (Cumming et al., 2017). Platform approval of the amount requested may be considered by lenders as a positive signal of borrower creditworthiness. Therefore, we expect a significant and positive effect of the amount requested on the campaign success.

The effect of the loan duration is less clear. Yum et al. (2012), for example, collect data from a Chinese lending platform and find that loan duration positively affects campaign success. Considering another Chinese platform, Feng et al. (2015) show that this indicator has a significant impact on the number of bids and funding timing but not on funding success, whereas Cai et al. (2016) find no significant effect of loan duration on lending decisions.

The literature on crowdfunding argues that motivations of lenders depend on the nature and specificities of projects (e.g. Mollick, 2014). Lenders for renewable energy projects, for example, do not necessarily seek rapid liquidity because they know that, in comparison to other sectors, environmental projects take a longer time to be implemented and achieve their goals (Hamilton, 2009), which means less liquidity for lenders. For this reason, we argue that investing in environment sector is not affected by loan duration, unlike in other sectors.

This leads to the following hypotheses:

H2: Information on a loan affects campaign success.

H2 a: The interest rate and the amount requested positively affect campaign success.

H2 b: We expect no effect of loan duration on campaign success.

Individual entrepreneur profile

Numbers of studies emphasize the size of the entrepreneur's social network in crowdlending decisions. Data on the social network represent a strong positive signal to lenders and contribute to the success of the campaign (e.g. Lin et al., 2013; Liu et al., 2015). Since the entrepreneur is known and appreciated by a large number of people, lenders are reassured about his credibility and encourage others to invest in the project. The size of the entrepreneur's social network is used by lenders to reduce the information asymmetry problems they may encounter (Freedman and Jin, 2017). Having a large network of relationships constitutes a valuable resource for entrepreneurs in managing the company (Nahapiet and Ghoshal, 1998) and should contribute indirectly to improve the economic performance of the firm (Baker, 1990). Accordingly, the social capital dimension of the entrepreneur is a positive signal of his trustworthiness and should positively affect campaign success.

Due to considerable asymmetric information, lenders have to evaluate the level of trustworthiness of the borrower by collecting personal information that helps them judge the borrower and his trustworthiness (Gonzalez and Loureiro, 2014). Age may imply a certain level of experience and competence (Pope and Sydnor, 2011) and older entrepreneurs may be perceived as more experienced and more competent than younger entrepreneurs. Focusing on peer-to-peer lending, Gonzalez and Loureiro (2014) find that age is the main criteria affecting lending decisions. Younger borrowers are associated with smaller loans.

In addition to age, the entrepreneur's gender may affect loan decision-making (Feng et al., 2015; Gonzalez and Loureiro, 2014; Pope and Sydnor, 2011). But this effect is ambiguous and depends mainly on platform specificities (country, model, etc.) and on the combination of borrower and lender (Gonzalez and Loureiro, 2014). Barasinska and Schäfer (2014) consider a German crowdlending platform and find no effect of gender on the individual borrower's

chance to receive funds whereas Feng et al. (2015) consider a Chinese crowdlending platform and show that lenders prefer female borrowers.

Gonzalez and Loureiro (2014) confirm the positive effect of gender on lending decisions, particularly when experience and competence of borrowers cannot be easily deduced. Considering a reward-based platform, Mollick and Robb (2016) suggest that crowdfunding benefits women. In contrast, Geiger and Oranburg (2018) find significant evidence that equity campaigns that have female entrepreneur receive fewer funds.

The entrepreneur's human capital is also considered in the literature as a source of credibility and predicted ability (Backes-Gellner and Werner, 2007). The level of education and professional experience provides information on the ability to manage the company, which enhances confidence in potential lenders. Focusing on crowdfunding campaigns, Liang et al. (2019) study the factors that influence funders' investment behavior and show that the fundraiser's ability and expertise are key variables affecting investment decisions. The renewable energy sector is particularly innovative and we argue that entrepreneurs in this sector should have higher skills and capabilities to conduct the project and to identify business strategy and opportunities. Thus, human capital, notably professional expertise in the environment sector, positively affects funding success on renewable energy platforms.

We consequently hypothesize a positive effect of personal characteristics of the entrepreneur on campaign success:

H3: The profile of the individual entrepreneur (age, the size of the social network, professional expertise in the environment and gender) positively affects campaign success.

Project description on the platform website

Other studies investigate how the number of pictures posted on the project affects campaign success. Greiner and Wang (2010), Ahlers et al. (2015) and Mollick (2014), among others, highlight the importance of publishing photos on the platform website to describe the project. The literature on internet-based e-commerce (e.g. Tidwell and Walther, 2002; Riegelsberger et al., 2003) confirms that visual self-disclosure affects buying decisions. The pictures help lenders create a visual idea of the project, which contributes to addressing information scarcity they face. This should encourage them to fund the project (Berger and Gleisner, 2009). Cumming et al. (2017) show however that in comparison to non-cleantech campaigns, cleantech campaigns are less intensive for gallery-items, implying that the number of photos is less relevant in such campaigns. According to Cumming et al. (2017), investors are more sensitive to text content (including hard and soft information) than to its visual presentation in the environment sector. Thus, we hypothesize no effect of the number of pictures on campaign success, in the renewable energy sector:

H4: The number of pictures posted has no effect on campaign success in the renewable energy sector.

Soft versus hard information

The financial intermediation literature usually classifies the information used by lenders to make their lending decision into two categories: hard and soft. Hard information is quantifiable and objective whereas soft information is descriptive and subjective (Liberti and Petersen, 2019). Most of the studies focus on banks by showing that these financial institutions rely mainly on quantifiable information to evaluate borrower trustworthiness. By contrast, lenders on crowdlending platforms also use soft information to mitigate information asymmetries between the funders (the crowd) and the founders (Yum et al., 2012).

Focusing on the lending-based model, Iyer et al. (2016), among others, find that lenders use soft information in addition to standard information to assess default risk. This information is even more important when the borrower has low credit quality (Iyer et al., 2016) or when the project is risky (Klaft, 2008). Lenders use this private information in addition to financial and factual information to evaluate the creditworthiness of the borrower. In the environmental context, Cumming et al. (2017) confirm the importance of soft information on clean-tech projects due to their high level of risk in comparison with non-cleantech projects. Entrepreneurs, therefore, should provide soft information to reduce information asymmetries and to reassure investors on both the solvency and the benefits of renewable energy projects. But the main motivation of funders on lending-based platforms remains their monetary returns (Belleflamme et al., 2015). We argue that soft information is important for funding success to supplement hard information, which remains, even in a sustainable sector like renewable energy, the most important determinant affecting lending decisions. This leads to the following hypothesis:

H5: Soft information supplements hard information and plays an important role in raising funds.

2. Data collection

We collect data on 167 campaigns launched on the three most important crowdlending platforms specializing in financing renewable energy projects in France: Enerfip, Lendosphere, and Lumo, from their inception to the end of June 2018. As Appendix A shows, these platforms belong to the list of top crowdfunding platforms focused on renewable energy projects in the world.

As Table 1 shows, these platforms are relatively recent and were launched between 2012 (for Lumo) and 2014 (for Lendosphere and Enerfip). They function in similar ways. A company needing external finance joins the platform and provides certain information, including the registration number of the company, its financial accounts, and a brief description of the project. The platform examines the application using mainly two sets of criteria: the project's financial solvency and the seriousness of its environmental approach. If the request is approved, the platform asks the company to create its own "pitch", published on the platform website, in order to present and explain the project to potential investors. Once the "pitch" is online, and continuing for a number of days determined by the platform, investors can lend to

the project. Each platform specifies the minimum amount that investors can invest, ranging from 10 EUR for Enerfip to 50 EUR for Lendosphere. Unlike most French crowdlending platforms, the three platforms considered in our sample opted for a *flexible keep-it-all* funding model instead of a *fixed all-or-nothing* mechanism (Cumming et al., 2019), meaning that even if the loan is not fully funded, the money collected is transferred to the borrower. By contrast, with the fixed model, the funds are transferred to the entrepreneur only if the minimum goal is attained. Although Lendosphere is the youngest of the three platforms, it is the best performing, with more than 25 million euros raised, 84 projects financed and 263 investors on average per project.

Table 1: Main characteristics of the three platforms

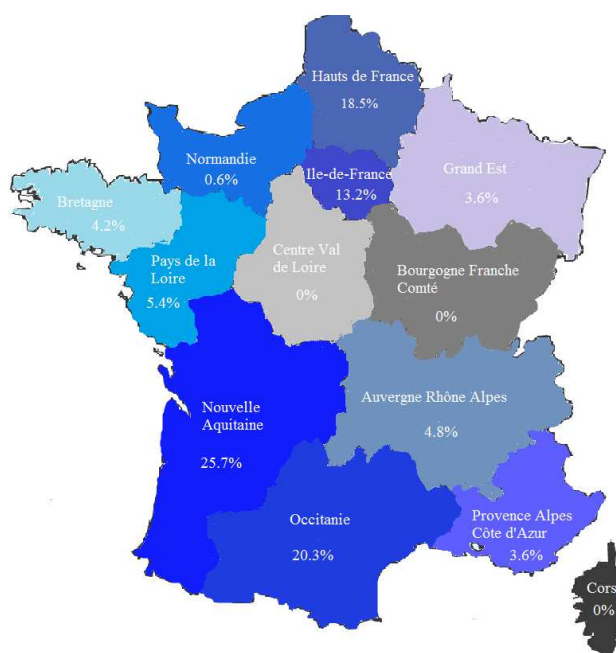
	Enerfip	Lendosphere	Lumo
Date of creation	January 2014	December 2014	March 2012
Types of projects	Renewable Energy	Environment and energy	Renewable Energy
Type of loan	Loan with interest	Loan with interest	Loan with interest
Amount minimum (EUR)	10	50	25
Who can invest in?	Individuals (private) and legal entities (associations and companies)		
Funding <i>model</i>	<i>Keep what you raise</i>	<i>Keep what you raise</i>	<i>Keep what you raise</i>
Interest rate	From 3 to 8 %	From 4 to 8 %	From 3 to 7 %
Default rate	0%	0%	0%
Total amount raised (EUR)	7 730360	25 053 211	5 580 625
Number of projects	39	84	44
Number of investors (in average)	149	263	104
Interest rate (in average)	5.75%	5.56%	4.17%
Loan duration in months (in average)	38	35	117

Source: Information is obtained from platform websites (Enerfip, Lendosphere and Lumo) at the end of June 2018.

Our dataset comprises all campaigns posted on the three website platforms since their inception. We gather the most campaign information from the three crowdlending platforms where they are publicly available. Some variables of our study relating to the company, such as its net income, its age and the number of its employees are not always mentioned and we used the Diane database to complete missing financial variables. Other variables relate to human capital of the entrepreneur: age, gender, and professional background. In general, we find this information in the description of the project on the platform website. However, for more accurate data, we also include information provided on the entrepreneur’s LinkedIn profile, when available.

In addition to quantitative data that we collected on the characteristics and success of crowdlending campaigns, we also recorded information on the region of each campaign. As we can observe from Fig. 2, all the projects posted on the three platforms originate in France. The highest percentage of renewable energy projects are in the Nouvelle Aquitaine region (25.7 percent of all projects supported by Enerfip, Lumo and Lendosphere), followed by Occitanie and the Hauts de France region (20.3 percent and 18.5 percent of all projects respectively). We notice that for some French regions, notably Centre Val de Loire and Bourgogne France Comté, there are no renewable energy crowdlending projects yet.

Fig. 2 Geographical distribution of crowdlending projects in our sample



Our empirical study involves estimating the impact of different factors on the success of crowdfunding project campaigns.

To emphasize the robustness of our results, we use three different variables to proxy the success of campaigns: the *Percentage funded* (e.g. Cumming et al., 2017; Greiner and Wang, 2010) that corresponds to the ratio of the total amount collected over the amount requested set by the company. The second independent measure is the number of lenders - *Number_lenders* (e.g. Cumming et al., 2017; Du et al., 2019), which allows us to assess the number of investors attracted by the campaign who decided to transfer funds to the company. The third independent measure is the *Amount collected* (e.g. Calic and Mosakowski, 2016; Cumming et al., 2017; Du et al., 2019), which corresponds to the amount raised and transferred to the company (the borrower). The higher this amount the more attractive is the campaign. Following Cumming et al. (2017), we consider the *Percentage funded* as the primary measure in our study.

For the independent variables, we consider two sets of information about each project: hard and soft information. For hard information, we distinguish information on the project from that on the company. To test the effect of information about the company on the success of the projects (H1), we consider three variables: company financial performance proxied by its net income - *Net income* (Lin et al. 2013), its age - *Age_firm* (Ahlers et al., 2015; Maier, 2016), and its size proxied by the number of employees - *Nbre_employees* (Ahlers et al., 2015; Maier, 2016).

To test the effect of loan information on project attractiveness (H2), we consider three variables: the loan amount (*Amount requested*) (Greiner and Wang, 2010; Maier, 2016) and

the interest rate (*Interest rate*) (Pope and Sydnor, 2011; Cai et al., 2016) in order to test H2 a and the duration of the loan (*Loan duration*) (Feng et al., 2015) to test H2 b.

For soft information, we analyse several attributes of the entrepreneur to test H3: age (*Age_entrepreneur*) (Gonzalez and Loureiro, 2014), gender (*Gender*) (Feng et al., 2015), and the size of the social capital network proxied by the number of contacts on LinkedIn (*Linkedin*). To gather data for this variable which is not available on the platforms of our sample, we conducted a search on LinkedIn based on the name of both the entrepreneur and the company, when available. Following Colombo et al. (2015), we opted for a measure of professional social capital (such as LinkedIn) rather than social capital based on friendships (such as Facebook) for two reasons. First, the lending-based platforms of our sample are of a commercial nature. Second, we want to assess the effects of large networks of professional relationships the entrepreneur has which the literature suggests affects managing the company (Nahapiet and Ghoshal, 1998) and improves its economic performance (Baker, 1990). We also analyse entrepreneur professional expertise (*Expertise*) proxied by a dummy variable which takes the value 1 if the entrepreneur has previous professional experience in the energy or the environment sector (in line with Barbi and Mattioli, 2019). We gather this data from two different sources: directly from the platforms, when available, or from the LinkedIn page of the entrepreneur. For soft information, we include the number of photos (*Pictures*) posted on the website to describe the project (in line with Cumming et al., 2017) to test H4.

In the crowdlending sector, loans are unsecured, so the platforms do not offer guarantees to the lenders, who prefer to invest on platforms with good reputation (Greiner and Wang, 2010). We control for the reputation and attractiveness of platforms by using their Alexa ranking (*Ranking*) that measures internet traffic and allows us to identify the most visited platforms (e.g. Gedda et al., 2016). The highly-ranked platforms correspond to those that are the most visited and thus more reputable.

We have log-transformed all the factors with highly skewed distributions. Table 2 summarizes the variables used and the expected sign of each variable according to the literature.

Table 2: Independent variables used in the empirical analysis

Variables	Literature on crowdfunding	Description	Hyp.	Expected sign
<i>Net income</i>	Cai et al. (2016); Greiner and Wang (2010); Iyer et al. (2016)	The logarithm of the company's net income	H1	+
<i>Age_firm</i>	Maier (2016)	The logarithm of the company's age	H1	+
<i>Nbre_employees</i>	Maier (2016)	The logarithm of the number of employees in the company	H1	+
<i>Amount requested</i>	Cumming et al. (2017); Greiner and Wang (2010); Lin et al. (2013); Yum et al. (2012)	The logarithm of the amount requested	H2 a	+
<i>Interest rate</i>	Cai et al. (2016); Freedman and Jin (2017); Pope and Sydnor (2011)	The interest rate of the loan	H2 a	+
<i>Loan duration</i>	Cai et al. (2016); Feng et al. (2015); Yum et al. (2012)	The logarithm of the duration of the loan	H2 b	no effect
<i>Age_entrepreneur</i>	Gonzalez and Loureiro (2014); Feng et al. (2015)	The age of the entrepreneur	H3	+
<i>Gender</i>	Feng et al. (2015); Gonzalez and Loureiro (2014); Mollick and Robb (2016)	Dummy variable = 1 if the entrepreneur is a man, 0 otherwise	H3	+
<i>Linkedin</i>	Lin et al. (2013) ; Liu et al. (2015)	The number of entrepreneur contacts on the Linkedin	H3	+
<i>Expertise</i>	Liang et al. (2019)	Dummy variable = 1 if the entrepreneur has a professional experience in environment or in energy, 0 otherwise	H3	+
<i>Pictures</i>	Ahlers et al. (2015); Cumming et al. (2017); Greiner and Wang (2010); Mollick (2014)	The number of pictures used in the description of the project	H4	No effect

3. Results and discussion

We proceed in four steps. First, we examine the correlation between variables to detect potential multicollinearity problems and we use the variance inflation factor (VIF) analysis to confirm our results. Second, we conduct a univariate analysis to investigate differences in potential determinants affecting campaign success between successful and unsuccessful projects. Third, we test all hypothesized relationships with ordinary least squares (OLS) estimation (conducted using Stata). Finally, we perform a hierarchical multiple regression to test if the soft variables explain the campaign success beyond hard indicators in order to test H5.

3.1 Descriptive statistics

Table 3 presents descriptive statistics. Our dependent variable shows a mean *Percentage funded* of 133.39 percent; 13 projects had a *Percentage funded* less than 100 percent, 64 projects had a *Percentage funded* equal to 100 percent, 19 projects exceeded a percentage of 200 percent, and the most successful campaign had a percentage of amount funded of 553.38 percent. Only 7.78 percent of projects of the whole sample failed to achieve their funding target. This rate of failure is very low if we compare it with previous studies where this rate exceeds 36 percent (e.g. Hörisch, 2015; Mollick, 2014). This difference can be explained by the fact that French platforms in our sample apply very high preselection criteria and post only projects that have a great probability of being totally financed. A second explanation is, as highlighted by Vasileiadou et al. (2016), projects posted by specialized platforms usually succeed better than projects on general platforms. A third explanation is that sustainable projects collect capital more easily than non-sustainable orientation projects, in line with the study of Hörisch (2018).

On average, a crowdlending campaign in renewable energy attracts around 194 lenders and the amount of funds raised is about 229,725.7 EUR. Table 3 shows important variability across many variables. The amount requested ranges from 5,000 EUR to 2,200,000 EUR (SD 233,028.6) with a mean of 169,753.8 EUR, which is higher than the average amount requested in all crowdlending projects in France (100,044 EUR for the first half of 2017, according to financeparticipative.org). The loan duration extends from 12 to 180 months, with a mean of 58 months. Similarly, campaigns showed wide variation in characteristics of firms requesting funds. Some of them are young (3 years), small (with only two employees) and even have negative net income (-9,591,000 EUR), while others are older, larger (with more than 1486 employees) and report net income about 92,754,000 EUR. On average, companies in our sample are relatively young SMEs, with 141 employees and having 14.64 years since founding.

Table 3. Descriptive Statistics

Variable	N	Mean	Median	SD	Min	Max
<i>Percentage funded</i>	167	1.333	1.064	0.699	0.160	5.533
<i>Amount collected (EUR)</i>	167	229725.7	124600	328566.8	4125	2500000
<i>Number_lenders</i>	167	194.916	162	180.291	14	1297
<i>Amount requested (EUR)</i>	167	169753.8	100000	233028.6	5000	2200000
<i>Loan duration (in months)</i>	165	58.072	36	48.735	12	180
<i>Interest rate</i>	166	5.241	5.375	1.171	2.25	7.05
<i>Net income (in 1000 EUR)</i>	157	7234.261	274.700	15800	-9591	92754
<i>Age_firm</i>	167	14.640	16	8.976	3	61
<i>Nbre_employees</i>	137	141.591	40	327.4042	2	1486
<i>Age_entrepreneur</i>	162	50.049	50	9.784	27	71
<i>Gender</i>	167	0.970	1	0.170	0	1
<i>Linkedin</i>	167	160.970	1	210.030	0	500
<i>Expertise</i>	138	0.311	0	0.464	0	1
<i>Pictures</i>	167	7.317	8	3.478	0	19
<i>Ranking</i>	167	5141531	6498397	1370706	3680575	6498397

Note: This Table reports respectively number of observations, mean, median, standard deviation, minimum, and maximum of the variables used.

Considering entrepreneur characteristics, we observe that they are overwhelmingly male (97 percent of our sample) and not relatively young (50 years old on average). Surprisingly, only 31 percent have professional experience in the energy and environment sector. We also notice considerable variability among the number of their LinkedIn contacts (SD 210.030) which range from 0 (when the entrepreneur doesn't have a LinkedIn page) to more than 500. This suggests that social media is not extensively used by entrepreneurs to collect funds.

Except for one campaign, the projects posted on the platform websites use pictures. Appendix B shows photos posted to help finance the last stages of wind turbines in the Hauts de France region. In addition to photos describing the projects, we find photos of management and the working team for some campaigns.

We also study the correlations between the variables used in the model to detect potential multicollinearity problems. Table 4 shows that the correlations between the independent variables are not high, meaning that multicollinearity is not a problem in our model. We confirm our results by conducting a variance inflation factor (VIF) analysis associated with the independent and control variables. Table also 4 reports the results of VIF analysis. The mean VIF is 2.42 and the maximum VIF of the variables is 4.06, less than the conventional threshold of 5, indicating no issue of multicollinearity (Hair et al., 2009).

Table 4. Pearson Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	VIF
1	1															
2	0.38***	1														
3	0.36***	0.82***	1													
4	0.02	0.85***	0.77***	1												1.78
5	-0.34***	-0.13*	-0.19***	-0.09	1											4.06
6	0.28***	0.10	0.10	0.07	-0.71***	1										2.74
7	0.14*	0.04	-0.01	0.00	-0.13*	-0.03	1									2.25
8	0.09	0.02	0.00	-0.01	0.00	-0.19**	0.80***	1								2.61
9	-0.00	0.01	-0.03	0.04	-0.18**	0.12	0.40***	0.55***	1							3.81
10	0.26***	0.24***	0.26***	0.20***	-0.33***	0.08	0.40***	0.41***	0.08	1						2.19
11	0.02	-0.02	0.04	-0.05	0.06	0.03	-0.67***	-0.54***	-0.48***	-0.05	1					2.13
12	0.01	-0.015	0.00	0.03	-0.17**	0.12*	-0.27***	-0.25***	0.05	-0.35***	-0.03	1				1.63
13	0.03	0.06	0.00	0.07	-0.21**	0.36***	-0.22***	-0.33***	0.19**	-0.15*	0.13	0.05	1			1.62
14	0.30***	0.09**	0.26***	0.13*	-0.47***	0.31***	0.20**	0.21***	0.10	0.31***	-0.03	0.03	0.11	1		1.88
15	0.39***	0.21***	0.38***	0.10	-0.49***	0.30***	-0.03	0.10	0.02	0.17**	0.16**	0.05	0.09	0.60***	1	2.38

With 1 refers to Percentage funded, 2 to Amount collected, 3 to Number_lenders, 4 to the Amount requested, 5 to Loan duration, 6 to Interest rate, 7 to Net income, 8 to age_firm, 9 to Nbre_employees, 10 to Age_entrepreneur, 11 to Gender, 12 to LinkedIn, 13 to Expertise, 14 to Pictures and 15 to Ranking. VIF: Variance Inflation Factor. Variance inflation factors of independent and control variables reported in this table are in OLS regression analysis reported in table 5. All VIF are less than 5. * p<0.05, ** p<0.01, *** p<0.001

3.2 Empirical Results

3.2.1 Univariate analysis

We divide our sample into two sub-samples, distinguishing between campaigns raising more or less than the median of the *Percentage funded* (1.064), campaigns that attract more or less than the median of the *Number_lenders* (162 investors) and campaigns that raise more or fewer funds than the median of the *Amount collected* in the sample (124,600 EUR). We find that 83 campaigns raised more than the median percentage of funds, and 83 campaigns collected more than 124,600 EUR, while 82 campaigns attracted more than 162 investors. Table 5 reports the mean of our indicators in each sub-sample and the mean difference. We find similar results regardless of the variable selected to measure the success of the campaign. Campaigns that succeeded most have higher net income, larger size and are older (around 15 years vs. 13.7), consistent with H1. But in most cases, these differences are not statistically significant.

We find that the more successful crowdlending projects have, on average, a greater interest rate. This difference is even highly significant if we consider the *Percentage funded* as proxy to assess the success of the campaign. Moreover, we find that the higher the amount requested, the greater the number of lenders. These results offer preliminary support for H2. In contrast, we find that successful crowdlending projects have, on average, a lower loan duration, around 37 months for successful campaigns (in terms of *Percentage funded*) compared to 79.7 months for the others.

Table 5 also shows that the entrepreneurs of successful crowdlending projects are older (around 52 years vs. 48 years). This difference is statistically and strongly significant regardless of the three indicators of campaign success that we consider in this study. In addition, the entrepreneurs of successful campaigns have, on average, more friends on LinkedIn. They have around 183 friends for campaigns that attracted more investors versus 137 for the other sub-sample. This difference is, however, not significant, in line with the study of Cumming et al. (2019), who focus on reward-based crowdfunding campaigns and find no significant difference in the number of social network links between successful and unsuccessful projects. Regarding entrepreneur expertise (*Expertise*), our results do not allow us to make conclusions. While we find that entrepreneurs of successful campaigns, in term of *Percentage funded*, have more expertise in energy than unsuccessful campaigns, we find contrary results if we consider the number of lenders and the amount requested as an indicator of the success of a campaign. This difference between the two sub-samples is not statistically significant whatever the indicator.

The results show that, in term of *Amount collected*, there are more females in the sub-sample corresponding to successful campaigns, a difference significant at the five percent level. These findings allow us to partially confirm H3 on the profile of the entrepreneur on lending decisions. On average, successful campaigns post around eight photos whereas less successful campaigns post seven. The difference is statistically highly significant for the percentage funded and the number of lenders as measures of the success of the campaigns.

Table 5: Results of univariate analysis

Variable	<i>By Percentage funded</i>			<i>by Number_lenders</i>			<i>by Amount collected</i>		
	below median	above median	difference	below median	above median	difference	below median	above median	difference
<i>Amount requested</i>	173360.1	166190.5	7169.584	73385.06	262721.3	-189336.2***	58348.92	279832.4	-221483.5***
<i>Interest rate</i>	4,845	5,627	-0,782***	5.150	5.330	-0.179	5.140	5.342	-0.202
<i>Loan duration</i>	79.703	37.214	42.489***	69.878	46.409	23.468***	65.132	50.926	14.205**
<i>Net income</i>	6818418	7634510	-816092	5972097	8359564	-2387467	5193691	9198310	-4004619
<i>Nbre_employees</i>	138.967	143.697	-4.730	122.421	158.397	-35.975	77.779	204.478	-126.698***
<i>Age_firm</i>	13.987	15.285	-1.297	13.731	15.517	-1.785	13.867	15.404	-1.537
<i>Age_entrepreneur</i>	47.950	52.148	-4.197***	48.049	52.049	-4***	48.112	51.939	-3.826**
<i>Gender</i>	0.975	0.964	0.011	0.963	0.976	-0.013	1	0.940	0.059**
<i>Linkedin</i>	136.180	185.464	-49.283	137.524	183.588	-46.063	167.506	154.511	12.994
<i>Expertise</i>	0.283	0.338	-0.054	0.373	0.253	0.119	0.314	0.308	0.005
<i>Pictures</i>	5.987	8.630	-2.643***	6.585	8.023	-1.438***	7.132	7.5	-0.367
<i>Observations</i>	83	84		82	85		83	84	

This table provides means of various variables for the sub-sample of successful campaigns versus the sub-sample of unsuccessful campaigns. The success is proxied by three different measures: the *Percentage funded*, the *Number_lenders* and the *Amount collected*. The table also shows the results of the mean difference test between both subsamples. *, **, *** Significant at 10%, 5%, and 1% levels respectively

This result suggests that pictures not only attract more lenders but also persuade the crowd to lend more money. Overall, these preliminary findings suggest that there are some differences between successful and unsuccessful campaigns relating to the amount requested, the loan duration, the interest rate, the age of the entrepreneur and the number of pictures posted to describe the project.

3.2.2 Multivariate analysis

We run three sets of regressions; the first considers the ratio of the amount funded to the amount requested (*Percentage funded*) as the dependent variable, the second employs the number of investors (*Number lenders*) as the dependent variable while the third takes the amount collected (*Amount collected*) as proxy to assess the success of renewable energy crowdlending campaigns. In each set, Model (1) focuses on hard information by including financial information such as net income (*Net income*), company age (*Age_firm*) and the number of employees (*Nbre_employees*) to test H1. We also include in Model (1) hard information about the loan by considering the campaign goal (*Amount requested*), the loan duration (*Loan duration*) and the interest rate (*Interest rate*) to test H2. Model (2) addresses hypotheses H3 and H4 about soft information and includes the number of pictures posted in the pitch (*Pictures*) in addition to different entrepreneur information, including age (*Age_entrepreneur*), gender (*Gender*), the number of contacts on LinkedIn (*Linkedin*) and the dichotomous variable on expertise in the energy sector (*Expertise*). Model (3) reflects the effect of all information, hard and soft, on the dependent variable to assess the statistical and economic significance of our previous results. Table 6 presents the sets of regressions. The explanatory power of each model is high, with the exception of Model 2. In addition, regarding the independent variable, we observe that the coefficient and the significance of each variable remain stable across models.

Table 6 shows major factors that positively affect the campaign. In terms of financial company-specific attributes, we find that the net income (*Net income*) contributes to the increase of the amount collected, the number of lenders and the percentage funded with a statistical significance at the 1 percent, 5 percent and 1 percent levels respectively in Model (1). This result suggests that firm financial performance proxied by net income is a key factor attracting lenders and motivating them to lend more funds, in line with previous studies on crowdlending that unanimously confirm the role of firm standard financial performance in affecting lending decisions (e.g. Cai et al. 2016; Iyer et al., 2016). The size of the firm measured by the number of employees (*Nbre_employees*) is also positively associated with campaign success, especially in terms of *Percentage funded* and the *Amount collected*. The variable is statistically significant at the 1 and 5 percent levels respectively in Model (1). Lenders prefer to give money to the biggest firms rather than the smallest ones, suggesting that lenders consider firm size as a positive signal of well-established firms in the industry. As suggested by the literature on information asymmetry (e.g. Berger and Udell, 1998; Cenni et al. 2015), these companies are less opaque to the market and present less uncertainty on their future development. Surprisingly, we find that the age of the firm (*Age_firm*) is negatively associated with the success of the campaign, but only in Model (3) for both sets of regressions (for *percentage of amount funded* and *amount collected*). This significance is only at the 10

percent level. According to our results, lenders are inclined to invest more capital in younger renewable energy firms than older ones. This result can be explained by a philanthropy argument in the sense that lenders want to help young firms that usually encounter financing problem from banks.

These results allow us to partially support H1 which proposes that the economic company profile (company net income, and its size) positively affects the campaign.

Next, H2 a predicts a significant effect of the interest rate (*Interest rate*) and the campaign goal size (*Amount requested*) on funding success. We find that the interest rate is positively and significantly associated with the *Percentage funded* as well as the *Amount collected* in both Model (1) and Model (3), with significance at the 1 percent level, in line with most previous studies (e.g. Cai et al., 2016), suggesting that higher interest rates means greater returns to lenders and they are motivated to lend more money in projects offering high interest rates in order to increase their financial return. This result confirms that one of the main goals of lenders is a bigger return on investment. We find a positive and significant relationship of the campaign goal size (*Amount requested*) with crowdlending campaign success in terms of the number of investors and the amount collected, a variable statistically significant at the 1 percent level and for both models (1) and (3). Larger loans attract more lenders and persuade them to bid higher amounts, inconsistent with some previous studies that find loans with smaller amounts are more likely to receive funding (e.g. Lin et al. 2009; Yum et al., 2012; Greiner and Wang, 2010). Our finding is however in line with the study of Cumming et al. (2017) which shows that cleantech projects are particularly sensitive to the amount requested. This may be due to the fact that lenders in the renewable energy sector prefer larger loans because they offer higher returns. Another explanation of this positive effect is that, as discussed above, loan amount can be considered by lenders as an indicator of the credibility of the borrower. When the project is weak, the borrower will ask for smaller loans to improve financing and vice versa.

Our results confirm the importance of interest rates and the loan amount in helping the founders succeed in their crowdlending campaign.

Considering loan duration (*Loan duration*), it has a positive relation with crowdlending success, an effect not significant in both models (1) and (3) and regardless of the three dependent variables considered. This evidence supports H2 b that loan duration has no statistical effect on the success of the campaign, in line with Cai et al. (2016). This result suggests that, in the renewable energy sector, the loan duration is not a fundamental element affecting lending decisions and may reflect the specificities of projects that take a relatively long time to come to fruition.

Table 6 : Determinants of the crowdfending campaign success

	Percentage funded			Number_lenders			Ln amount collected		
	Model (1)	Model (2)	Model (3)	Model (1)	Model (2)	Model (3)	Model (1)	Model (2)	Model (3)
Amount requested	0.014 (0.020)		-0.011 (0.024)	0.627*** (0.053)		0.639*** (0.076)	1.047*** (0.039)		0.988*** (0.045)
Loan duration	0.043 (0.056)		0.076 (0.065)	0.021 (0.109)		-0.011 (0.136)	0.000 (0.091)		0.072 (0.102)
Interest rate	0.062*** (0.023)		0.083*** (0.026)	-0.086 (0.057)		-0.068 (0.073)	0.127*** (0.039)		0.164*** (0.044)
Net income	0.019*** (0.004)		0.012** (0.006)	0.031** (0.013)		0.038** (0.016)	0.032*** (0.008)		0.019* (0.010)
Age_firm	-0.042 (0.042)		-0.094* (0.050)	-0.171 (0.106)		-0.165 (0.125)	-0.059 (0.075)		-0.162* (0.093)
Nbre_employees	0.052*** (0.019)		0.048** (0.025)	0.058 (0.047)		0.114* (0.060)	0.081** (0.033)		0.072* (0.043)
Age_entrepreneur		0.007*** (0.001)	0.008*** (0.002)		0.026*** (0.007)	0.000 (0.007)		0.054*** (0.010)	0.018*** (0.005)
Gender		-0.047 (0.062)	0.034 (0.101)		-0.374* (0.219)	0.400* (0.233)		-0.974*** (0.229)	-0.000 (0.185)
Linkedin		0.000* (0.000)	0.000 (0.000)		0.000 (0.000)	-0.000 (0.000)		0.000* (0.000)	0.000 (0.000)
Expertise		0.052 (0.039)	-0.041 (0.046)		-0.063 (0.148)	-0.163 (0.115)		0.404** (0.206)	-0.069 (0.080)
Pictures		0.005 (0.005)	-0.002 (0.006)		-0.018 (0.028)	-0.025 (0.020)		0.038 (0.285)	-0.004 (0.011)
Ranking	6.37 ^e -0.8*** (1.74 ^e -0.8)	5.61 ^e -0.8*** (1.66 ^e -0.8)	4.84 ^e -0.8** (2.14 ^e -0.8)	2.79 ^e -0.7*** (3.37 ^e -0.8)	3.27 ^e -0.7*** (6.33 ^e -0.8)	2.60 ^e -0.7*** (4.30 ^e -0.8)	1.05 ^e -0.7*** (2.85 ^e -0.8)	2.07 ^e -0.7*** (8.47 ^e -0.8)	8.41 ^e -0.8** (3.58 ^e -0.8)
Constant	-0.553 (0.494)	0.088 (0.132)	-0.602 (0.570)	-3.659*** (0.869)	2.371*** (0.478)	-4.149*** (1.180)	-2.245*** (0.778)	8.367*** (0.655)	-2.292*** (0.899)
R-squared	0.340	0.269	0.429	0.743	0.330	0.741	0.897	0.308	0.918
Root MSE	0.211	0.214	0.196	0.447	0.731	0.472	0.389	1.083	0.371
F-statistic	8.19	7.50	5.13	38.50	9.77	15.21	121.13	11.31	72.20

This table provides OLS regressions for the *Percentage funded*, the *Number_lenders* and the *Amount requested* with standard error in parenthesis. The significance of F-statistic is equal to 0.000 in all the regression models. The number of observation is 131 for Model (1), 133 for Model (2) and 107 for Model (3). *, **, *** Significant at 10%, 5%, and 1% levels respectively.

In terms of entrepreneur-specific attributes, the age of the entrepreneur (*Age_entrepreneur*) is positively and strongly significant (at the 1 percent level), suggesting that lenders tend to give money to entrepreneurs who are not very young, consistent with Gonzalez and Loureiro (2014). Even in the renewable energy sector, the age of the entrepreneur is a key element affecting lending decisions and the probability of funding success, suggesting that age is an indicator of the experience and competence of the entrepreneur, which in turn reassures lenders and persuades them to lend money. Considering the gender of the entrepreneur (*Gender*), we find that this coefficient is negative and significant in Model (2) for the two least sets of regressions (*Number_lenders* and *Amount_collected*). However, it becomes positive and significant at the 10 percent level in Model (3) when we consider the number of lenders as proxies for the success of the campaign. The sign change of the *Gender* coefficient is probably explained by the very small number of female entrepreneurs in our sample (only 3 percent of the whole sample), which may bias our results. Accordingly, we can confirm that gender has an effect on funding success but we cannot conclude if this effect is positive or negative.

For the number of contacts of the entrepreneurs on LinkedIn (*Linkedin*), we find a positive relation of this variable with the success of crowdlending campaigns. But this coefficient is statistically significant only at the 10 percent level and only for Model (1) when we consider the *Percentage_funded* and *the Amount_collected* as the dependent variables. This finding partly supports the role of the size of the entrepreneur's social network through the number of LinkedIn contacts of the entrepreneur. This result also supports empirical evidence on the work of Lin et al. (2013) and Liu et al. (2015), arguing that the size of the borrower's network positively affects the success of crowdlending campaigns.

The effect of the entrepreneur's expertise (*Expertise*) is only significant in the last regression (the *Amount_collected*) and only in Model (2), at 10 percent. This finding does not allow us to confirm the role of the entrepreneur's expertise in the success of crowdlending campaigns. Our findings partially support H3; the entrepreneur profile, especially age and the size of the social network, facilitate collecting funds.

The number of pictures, is not a statistically significant variable in any of the three sets of regressions, consistent with H4. This result suggests that visual descriptions of renewable energy projects as measured by the number of photos do not contribute to improving fund collection, in line with Cumming et al. (2017), who show that in comparison to non-cleantech campaigns, cleantech campaigns are less sensitive to photos.

The control variable- the *Ranking* variable coefficient- is positive and strongly significant in all the specifications, consistent with the view that platform reputation and visibility contribute to crowdlending campaign success.

In addition, we perform a hierarchical multiple regression to test if the soft variables explain campaign success (in terms of the *Percentage_funded*) beyond hard indicators. To achieve that, we proceed by steps. The first step includes a control variable (*Ranking*) and the predictor hard variables of the study. The second step adds the predictor soft variables. The F-test is not significant ($F(5,94) = -0.271$ $p = 1.000$), showing that soft variables have limited

predictive power in comparison to hard information. This result provides strong evidence that hard information plays the most important role in raising capital and soft information, by describing projects better supplements hard information. Both contribute to campaign success, consistent with H5.

4 Implications, limitations and conclusion

Implications

This study has theoretical and managerial implications. The research complements previous studies that investigate the determinants of successful crowdfunding campaigns by considering renewable energy products in terms of risk and sustainability that can affect lending decisions and campaign success. In addition, it contributes to the literature on financing firms by studying lending models where there are a great number of small lenders and different types of information (soft and hard). This analysis helps entrepreneurs and platforms that specialize in the environmental sector to identify the mechanisms they can use to increase project attractiveness. They should pay careful attention to how they present the project online and highlight project financial characteristics and economic benefits. Platforms need to provide details on the entrepreneur, his age, the size of his social network and his professional experience. These elements contribute to successful crowdlending campaigns. Increasing the chances of success of crowdfunding campaigns will contribute to boost the development and prosperity of the crowdfunding sector as a whole.

The development of crowdfunding is important for at least two reasons. First, we expect the energy sector to expand in a way that requires large investments. Most of the investments will come from the private sector (IRENA, 2016). We argue that in such a context, crowdfunding, as a different way of financing, can play a significant role in helping environmental firms to collect funds.

Second, as highlighted by the literature, the renewable energy sector often encounters difficulties in financing. Projects in developing countries may face more difficulties in implementation, including financing (IRENA, 2016). Crowdlending can be a viable solution for them under condition that platforms identify the risk associated with such projects and communicate it to potential lenders.

Limitations and Future Research Directions

As an exploration into this new area of research, our study has some limitations. First, the platform sample includes only those specializing in lending to SMEs. It would be valuable to extend the analysis to other kinds of crowdfunding, especially crowdequity, which can be more appropriate for startups and firms specializing in innovation (Mazzucato and Semieniuk, 2018). The second limitation concerns the size of our sample, which is relatively small and is explained by the fact that the overall number of crowdlending platforms dedicated to the renewable energy sector is still limited. Further research could add more European countries to the sample.

Lenders are a crucial target audience of crowdfunding platforms and they directly affect the success of campaigns and even the future of platforms. Further studies could analyze their preferences and perceptions. Researchers could question users on their perceptions of the platforms and about projects published to learn more about how certain platform actions affect campaign success.

We believe that crowdlending can be not only a response to financing renewable energy projects but a way to encourage launching energy innovations in the market. Researchers need to discover more about funders since their views would be useful to policy-makers as they consider regulatory measures and new policies to encourage the development of crowdlending in the renewable energy sector.

Conclusion

Academic studies on the dynamics of successful crowdfunding projects are still limited, especially as they investigate environmental projects where most of the papers focus on the reward-based model (Hörisch, 2019). Unlike previous research, this study investigates financing in the renewable energy sector by focusing on a lending-based model of crowdfunding – the crowdlending model. It is still a niche but has the potential to expand in the future and contribute to raising funds efficiently for renewable energy projects (Vasileiadou et al., 2016). To succeed, crowdlending campaigns have to attract more lenders – the crowd- and motivate them to offer higher bids. We run three sets of regression in order to identify the factors that contribute to increasing the success of crowdlending projects.

Our results clearly show that financial characteristics are fundamental elements affecting campaign success. Asking for a significant amount with a high interest rate helps funders raise more capital and attracts a higher number of lenders. Investors prefer to lend to firms in renewable energy that are financially solid, rather big and not too old. These are considered key success factors for renewable energy projects. Like traditional banks, lenders rely on financial information to make their decisions, suggesting that even if the projects have social and environmental implications and contrary to reward-based models, the objective of lenders remains a good return on investment. However, our results also highlight the importance of personal information about the entrepreneur, mainly his age. We find weak evidence that social network size and gender of the entrepreneur are related to project success. This information contributes to reassuring lender about the trustworthiness of borrowers, which affects campaign success positively. A third salient result of our study shows that soft and subjective information supplement hard and quantitative information. This finding allows us to highlight the information asymmetry problems and the level of risk that lenders encounter with renewable energy projects. Lenders need various types of information (both subjective and objective) before making a decision to lend, in line with Cumming et al. (2017).

References

Ahlers, G., Cumming, D., Günther, C., Schweizer, D., 2015. Signaling in Equity Crowdfunding. *Entrep. Theo. Pract.* 39, 4, 955-980.

- Backes-Gellner, U., Werner, A., 2007. Entrepreneurial Signaling via Education: A Success Factor in Innovative Start-Ups. *Small Bus. Econ.* 29, 1-2, 173-190.
- Baker, W., 1990. Market Networks and Corporate Behavior. *Am. J. Sociol.* 6, 589–625.
- Barasinska, N. Schäfer, D., 2014, Is Crowdfunding Different? Evidence on the Relation between Gender and Funding Success from a German Peer-to-Peer Lending Platform. *Ger. Econ. Rev.* 15, 4, 436-452.
- Barbi, M., Mattioli, S., 2019. Human capital, investor trust, and equity crowdfunding. *Res. Int. Bus. Financ.* 49, 1-12.
- Belleflamme, P., Lambert, T., Schwienbacher, A., 2014. Crowdfunding: Tapping the right crowd. *J. Bus. Venturing.* 29, 5, 585-609.
- Belleflamme, P., Omrani, N., Peitz, N., 2015. The economics of crowdfunding platforms. *Inf. Econ. Policy.* 33, 11-28.
- Bento, N., Gianfrate, G., Groppo, S., 2019. Do crowdfunding returns reward risk? Evidences from clean-tech projects. *Technol. Forecast. Soc. Change.* 141, 107-116.
- Berger, A., Udell, G., 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *J. Bank. Financ.* 22, 613-673.
- Berger, S., and Gleisner, F., 2009. Emergence of financial intermediaries on electronic markets: The case of online P2P lending. *Bus. Res.* 2, 1, 39–65.
- Bodie, Z., Alex K., Alan J. M., 2012. *Essentials of Investments*, 9th edition. McGraw-Hill, New York.
- Cai, S., Lin, X., Xu, D., Fu, X., 2016. Judging online peer-to-peer lending behavior: A comparison of first-time and repeated borrowing requests. *Inf. Manag.* 53, 7, 857-867.
- Calic, G., Mosakowski, E. 2016. Kicking Off Social Entrepreneurship: How A Sustainability Orientation Influences Crowdfunding Success. *J. Manag. Stud.* 53, 738-767.
- Cenni, S., Monferrà, S., Salotti, V., Sangiorgi, M., Torluccio, G., 2015. Credit rationing and relationship lending. Does firm size matter? *J. Bank. Financ.* 53, 249–265.
- Cholakova, M, Clarysse, B., 2015, Does the possibility to make equity investments in crowdfunding projects crowd out rewards-based investments? *Entrep. Theor. Pract.* 39, 145–172.
- Colombo, M., Franzoni, C., Rossi-Lamastra, C., 2015. Internal Social Capital and the Attraction of Early Contributions in crowdfunding. *Entrep. Theor. Pract.* 39, 1, 75–100.
- Cumming, D., Leboeuf, G., Schwienbacher, A., 2017. Crowdfunding cleantech. *Energy Econ.* 65, 292-303.
- Cumming, D., Leboeuf, G., Schwienbacher, A., 2019. Crowdfunding models: Keep-It-All vs. All-Or-Nothing. *Financ. Manag.* In press.
- Dilger MG, Jovanović T, Voigt K-I. 2017. Upcrowding energy co-operatives–Evaluating the potential of crowdfunding for business model innovation of energy co-operatives. *J. Environ. Manag.* 198, 50–62.
- Du, Z., Wang, K., Li, M., 2019. Promoting crowdfunding with lottery: The impact on campaign performance. *Inf. Manag.* In press.
- Duarte, J., Siegel, S., Young, L., 2012. Trust and Credit: The role of Appearance in peer-to-peer lending. *Rev. Financ. Stud.* 25, 2455-2483.
- Eleftheriadis, I.M., Anagnostopoulou, E.G., 2015. Identifying barriers in the diffusion of renewable energy sources. *Energy Policy.* 80, 153-164.

Feng, Y., Fan, X., Yoon, Y., 2015. Lenders and borrowers' strategies in online peer-to-peer lending market: An empirical analysis of PPDAl.com. *J. Electron. Commer. Res.* 16, 3, 242-260.

Freedman, S., Jin, G., 2017. The information value of online social networks: Lessons from peer-to-peer lending. *Int. J. Ind. Organ.* 51, 185-222.

Gedda, D., Nilsson, B., Sathen, Z., Soilen, K., 2016. Crowdfunding: Finding the Optimal Platform for Funders and Entrepreneurs. *Technol. Innov. Manag. Rev.* 6, 3, 31-40.

Geiger, M., Oranburg, S., 2018. Female entrepreneurs and equity crowdfunding in the US: Receiving less when asking for more. *J. Bus. Venturing Insights*.10, In press.

Gonzalez, L., Loureiro, Y.K., 2014. When can a photo increase credit? The impact of lender and borrower profiles on online peer-to-peer loans. *J. Behav. Exp. Financ.* 2, 44-58.

Greenunivers, 2018. Baromètre 2017 du crowdfunding EnR : 20,5 M€ investis par les citoyens. <https://www.greenunivers.com/2018/04/exclusif-barometre-2017-du-crowdfunding-205-me-pour-les-enr-180320/> (accessed 27 august 2019).

Greiner, M., Wang, H., 2010. Building Consumer-to-Consumer Trust in E-Finance Marketplaces: An Empirical Analysis. *Int. J. Electron. Commer.* 15, 105-136.

Hair, J., Anderson, R., Tatham, R., Black, W., 2009. *Multivariate data analysis*, seventh ed. Macmillan, New York.

Hamilton, K., 2009. *Unlocking Finance for Clean Energy: The Need for 'Investment Grade' Policy*. Chatham House Briefing Paper.

Herzenstein, M, Dholakia, U., Andrews, R., 2011. Strategic Herding Behavior in Peer-to-Peer Online Loan Auctions. *J. Interact. Marketing.* 25, 1, 27–36.

Hörisch, J., 2015. Crowdfunding for environmental ventures: an empirical analysis of the influence of environmental orientation on the success of crowdfunding initiatives. *J. Clean. Prod.* 107, 636-645.

Hörisch, J., 2018. 'Think big' or 'small is beautiful'? An empirical analysis of characteristics and determinants of success of sustainable crowdfunding projects. *Int. J. Entrep. Venturing.* 10, 1, 111-129.

Hörisch, J., 2019. Take the money and run? Implementation and disclosure of environmentally-oriented crowdfunding projects. *J. Clean. Prod.* 223, 127-135.

IEA and IRENA, 2017. *Perspectives for the energy transition- Investment needs for a low-carbon energy system*. Int. Renew. Energy Agency, Bonn, Germany.

IRENA, 2015. *Renewable Power Generation Costs in 2014*. Int. Renew. Energy Agency, Bonn, Germany.

IRENA, 2016. *Unlocking Renewable Energy Investment: The role of risk mitigation and structured finance*. Int. Renew. Energy Agency, Abu Dhabi.

Iyer, R., Khwaja, A., Luttmer, E., Shue, K., 2016. Screening peers softly: Inferring the quality of small borrowers. *Manag. Sci.* 62, 6, 1554-1577.

Klafft, M., 2008. Peer to peer lending: auctioning microcredits over the Internet, in: Agarwal, A., Khurana, R. (Eds.), *Proceedings of the International Conference on Information Systems, Technology and Management*. IMT, Dubai.

KPMG Report: *Alternative lending market trends in Continental Europe in 2016*.

Lam, P., Law, A., 2016. Crowdfunding for renewable and sustainable energy projects: An exploratory case study approach. *Renew. Sustain. Energy Rev.* 60, 11–20.

- Leboeuf, G., Schvienbacher, A., 2018. Crowdfunding as a New Financing Tool, in: Cumming, D., Hornuf, L. (Eds.), *The Economics of Crowdfunding*. Palgrave Macmillan, London, pp.11-28.
- Liang, T., Wu, S., Huang, C., 2019. Why funders invest in crowdfunding projects: Role of trust from the dual process Perspective. *Inf. Manag.* 56, 1, 70-84.
- Liberti, J.M., Petersen, M.A., 2019. Information: Hard and soft. *Rev. Corp. Financ. Stud.* 8, 1, 1-41.
- Lin, M., N. Prabhala, Viswanathan, S., 2013. Judging Borrowers by the Company They Keep: Friendship Networks and Information Asymmetry in Online Peer-to-Peer Lending. *Manag. Sci.* 59, 1, 17–35.
- Liu, D., Brass, D., Lu, Y., Chen, D., 2015. Friendships in online peer-to-peer lending: pipes, prisms, and relational herding. *MIS Q.* 39, 3, 729-742.
- Lu, Y., Chang, R., Lim, S., 2018. Crowdfunding for solar photovoltaics development: A review and forecast. *Renew. Sustain. Energy Rev.* 93, 439-450.
- Lukkarinen, A., Teich, J., Wallenius, H., Wallenius, J., 2016. Success drivers of online equity crowdfunding campaigns. *Decis. Support Syst.* 87, 26–38.
- Maier, E., 2016. Supply and demand on crowd-lending platforms: connecting small and medium-sizes enterprises borrowers and consumers investors. *J. Retail. Consum. Serv.* 33, 143-153.
- Mazzucato, M., Semieniuk, G., 2018. Financing renewable energy: Who is financing what and why it matters. *Technol. Forecast. Soc. Change.* 127, 8-22.
- Mollick, E., 2014. The dynamics of crowdfunding: An exploratory study. *J. Bus. Venture.* 29, 1-16.
- Mollick, E., Robb, A., 2016. Democratizing Innovation and Capital Access: The Role of Crowdfunding. *Calif. Manag. Rev.* 58, 2, 62-87.
- Nahapiet, J., Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage. *Acad. Manag. Rev.* 23, 2, 242-266.
- Pope, D., Sydnor, J., 2011. What's in a picture? Evidence of discrimination from Prosper.com. *J. Hum. Resour.* 46, 53-92.
- Riegelsberger, J., Sasse, M.A., McCarthy, J.D., 2003. The researcher's dilemma: Evaluating trust in computer-mediated communication. *Int. J. Hum. Comput. Stud.* 58, 6, 759–781.
- Short, J., Anglin, A., 2019. Is leadership language 'rewarded' in crowdfunding? Replicating social entrepreneurship research in a rewards-based context. *J. Bus. Venturing Insights*. In press.
- Stiglitz, J., Weiss, A., 1981. Credit Rationing in Markets with Imperfect Information. *Am. Econ. Rev.* 71, 3, 393-410.
- Tidwell, L. and Walther, J., 2002. Computer-mediated Communication Effects on Disclosure, Impressions, and Interpersonal Evaluations: Getting to Know one Another a Bit at a Time. *Hum. Commun. Res.* 28, 317-348.
- Valuates Report, 2019, *Global Crowdfunding Market Size, Status and Forecast 2019-2025*, Valuates.
- Vasileiadou, E., Huijben, J., Raven, R., 2016. Three is a crowd? Exploring the potential of crowdfunding for renewable energy in the Netherlands. *J. Clean. Prod.* 128, 142-155.
- Yildiz, O., 2014. Financing renewable energy infrastructures via financial citizen participation: the case of Germany. *Renew. Energy.* 68, 677-685.

Yum, H., Lee, B., Chae, M., 2012. From the wisdom of crowds to my own judgment in microfinance through online peer-to-peer lending platforms. *Electron. Commer. Res. Applications*. 11, 469-483.

Appendices

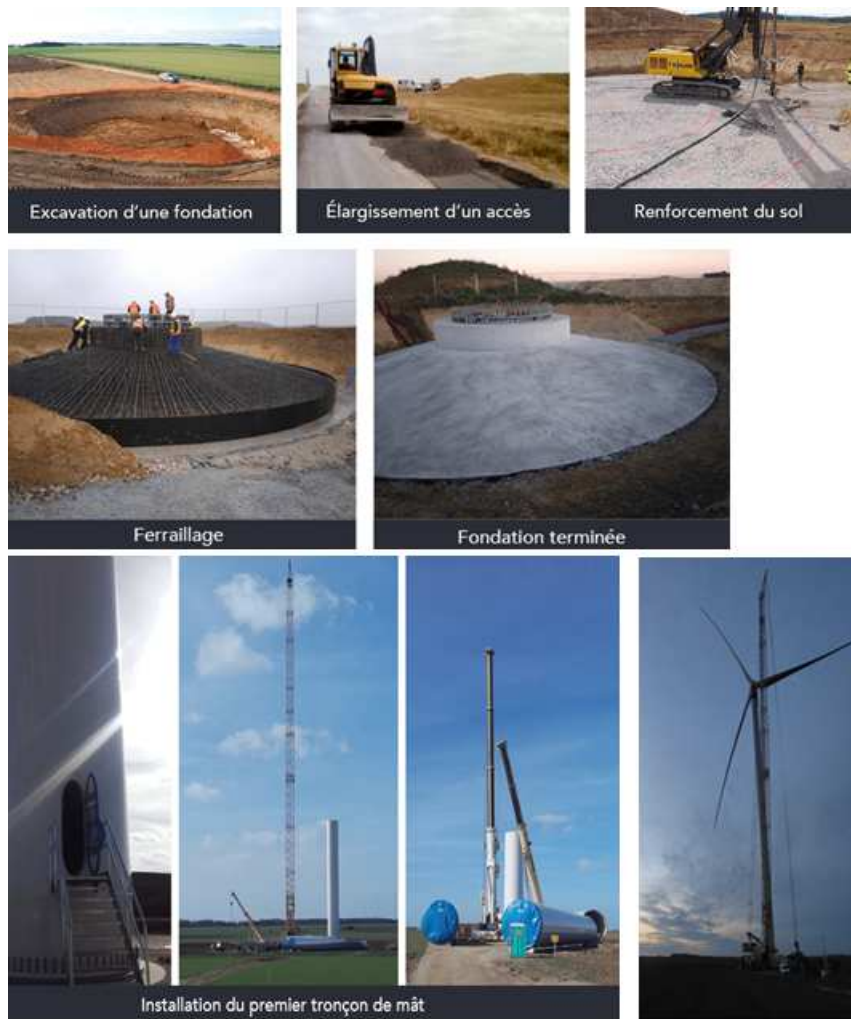
Appendix A: Top crowdfunding platforms specialized in renewable energy projects

N.	Country	Platform	N.	Country	Platform
1	UK	Trillion Fund	13	France	Lendosphere
2	Uk	Abundance	14	UK	Solar Schools
3	Netherlands	De Windcentrale	15	USA	SunFunder
4	USA	Village Power	16	Portugal	Coopernico
5	Germany	Econeurs	17	US	CollectiveSun
6	Germany	LeihDeinerUmweltGeld	18	Germany	GreenXmoney
7	Netherlands	DuurzaamInvesteren	19	France	Lumo
8	UK	Microgenius	20	USA	Re-Volv
9	Netherlands	Greencrowd	21	USA	Divvy Green
10	Germany	Bettervest	22	France	Enerfip
11	Netherlands	WeShareSolar	23	USA	Clean Reach
12	Germany	Greenvesting	24	USA	Mosaic

Note: This table reports (in terms of the amount raised) the top crowdfunding platforms in the world specialized in renewable energy.

Source: Renewable Energy Crowdfunding Conference, Renewable Energy Crowdfunding Overview and Map: London, 2015. <http://www.crowdfundres.eu/index.html@p=362.html>

Appendix B- The project of construction of wide turbines



Note: Except for one, all campaign pages on the three platforms of our sample display pictures describing the project and its progress. For 44 campaigns, the number of pictures posted exceeds 10. This figure is an example of pictures posted on a project page.