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# Crowdfunding cleantech

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ABSTRACT

This paper provides insights on the crowdfunding of new alternative energy technologies by enabling inferences from large pools of small investors. We provide large sample evidence from 81 countries around the world that cleantech crowdfunding is more common in countries with low levels of individualism and more common when oil prices are rising. Cleantech crowdfunding campaigns are more likely to have higher capital goals, more photos, a video pitch, and longer text descriptions of the campaign. Relative to non-cleantech campaigns, the success of cleantech campaigns, in terms of achieving funding goals, is more economically sensitive to the campaign's goal size, being not-for-profit, and having a video pitch. The evidence is consistent with the view that while alternative energies are viewed as being more risky, and investors face greater information asymmetries relative to other types of investment projects, there are mechanisms for entrepreneurs to mitigate these information problems and be at least as successful in cleantech crowdfunding markets.

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## 1. Introduction

New technologies such as cleantech present unique opportunities and challenges for investors. Cleantech encompasses four main sectors: energy, transportation, water, and minerals, and these sectors include projects such as green energy, renewable energy, recycling, wind power, solar power, biomass, hydro-electric, photovoltaic, geothermic, biofuel, green transport, gray water, and electric motors (Pernick and Wilder, 2007; Sadorsky, 2011). Many of these sectors have recently been characterized as generating the best opportunities for private investments (Aguilar and Cai, 2010).

Cleantech projects are characterized as encompassing a public good with positive externalities in terms of a cleaner environment; as such, cleantech often has higher costs for consumer adoption, where consumers may pay more in view of positive feelings associated with cleantech use (Bloomberg New Energy Finance, 2010, 2012). Therefore, the importance of cleantech investments is likely to vary from one country to another as a result of cultural differences in the sensitivity to environmental issues (Cameron et al., 1998; Kountouris and Remoundou, 2016), social responsibility, and socially responsible consumption (Liobikienėa et al., 2016). Such cultural traits may promote support for green product and cleantech initiatives (Romani et al., 2016). Cleantech is likewise characterized as having high risks in terms of being disrupted or becoming quickly obsolete (Hart and Milstein, 1999); therefore, investors face high information asymmetries with respect to evaluating not only the science underlying cleantech but also the market opportunities of cleantech investments (Bloomberg New Energy Finance, 2010, 2012).

Prior work on energy finance has largely been focused on studies of commodities markets with the use of exchange data (e.g., Dewally et al., 2013; Henderson et al., 2015) and on examining the financial performance of environmental mutual funds (Muñoz et al., 2014). There have been fewer studies of private companies in energy markets, arguably due to the scant availability of data, except in the case of venture capital studies of energy finance. Venture capitalists around the world have expertise in evaluating new technologies (Megginson and Weiss, 1991; Megginson, 2004; Nahata, 2008; Nahata et al., 2014); therefore, there has been much hype about the intersection between cleantech and venture capital in recent years (Wüstenhagen et al., 2009; Ghosh and Nanda, 2014; Marcus et al., 2012; Crifo and Forget, 2013; Cumming et al., 2016). Cleantech was one of the fastest growing sectors in the venture capital industry from 2000 to 2013, comprising over 10% of all venture capital deals in 2010–2013. In 2007, Nobel Peace Prize winner Al Gore was hired by Kleiner Perkins, one of the world's leading

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venture capital funds.[1] While early signs of cleantech venture capital looked promising (Buer and Wustenhagen, 2009), many funds that ventured into cleantech have lost a significant amount of their invested capital, including industry leaders such as Kleiner Perkins.[2]

Moreover, the fall in oil prices in late 2014 made cleantech investment substantially less attractive.[3] The combination between low oil prices and failed cleantech deals led many venture capitalists to think of cleantech as a 'dirty word'.[4] These industry developments have given rise to the need for alternative energies to seek alternative forms of funding outside of the mainstream alternative sources such as venture capital. Indeed, while Kumar et al. (2012) have found little evidence on established firms (based on stock prices), many of the path-breaking technologies in renewable investments are also made outside large firms.

One such new alternative form of funding on the rise is crowdfunding. Crowdfunding has grown exponentially in recent years worldwide from a $2 billion market in 2011, to $6 billion in 2012, and $16 billion in 2014. It is expected to reach $95 billion in 2025.[5] Standardized platforms such as Indiegogo have facilitated the growth of crowdfunding by enabling entrepreneurs to reach out to large numbers of investors to fund projects through Internet portals. In the U.S., these projects are funded through rewards and donations crowdfunding to retail investors, while equity crowdfunding is only available to accredited investors in the U.S. (Agrawal et al., 2015; Bayus, 2013; Belleflamme et al., 2013, 2014; Boudreau and Jeppesen, 2014; Burtch et al., 2013; Colombo et al., 2015; Mollick, 2014a, 2014b; Mollick and Kuppuswamy, 2014; Mollick and Nanda, 2014; Schwienbacher and Larralde, 2012).[6] In other countries, such as Australia (Ahlers et al., 2015) and European Union member states (Hornuf and Schwienbacher, 2017; Vismara, 2017), entrepreneurs may sell shares and other forms of securities over Internet portals in the form of equity crowdfunding. Unlike venture capital markets, in which control rights are transferred to investors to mitigate costs associated with information asymmetries (Cumming, 2008) and in unique ways for socially responsible investments (Scarlata and Alemany, 2010), crowdfunding markets are characterized by limited loss of control by the entrepreneur and a pronounced role for signaling by the entrepreneur. Since crowdfunders invest smaller amounts of money, they typically take into account not only tangible benefits but also societal ones, such as the extent to which these projects solve social and environmental problems. The large number of projects offered through crowdfunding platforms and the large number of investors offers a unique learning environment to study the information asymmetries offered by new technologies, such as alternative cleantech energy projects, and the usefulness of mechanisms on crowdfunding platforms to mitigate such information asymmetries.

In this paper, we examine the Indiegogo platform. Indiegogo is a U.S.-based platform but employs entrepreneurs from a very large number of countries around the world that engage in fundraising campaigns. These countries vary extensively in terms of cultural differences and concerns about environmental problems. Most of the campaign goals are between $5000 and $200,000. We study 22,786 campaigns over the period 2011–2013, where 1864, or 7.4% of the campaigns, involved cleantech projects.

We find that cleantech crowdfunding is more common in countries with low levels of individualism and more common when oil prices are rising. These findings are consistent with cultural traits that value the long-term, possess a greater awareness regarding social responsibility, and have high alternative energy costs. Cleantech crowdfunding campaigns are more likely to have higher capital goals, more photos, a video pitch, and longer text descriptions than other campaigns. Relative to non-cleantech campaigns, success of cleantech campaigns, in terms of achieving funding goals, is more economically sensitive to the campaign's goal size, being not-for-profit, and having a video pitch. Overall, the data are consistent with the view that cleantech projects have pronounced information problems investors must face. Cleantech entrepreneurs can make use of mechanisms on crowdfunding platforms to significantly mitigate the investors' information asymmetries in ways that make cleantech campaigns no less successful than their non-cleantech counterparts.

This paper is organized as follows. Section 2 discusses the testable propositions in view of the institutional setting of the Indiegogo platform. Section 3 presents the data. Multivariate analyses are presented in Section 4. The last section discusses the implications for practice, policy, and future research.

## 2. Hypotheses

In this section, we derive four testable hypotheses regarding cleantech crowdfunding. While these predictions have not been discussed or tested in prior literature, they are, nevertheless, closely aligned with prior work on the cleantech literature and other related fields on institutions and entrepreneurial finance. Our first two predictions are focused on the drivers of cleantech crowdfunding. Our third and fourth predictions pertain to the use of soft information and the success of cleantech crowdfunding campaigns compared to campaigns of other project types.

Cleantech projects are unique in a number of ways (WCED, 1987; Hall and Vredenburg, 2003; Bloomberg New Energy Finance, 2010, 2012; Henriques et al., 2013). First, there is a high chance that they may give rise to disruptions in traditional industries related to energy. This type of disruptive technology has the potential to give rise to very large payoffs; but, at the same time, there is a high risk that the cleantech project could itself be disrupted by other competing cleantech projects. Second, cleantech often involves high risks for consumer adoption, insofar as there are costs to switching from one energy source to another energy source. Sadorsky (2012) provides evidence on the correlation between renewable energy stocks and oil prices, making the holding of such stock a hedge in the crude oil futures market. Inchauspe et al. (2015) provide further evidence for the impact of oil prices on investments in renewable energy. Thus, oil price changes tend to affect cleantech adversely. Third, in view of the positive benefits of cleantech developments on the environment, many projects are costly but, consumers are nevertheless willing to pay higher prices to support green technologies that show corporate and environmental social responsibility. The more costly the use of traditional energy sources for consumers, the more likely it is that cleantech projects will be initiated as the potential profits to cleantech rise.

With the existence of positive externalities arising from cleantech, economic forces are likely to drive investments into renewable energy, and, in particular, the opportunity costs of relying on more traditional, crude oil. This view is consistent with empirical findings of Sadorsky (2012), Inchauspe et al. (2015) on investments made in renewable energy. Crude oil prices drive opportunity costs of renewable energy, since crude oil (and gas in some countries) are crucial alternative sources of energy for households. Thus, we expect cleantech projects to be more readily funded in periods of rising oil prices.

[1] http://money.cnn.com/2007/11/11/news/newsmakers/gore_kleiner.fortune/. See also http://www.washingtonpost.com/politics/decision2012/al-gore-has-thrived-as-green-tech-investor/2012/10/10/1dfaa5b0-0b11-11e2-bd1a-b868e65d57eb_story.html.

[2] http://www.reuters.com/article/2013/01/16/us-kleiner-doerr-venture-idUSBRE90F0AD20130116.

[3] http://www.cnbc.com/id/102279652#. See also Hamilton (2011).

[4] http://www.bloombergview.com/articles/2014-11-14/vcs-think-cleantech-is-a-dirty-word.

[5] http://www.crowdsourcing.org/.

[6] The Securities and Exchange Commission (SEC) has recently implemented Title III of the JOBS Act in the U.S. so that equity crowdfunding platforms can now also solicit non-accredited investors. However, U.S. equity crowdfunding platforms have been slow to take advantage of this opportunity, unlike in other countries, where equity crowdfunding has been commonplace for several years.

**H1.** Cleantech crowdfunding campaigns are more common in periods of rising oil prices.

There are ample reasons to expect cleantech crowdfunding levels to reflect soft institutional characteristics across countries. It is well established that cultural traits are in line with sensitivity to environmental issues and societal responsibility (Vitell et al., 1993). Since the cultural environment is reflected in the pro-environmental behavior of households (Milfront and Schultz, 2016) we expect that cleantech campaigns are more likely to originate in countries where there is a less dominant influence from established energy sources and a culture of low *power inequality* and *lower masculinity* (as defined by Hofstede, 1991, 2001, 2011; formal definitions are also provided, below). Masculine cultures focus on ambition and ego, while feminine cultures value the service towards others and the quality of life. As cleantech offers benefits to others and society at large, it is a much better fit with feminine societies than masculine societies. Similarly, lower power inequality cultures value equal opportunity for all individuals in society. Cleantech disrupts power held by established energy providers such as oil producers; hence, cultures that value low power distance are more likely to have a preference for cleantech.

There is exacerbated uncertainty regarding the science underlying cleantech, since much scientific research is funded by organizations such as oil companies that have an incentive to create a false impression about the need for and benefits of cleantech. For example, prominent scientific work debating the role of the oil industry in spurring global warming has been revealed to have been funded from the oil industry.[7] This type of nondisclosure, improper debate, and confusion in scientific journals exacerbates the uncertainty associated with cleantech and the information asymmetry faced by cleantech investors. For these reasons, we would expect cultures with high levels of *uncertainty avoidance* to be less likely to engage in cleantech crowdfunding.

Cultural characteristics other than power inequality, masculinity, and uncertainty avoidance can matter for cleantech, as well. Specifically, we may expect more cleantech crowdfunding investment in countries with a *long-term orientation*, less *indulgence*, and less *individualism*. Cleantech benefits individuals for many years in the future, and even generations that are not yet born, which generates more utility among individuals that have longer term, less indulgent characteristics. Furthermore, the benefits for consumer adoption of cleantech can give rise to positive externalities, and the consumption of cleantech may be non-excludable and non-rival, in that other consumers can benefit without paying for the benefit. As such, societies that are more *collective* and less *individualistic* will show greater support of cleantech in view of the non-rival and non-excludable nature of cleantech consumption.

**H2.** Cleantech crowdfunding campaigns more often originate from countries with low power distance, low individualism, low masculinity, low uncertainty avoidance, low indulgence, and high long-term orientation.

Our third hypothesis pertains to the mechanisms that can be used in crowdfunding campaigns, often referred to as the disclosure of "soft information," to mitigate information asymmetries between the entrepreneur and potential investors. In the context of crowdfunding, the use of soft information is costly for the entrepreneur to prepare and hard to replicate by others, if the intrinsic qualities of the entrepreneur and the project are low. Specifically, entrepreneurs can post extensive photo gallery items and a professional video, if their project is well-developed with prototypes, and if there exists equipment and facilities for developing the project further. Consistent with Spence (1973), entrepreneurs with a higher quality project, and entrepreneurs with better writing skills, can post lengthy project descriptions, and better-worded project descriptions, in order to mitigate information problems faced by their new backers. Therefore, they convey a costly signal by exerting more effort in preparing the campaign. Empirical evidence consistent with this view has been recently provided in crowdfunding (Ahlers et al., 2015; Cumming et al., 2014; Mollick, 2014a), showing that the disclosure of pictures, videos, and lengthier texts contributes to the success of crowdfunding campaigns. As cleantech projects are riskier, with potentially abstracting benefits to society at large, these mechanisms that transfer soft information about cleantech projects to potential investors are particularly important.

**H3.** Cleantech crowdfunding campaigns are more likely to make use of more detailed soft information to mitigate information problems, including more gallery items, video pitches, longer project descriptions, and better-worded project descriptions.

Our fourth hypothesis pertains to the success of crowdfunding projects. We have no reason to expect a priori that cleantech projects will be more or less successful, particularly in view of the mechanisms that can be used to mitigate information problems faced by investors. However, we would expect campaign success to be more sensitive to the use of soft information for cleantech projects when there are pronounced information problems faced by cleantech investors. As cleantech projects are, on average, riskier than non-cleantech, and the benefits to society need clarification and justification to entice a crowd to invest, the success of cleantech crowdfunding projects is more likely dependent on the use of gallery items, video pitches, and the length and quality of project descriptions.

**H4.** The success of cleantech crowdfunding campaigns is more sensitive to the use of soft project information.

## 3. Data and summary statistics

We use data from the reward-based crowdfunding platform Indiegogo. It was launched in 2008 and is now the second-largest reward-based platform worldwide, right after Kickstarter, which is more than twice as large in terms of projects started. One particularity of Indiegogo compared to Kickstarter is that entrepreneurs can choose between a flexible (so-called "keep-it-all") funding mechanism and a fixed ("all-or-nothing") one (Cumming et al., 2014), while on Kickstarter and most other reward-based platforms only the latter one is possible. Under the flexible mechanism, the entrepreneur gets to keep whatever the crowd has pledged, even if the minimum goal was not achieved by the end of the campaign. Under the fixed mechanism, the entrepreneur only collects the pledges if the minimum goal is achieved. As mentioned in Cumming et al. (2014), this has implications on the allocation of risk between the entrepreneur and the crowd, since, under the flexible mechanism, the crowd bears the risk that the project is undertaken, although it is underfunded. In contrast, the crowd's risk is reduced under an all-or-nothing mechanism. Campaigns generally last between two months and four months, depending on the funding mechanism chosen and the decision of the entrepreneur on total duration at the beginning of the campaign. As for other platforms, Indiegogo only earns fees if the campaign is successful. The success fee may vary between 4% and 9%.

Our dataset comprises all campaigns launched on the Indiegogo platform since it began until October 2013, when the data were extracted. Indiegogo leaves all the projects on its website, except those that do not achieve at least 500 currency units. Since it is an international platform, entrepreneurs may post amounts in US dollars, euros, Canadian dollars, Australian dollars, or British pounds. Whenever currency other than USD is used, we convert all values into USD using a yearly average exchange rate. Our original sample comprises 47,139 campaigns.

[7] http://www.washingtonpost.com/news/energy-environment/wp/2015/02/23/no-the-sun-isnt-driving-global-warming/.

We apply filters before performing analyses. We first drop all campaigns that were launched before November 2011, because there were very few projects at the beginning, and because the platform did not allow an entrepreneur the choice between the "all-or-nothing" (AON) or "keep-it-all" (KIA) model before that date. This filter is important here, since we explicitly control for the choice of funding model (consistent with Cumming et al., 2014). We further exclude all projects with a campaign goal below USD 5000, since they often target friends and family members (consistent with Mollick, 2014a). A final filter concerns the largest projects, where we exclude projects with a campaign goal beyond the 99-percentile of the distribution (which corresponds to a goal close to USD 200,000). These projects are very different in nature than the rest and may result in extreme outliers. This leads to a final dataset of 22,786 project campaigns.

To identify cleantech projects, we perform a text analysis by searching for the following words in the project description: "green energy," "cleantech," "recycle," "wind power," "solar power," "biomass," "renewable energy," "hydro-electric," "photovoltaic," "geotherm," "sustainable," "biofuel," "green transport," "environmental footprint," "greywater," and "electric motor." Since there is not clear consensus about what constitutes the "cleantech" industry, this list of words is directly derived from the definition of cleantech available on Wikipedia and other web pages such as http://www.cleantech.com/ (consistent with Cumming et al., 2016). This led to a sample of 1864 cleantech projects.

Appendix 1 and Figs. 1 and 2 summarize the projects by country. The projects originated from 81 countries around the world. The most common countries in the dataset include the U.S., Canada, the U.K., Australia, Germany, Italy, Israel, France, and the Netherlands (Appendix 1). For countries with more than 90 campaigns, the highest percentage of deals that are cleantech are from the Netherlands, South Africa, Mexico, and India (Fig. 1). For countries with more than 5 projects, and where at least 25% are cleantech, the countries with the highest proportion of cleantech projects are Liberia (67%), Sierra Leone (50%), Vietnam (50%), Zambia (50%), and Ecuador (44%) (Fig. 2). Finally, cleantech projects became more common over time, from 6.81% in the second semester of 2011 to 7.84% in the second semester of 2013 (Fig. 3).

A full description of variables available in our dataset is provided in Appendix 2, and summary statistics are provided in Table 1. Variables are classified in 5 types: project characteristics (subcategory, goal, duration, etc., as well as additional soft information provided either at the beginning of the campaign or during the campaign); measures of campaign output (number of backers or rewards left, etc.); macroeconomic and legal conditions; and, finally, cultural conditions.

The recorded project characteristics are mandatory information, and all entrepreneurs set them once and for all prior to the campaign start. While some variables are intrinsic to the project itself (the category/subcategory, the location), others are set freely by the entrepreneur (the goal, the funding model, the number of rewards, and the level of each reward—the amount a backer should give to choose the defined reward, the duration, etc.). The additional "soft" information is a set of descriptive information provided to inform the crowd about the project. It consists of text, pictures, video pitches, additional comments, and updates, as well as any other information that the entrepreneur discloses to potential backers. As these pieces of information are mostly

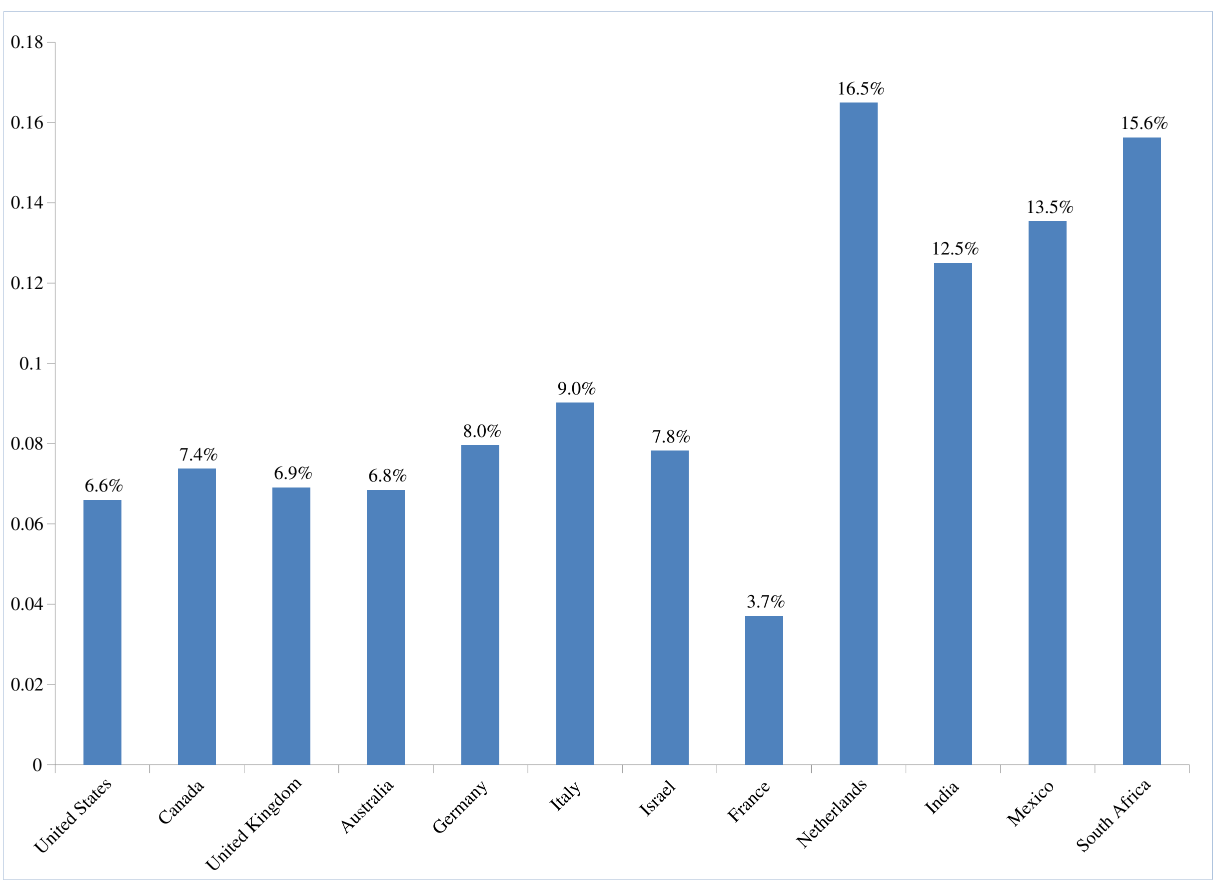


**Fig. 1.** Cleantech projects by country. This table shows the percentage of campaigns financing cleantech, for countries with more than 90 projects. Countries are ordered by total number of projects presented on the platform (from higher on the left to lower on the right).

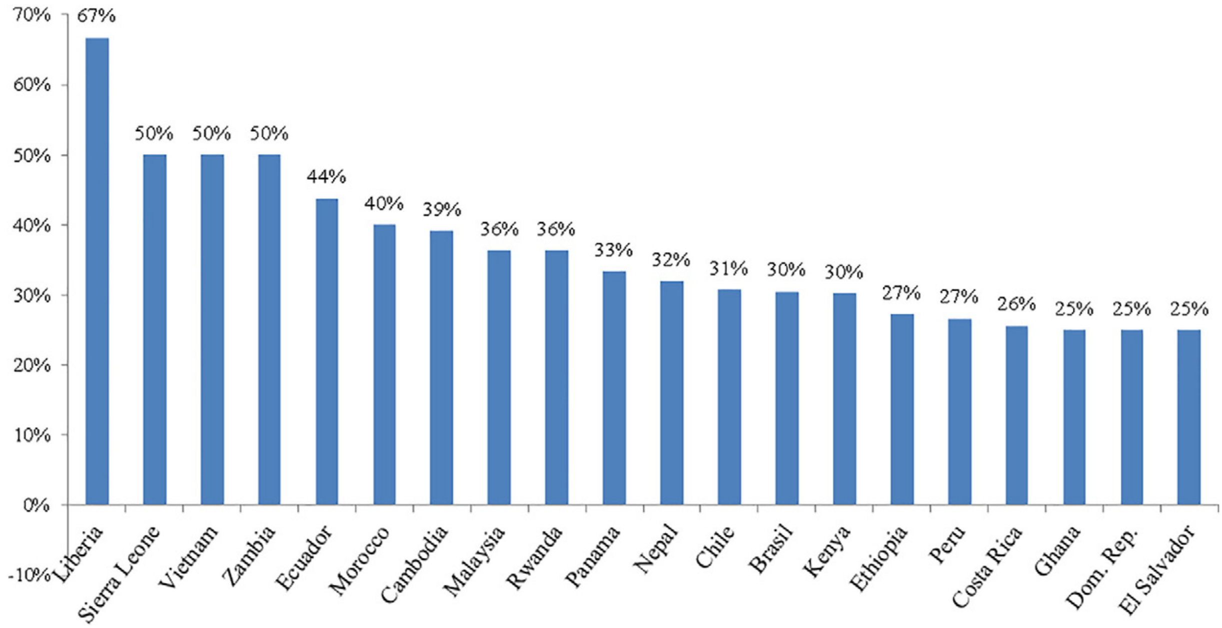


**Fig. 2.** Countries with a high proportion of cleantech projects. This table shows the percentage of campaigns financing cleantech for countries where such projects account for more than 25% of presented projects and with a total number of projects higher than 5.

of qualitative nature, we decided to limit ourselves to those that could be measured quantitatively. For instance, information such as number of words/pictures/items and presence or not of some items allow us to observe the implication of the entrepreneur in the project and the degree of preparedness, as it is associated with success (Mollick, 2014a, 2014b).

Given that this information is intended for reading by a wide audience, we also include a readability index as a control variable for evaluating crowd perception. Readability indexes are designed to gauge the understandability of written text. We use the Automated Readability Index (ARI). This index uses the full text of the project description, as described in Appendix 2. The ARI offers an index expressed as a US grade level. For instance, Grade 1 indicates text for children 6/7 years old, and Grade 12 indicates text for high school students 17/18 years old.

Finally, we consider campaign outputs based on observable information at the end of the campaign. It consists in total amount pledged by backers, total number of backers, and the completion ratio. These output measures define the success of the campaign. Our primary measure of success is the completion ratio, which corresponds to the ratio of total amount pledged over the goal set by the entrepreneur.

Table 1 indicates several statistical differences in the characteristics of cleantech versus non-cleantech investments. In total, there are 1684 cleantech campaigns and 21,102 non-cleantech campaigns. Cleantech deals are more likely to be non-profit (13% for cleantech and 10% for non-cleantech) and have high-target goals on average ($26,095 for cleantech and $20,635 for non-cleantech). Cleantech is less likely to be associated with the KIA funding model (93% for cleantech and 95% for non-cleantech). Cleantech has, on average, more reward levels (8.3 for cleantech versus 7.4 for non-cleantech). Cleantech projects are less likely to generate a digital output (17% for cleantech and 45% for non-cleantech), whereby the project size can be adjusted and still undertaken with partial funding. We do not find any significant difference in the length of cleantech versus non-cleantech campaigns, where both are approximately 48 days, on average. Finally, cleantech projects are done by larger teams, on average (2.89 persons versus 2.36 for non-cleantech projects).

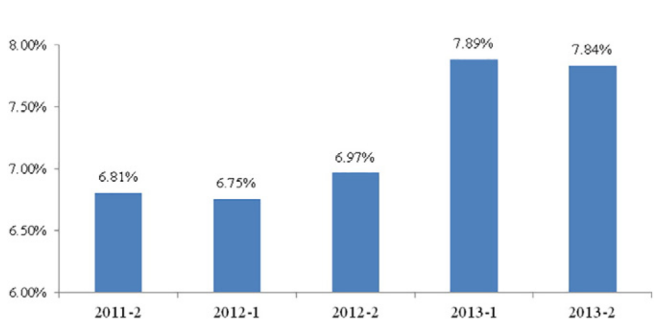


**Fig. 3.** Cleantech projects by semester. This table shows the overall proportion of cleantech projects for each semester.

Cleantech deals provide significantly more detailed soft information, on average. The catch phrase length is 120.8 words, on average, for cleantech versus 114.8 for non-cleantech. Cleantech projects have 5.68 updates, on average, compared to 5.05 updates for non-cleantech. Cleantech campaigns post 9.04 gallery items, on average, compared to 6.63 for non-cleantech; and 85% of cleantech campaigns involve a video versus 78% for non-cleantech. The full-text length is 6554 words for cleantech versus 4510 for non-cleantech, and the cleantech readability score is significantly higher at 16.54 compared to 15.15 for non-cleantech. However, there are no significant differences for the number of comments for cleantech versus non-cleantech (both 30, on average), nor for the use of social networks (the median is 3 networks for both cleantech and non-cleantech).

Cleantech projects, on average, are not significantly more successful. The completion ratio is 44% for cleantech and non-cleantech. Funding success, in terms of meeting the goal, is 19% for cleantech and 18% for non-cleantech. However, cleantech projects, on average, attract a significantly higher total pledge ($7900) than non-cleantech ($6478), as well as more backers (94.28 for cleantech versus 81.37 for non-cleantech, though this latter difference is not statistically significant).

On average, cleantech deals are significantly more common over periods when there has been an increase in oil prices over the prior 6 months ($2.52 for cleantech versus $1.77 for non-cleantech), and higher oil prices at the end of the campaign ($96.28 for cleantech and $95.97 for non-cleantech), consistent with H1.

**Table 1**
Summary statistics.
This table provides summary statistics for the subsample of cleantech versus non-cleantech projects. The last column shows results of the mean difference test between both subsamples. *, **, ***Significant at the 10%, 5%, and 1% levels, respectively. Variables are as defined in Appendix 2.

| Variables | Non-cleantech | | | Cleantech | | | Mean diff. test |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | Median | Mean | S.D. | Median | |
| *Project characteristics* | | | | | | | |
| Verified non-profit | 0.10 | 0.30 | 0 | 0.13 | 0.34 | 0 | −0.03*** |
| Goal | 20,635 | 26,160 | 10,000 | 26,095 | 30,764 | 15,000 | −5500*** |
| Keep-it-all dummy | 0.95 | 0.22 | 1 | 0.93 | 0.25 | 1 | 0.02*** |
| Reward's levels | 7.38 | 3.96 | 8 | 8.27 | 3.56 | 8 | −0.89*** |
| Digital output dummy | 0.45 | 0.50 | 0 | 0.17 | 0.37 | 0 | 0.29*** |
| Team size | 2.36 | 2 | 2 | 2.89 | 2.31 | 2 | −0.53*** |
| Duration | 48.32 | 22.77 | 45 | 48.33 | 20.52 | 45 | −0.01 |
| *Soft information and success* | | | | | | | |
| Catch phrase length | 114.8 | 38.75 | 125 | 120.8 | 36.48 | 131 | −5.97*** |
| Updates | 5.05 | 8.88 | 2 | 5.68 | 7.85 | 3 | −0.63*** |
| Comments | 29.91 | 227.7 | 13 | 30.07 | 105.8 | 14 | −0.16 |
| Gallery's items | 6.63 | 10.46 | 3 | 9.04 | 11.10 | 5 | −2.41*** |
| Video pitch dummy | 0.78 | 0.41 | 1 | 0.85 | 0.36 | 1 | −0.07*** |
| Full text length | 4510 | 3302 | 3707 | 6554 | 4366 | 5349 | −2000*** |
| Social networks | 3.27 | 32.80 | 3 | 3.48 | 2.07 | 3 | −0.21 |
| A.R. index | 15.15 | 4.69 | 14.83 | 16.54 | 3.21 | 16.22 | −1.39*** |
| Completion ratio | 0.44 | 1.21 | 0.22 | 0.44 | 1.06 | 0.23 | −0.002 |
| Success dummy | 0.18 | 0.38 | 0 | 0.19 | 0.39 | 0 | −0.02 |
| Total pledge | 6478 | 30,318 | 2460 | 7900 | 23,695 | 3088 | −1400* |
| Total backers | 81.37 | 415.8 | 33 | 94.28 | 381.6 | 38 | −12.91 |
| *Macroeconomic conditions* | | | | | | | |
| Oil Price Evol 6M | 1.77 | 10.70 | 4.14 | 2.52 | 10.17 | 4.87 | −0.75*** |
| Oil price at start | 95.74 | 7.15 | 95.25 | 95.93 | 7.19 | 95.34 | −0.19 |
| Oil price at end | 95.97 | 7.04 | 95.25 | 96.28 | 7.23 | 95.61 | −0.31* |
| Gas Price Evol 6M | 0.18 | 0.85 | 0.39 | 0.24 | 0.85 | 0.43 | −0.059*** |
| Gas price at start | 3.3 | 0.58 | 3.39 | 3.35 | 0.58 | 3.43 | -0.052*** |
| S&P500 Evol 6M | 119.3 | 76.35 | 119.05 | 123.19 | 74.41 | 122.78 | -3.895** |
| S&P500 at Start | 1496.91 | 132.36 | 1472.34 | 1505.94 | 129.79 | 1513.17 | −9.032*** |
| *Cultural dimensions* | | | | | | | |
| Power distance | 40.81 | 7.74 | 40 | 41.99 | 10.22 | 40 | −1.18*** |
| Individualism | 86.21 | 13.04 | 91 | 83.12 | 18.58 | 91 | 3.09*** |
| Masculinity | 60.09 | 7.48 | 62 | 59.28 | 8.93 | 62 | 0.81*** |
| Uncertainty avoidance | 47.91 | 9.43 | 46 | 48.91 | 11.21 | 46 | −1.00*** |
| Long term orientation | 29.86 | 11.22 | 25.69 | 30.31 | 11.97 | 25.69 | −0.45 |
| Indulgence | 66.54 | 8.18 | 68.08 | 65.97 | 9.38 | 68.08 | 0.57*** |
| *Legal conditions* | | | | | | | |
| Strength of minor. investors protection index | 6.62 | 0.56 | 6.60 | 6.46 | 0.85 | 6.60 | 0.16*** |
| Observations | 21,102 | | | 1684 | | | |

Cleantech deals are significantly associated with different Hofstede cultural indices. Cleantech deals are more common in countries with higher power distance scores (41.99 for cleantech versus 40.81 for non-cleantech), lower individualism scores (83.12 for non-cleantech and 86.21 for cleantech), lower masculinity scores (59.28 for cleantech and 60.09 for cleantech), higher uncertainty avoidance scores (48.91 for cleantech and 47.91 for non-cleantech), and lower indulgence scores (65.97 for cleantech and 66.54 for non-cleantech). These findings offer preliminary support for H2. Finally, Table 1 shows cleantech deals are more likely in countries with lower legal protection scores (6.46 for cleantech and 6.62 for non-cleantech).[8]

Table 2 provides a correlation matrix. The correlations are consistent with the comparison tests in Table 1 for cleantech versus non-cleantech. Also, note from Table 2 that there are high correlations across some of the variables in the data, including, for example, the country-level measures. As such, in the next section, we consider robustness to excluding different variables in the alternative specifications (reported and otherwise available on request). We further checked values of variance inflation factors in our analyses to ensure lack of multicollinearity in the specifications shown below (the highest value of some variables being below 4, but most below 2).

## 4. Multivariate analyses

Our regression analyses proceeds in three steps. First, we study the frequency of cleantech crowdfunding campaigns to test H1 and H2. Second, we examine the factors that affect the use of soft information for cleantech versus non-cleantech campaigns to test H3. Finally, we examine the effect of soft and other information on crowdfunding success for cleantech versus non-cleantech campaigns. Each model is estimated with heteroscedasticity robust standard errors. Alternative specifications with clustered standard errors by time period and/or industry and/or country did not materially change any of the results reported below and are available on request.

Table 3 presents an analysis of factors that affect the likelihood that a crowdfunding campaign will involve a cleantech project. The determinants of cleantech crowdfunding are a function of oil prices and cultural variables, as well as fixed effects for the different time periods. Several control variables are included, among which the extent to which investors are protected (consistent with finding of Kim and

[8] In unreported analysis, we have considered a variety of other country variables, such as legal and policy variables. For instance, we have investigated policy differences proxied by ICRG indices on government stability, socio-economic conditions, existence of external conflicts, and corruption. These directly pertain to the political and legal environment. Their inclusion does not alter our main conclusions on the hypotheses.

**Table 2**
Correlation matrix.
This table provides correlations for the main variables in the sample. *Significant at the 5% level. Variables are as defined in Appendix 2.

| | Success | Cleantech dummy | Goal | Verified non-profit | Keep-it-all dummy | Gallery's items | Video pitch dummy | Full text length | Social networks | A.R. index | Oil Price Evol 6M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Success | 1 | | | | | | | | | | |
| Cleantech dummy | 0.0109 | 1 | | | | | | | | | |
| Goal | −0.1722* | 0.0705* | 1 | | | | | | | | |
| Verified non-profit | 0.0374* | 0.0292* | 0.0251* | 1 | | | | | | | |
| Keep-it-all dummy | −0.1036* | −0.0203* | −0.0915* | 0.0790* | 1 | | | | | | |
| Gallery's items | 0.0803* | 0.0600* | 0.1048* | −0.0017 | −0.0225* | 1 | | | | | |
| Video pitch dummy | 0.0439* | 0.0449* | 0.0964* | 0.0442* | −0.0362* | 0.1215* | 1 | | | | |
| Full text length | 0.0446* | 0.1550* | 0.2176* | −0.0117 | −0.0983* | 0.2334* | 0.1635* | 1 | | | |
| Social networks | 0.0007 | 0.0017 | 0.0061 | 0.0047 | 0.0001 | 0.0191* | 0.0215* | 0.0012 | 1 | | |
| A.R. index | 0.0105 | 0.0788* | 0.0374* | 0.1039* | 0.0252* | 0.0160* | 0.0524* | 0.1247* | 0.0476* | 1 | |
| Oil Price Evol 6M | 0.0166* | 0.0185* | 0.0091 | 0.0961* | 0.0119 | −0.0510* | 0.0558* | 0.0471* | 0.0004 | 0.0265* | 1 |
| Oil price at start | 0.0078 | 0.007 | 0.0064 | 0.0490* | 0.0160* | −0.0690* | 0.0334* | 0.0410* | −0.0041 | 0.0171* | 0.7902* |
| Oil price at end | 0.0188* | 0.0115 | 0.0148* | 0.0855* | 0.0074 | −0.0392* | 0.0341* | 0.0478* | −0.0009 | 0.0204* | 0.5095* |
| Gas price at start | 0.0273* | 0.0229* | 0.0707* | 0.1356* | −0.0311* | 0.0087 | 0.0661* | 0.0708* | 0.0102 | 0.0296* | 0.1388* |
| Gas Price Evol 6M | 0.0114 | 0.0175* | 0.0735* | 0.0567* | −0.0476* | 0.0526* | 0.0253* | 0.0393* | 0.0089 | 0.0059 | −0.3630* |
| S&P500 at Start | 0.0272* | 0.0173* | 0.0775* | 0.1316* | −0.0371* | −0.0309* | 0.0812* | 0.0877* | 0.007 | 0.0287* | 0.5026* |
| S&P500 Evol 6M | 0.0171* | 0.0131* | 0.0332* | 0.0843* | −0.0186* | −0.0058 | 0.0621* | 0.0520* | 0.0031 | 0.0181* | 0.6341* |
| Power distance | −0.0085 | 0.0381* | 0.0064 | −0.0253* | −0.0017 | 0.0272* | −0.0001 | 0.0694* | −0.0009 | 0.0449* | 0.0108 |
| Individualism | 0.0108 | −0.0585* | −0.0218* | 0.0999* | 0.0602* | −0.0649* | −0.0259* | −0.1187* | 0.0012 | −0.0726* | −0.0142* |
| Masculinity | −0.004 | −0.0274* | −0.0159* | 0.0772* | 0.0626* | −0.0288* | −0.0206* | −0.0446* | 0.001 | −0.0005 | −0.0231* |
| Uncertainty avoidance | −0.0168* | 0.0268* | 0.0168* | −0.0567* | −0.0547* | 0.0632* | 0.0204* | 0.1137* | 0.0003 | 0.0680* | 0.0158* |
| Long term orientation | 0.0068 | 0.0102 | 0.0340* | −0.1157* | −0.0979* | 0.0851* | 0.0405* | 0.1501* | 0.0002 | 0.0544* | 0.0134* |
| Indulgence | 0.0071 | −0.0176* | −0.0295* | 0.0465* | 0.0453* | −0.0686* | −0.0223* | −0.1034* | 0.0004 | −0.0486* | −0.0123 |
| Minor. invest. protec. idx | 0.0140* | −0.0715* | −0.0097 | −0.0503* | −0.0118 | −0.0197* | 0.0024 | −0.0142* | 0.0007 | −0.0254* | −0.0069 |

| | Oil price at start | Oil price at end | Gas price at start | Gas Price Evol 6M | S&P500 at Start | S&P500 Evol 6M | Power distance | Individualism | Masculinity | Uncertainty avoidance | Long term orientation | Indulgence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oil price at end | 0.4681* | 1 | | | | | | | | | | |
| Gas price at start | −0.0235* | 0.3421* | 1 | | | | | | | | | |
| Gas Price Evol 6M | −0.4146* | −0.1254* | 0.6759* | 1 | | | | | | | | |
| S&P500 at Start | 0.4853* | 0.4744* | 0.6872* | 0.3476* | 1 | | | | | | | |
| S&P500 Evol 6M | 0.3824* | 0.3731* | 0.2549* | −0.0116 | 0.6766* | 1 | | | | | | |
| Power distance | 0.0061 | 0.0158* | 0.0206* | 0.0143* | 0.0177* | 0.0108 | 1 | | | | | |
| Individualism | −0.0082 | −0.0165* | −0.0109 | −0.0062 | −0.0135* | −0.0127 | −0.6470* | 1 | | | | |
| Masculinity | −0.0156* | −0.0235* | −0.0253* | −0.0097 | −0.0316* | −0.0307* | −0.0688* | 0.4099* | 1 | | | |
| Uncertainty avoidance | 0.0038 | 0.0114 | 0.0155* | 0.0084 | 0.0192* | 0.0255* | 0.4092* | −0.5899* | −0.2135* | 1 | | |
| Long term orientation | 0.0051 | 0.0134* | 0.0008 | −0.0132* | 0.0043 | 0.0164* | 0.2780* | −0.5715* | −0.2308* | 0.3316* | 1 | |
| Indulgence | −0.0007 | −0.0088 | −0.0228* | −0.009 | −0.0164* | −0.0160* | −0.5280* | 0.5607* | 0.1317* | −0.4438* | −0.6173* | 1 |
| Minor. invest. protec. idx | −0.0009 | −0.0104 | −0.0210* | −0.0167* | −0.0197* | −0.0144* | −0.2994* | 0.2417* | 0.0438* | −0.3869* | 0.0882* | 0.2254* |

**Table 3**
Cleantech-based crowdfunding campaigns.
This table provides marginal effects in probit regressions for the determinants of cleantech campaigns. The dependent variable is "cleantech dummy." Regressions 1, 2, and 3 show results respectively for macroeconomics conditions, cultural dimensions, and legal conditions. Regressions 4 shows results for all the independent variables taken together with semester fixed effect. Regression 5 adds control for world economic evolution. Regression 6 uses oil prices adjusted at the country level, and regression 7 tests our hypothesis on gas as an alternative fossil energy source. Standard deviations are estimated robust to heteroscedasticity. *, **, ***Significant at the 10%, 5%, and 1% levels, respectively. Variables are as defined in Appendix 2.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| *Macroeconomic conditions* | | | | | | | |
| Oil Price Evol 6M | 0.0008147*** | | | 0.0007496** | 0.0009841*** | | |
| Oil price at start | −0.0007698* | | | −0.0008314 | −0.0010828** | | |
| Oil price at end | 0.0001763 | | | −0.000111 | −0.000059 | | |
| Country Adj. Oil Price Evol 6M | | | | | | 0.0006125** | |
| Country adj. oil price at start | | | | | | −0.0001074 | |
| Gas Price Evol 6M | | | | | | | 0.0126354** |
| Gas price at start | | | | | | | 0.0063454 |
| S&P500 Evol 6M | | | | | −0.0000738 | −0.0000461 | 0.0000244 |
| S&P500 at Start | | | | | 0.0000648 | 0.0000405 | −0.0000026 |
| *Cultural dimensions* | | | | | | | |
| Power distance | | −0.0000894 | | −0.0001581 | −0.0001593 | −0.0002325 | −0.0001727 |
| Individualism | | −0.0009883*** | | −0.0010163*** | −0.0010154*** | −0.0010838*** | −0.0010216*** |
| Masculinity | | −0.0000842 | | −0.0000736 | −0.0000721 | −0.0000749 | −0.0000563 |
| Uncertainty avoidance | | −0.0002628 | | −0.0003505* | −0.0003464* | −0.0003416 | −0.0003526* |
| Long term orientation | | −0.0001899 | | −0.0001485 | −0.0001459 | −0.0000476 | −0.000138 |
| Indulgence | | 0.000166 | | 0.0002213 | 0.000222 | 0.0002423 | 0.0002214 |
| *Legal conditions* | | | | | | | |
| Strength of min. invest. protec. index | | | −0.0246323*** | −0.0053462 | −0.0052851 | −0.0060293 | −0.0054862 |
| Semester fixed effect | | | | Yes | Yes | Yes | Yes |
| Observations | 22,875 | 22,014 | 22,768 | 22,014 | 22,014 | 21,972 | 22,014 |
| Pseudo R-squared | 0.001 | 0.004 | 0.008 | 0.005 | 0.005 | 0.005 | 0.005 |

**Table 4**
Crowdfunding campaign presentation.
This table provides OLS regressions for the campaign goal (1), number of gallery items (2), the length of the text describing the campaign (4), and the readability score of the text (5), and a probit regression for the probability of the use of a video pitch (3). *, **, ***Significant at the 10%, 5%, and 1% levels, respectively. Variables are as defined in Appendix 2.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Ln(goal) | Gallery | Video pitch | Full text length | ARI |
| *Project characteristics* | | | | | |
| Cleantech dummy | 0.159*** | 2.188*** | 0.087*** | 1947.117*** | 1.172*** |
| Keep-it-all dummy | −0.201*** | 0.430 | −0.027** | −692.923*** | 0.397*** |
| Verified non-profit | 0.167*** | 0.909*** | 0.060*** | 132.147* | 1.384*** |
| *Macroeconomic* | | | | | |
| Oil Price Evol 6M | 0.001 | −0.041*** | 0.001** | 2.946 | 0.006 |
| Oil Price at Start | −0.002 | 0.028 | −0.002*** | −5.656 | −0.006 |
| Oil Price at End | −0.002 | 0.012 | −0.001* | 2.621 | −0.003 |
| *Cultural dimensions* | | | | | |
| Power distance | 0.020* | −0.221 | −0.036*** | 50.860 | −0.049 |
| Individualism | −0.002 | −0.057 | −0.009*** | 11.781 | −0.024 |
| Masculinity | −0.010 | 0.393 | 0.047*** | 8.584 | 0.134 |
| Uncertainty Avoidance | −0.012** | 0.115 | 0.015*** | 38.873* | 0.111*** |
| Long Term Orientation | −0.003 | −0.028 | −0.006*** | −4.216 | −0.022 |
| Indulgence | 0.015 | −0.406** | −0.040*** | −23.915 | −0.153 |
| *Legal conditions* | | | | | |
| Strength of min. invest. protec. index | 0.369*** | −2.883** | −0.229*** | 439.102 | −0.699 |
| Constant | 6.834*** | 32.910** | 3.815*** | −2590.033 | 20.530*** |
| Sub-category fixed effect | Yes | Yes | Yes | Yes | Yes |
| Semester fixed effect | Yes | Yes | Yes | Yes | Yes |
| Country fixed effect | Yes | Yes | Yes | Yes | Yes |
| Observations | 22,014 | 22,014 | 22,014 | 22,014 | 21,838 |
| R-squared | 0.095 | 0.048 | 0.122 | 0.113 | 0.044 |
| Adjusted R-squared | 0.091 | 0.044 | 0.118 | 0.109 | 0.040 |

Park, 2016, on the impact of financial development on investments in renewable energy projects) and the general economic conditions (the measures S&P500 Evol 6M and S&P500 at Start). There are 5 alternative probit regression models to assess the statistical and economic significance of the results to alternative control variables.

The data in Table 3 highlight some of the main robust factors that affect the likelihood that a campaign involves a cleantech project. To begin, there is evidence that oil prices matter, and, in particular, the evolution of oil prices over the 6 months prior to the start of the campaign (Oil Price Evol 6M). This effect is statistically significant at the 1% level in Models 1 and 5 and at the 5% level in Model 4. Model 5 shows the results are robust to the inclusion of a control variable for general economic conditions (S&P500 Evol 6M and S&P500 at Start), which may strongly affect oil price movements. In terms of the economic significance, the results show that a 1-standard deviation increase in the change in oil prices over the prior six months gives rise to a 0.8% increase ($=0.0008147 * 10.17 = 0.008285499$) in the probability of a cleantech crowdfunding campaign, based on the Model 5 estimate. Because the average probability of a crowdfunding campaign is 7.39% in the data, a 0.8% increase is equivalent to an increase by 10.8% ($=(0.0739 + 0.008) / 0.0739 - 1$).[9] This effect is, therefore, both statistically and economically significant, strongly supporting H1. The impact of oil prices at the start of the campaign is also significant at the 5% level in Model 5, but this effect is not robust to other specifications (Models 1 and 4).

To stress the robustness of these results, we use country-adjusted oil price changes. As crude oil is only naturally present and available in a few countries but traded worldwide in USD, when it comes to final users, the price may vary greatly from one country to another. For instance, differences may result from currency conversions or from country-specific taxes on energy. The website globalpetrolprices.com offers a country index of oil-derived products prices. We use their gasoline index to adjust the price at a country level. More specifically, we multiply the oil prices used so far for our analysis by their adjustment factor to obtain country-adjusted prices. Results are provided in Model 6 of Table 3. We obtain qualitatively similar results for our primary measure of oil price changes. Similarly, we use gas price changes as a possible alternative driver, since, in many countries, gas is widely used as a source of energy by households. Again, we obtain similar results (see Model 7).

The cultural variables highlight one significant factor that affects the probability of a cleantech deal. Individualism is negatively associated with the probability of cleantech deals, and this effect is statistically significant at the 1% level in the specifications. A 1-standard deviation increase in individualism is associated with a 1.3% reduction in the probability of a cleantech campaign (according to Model 5), which is a drop by 17.9%, relative to the average frequency of cleantech deals. Uncertainty avoidance is partially also significant, however, at the 10% level only, and only in Models 4, 5, and 6. Note, as well, that the cultural variables are highly correlated with each other; as such, we replicated the regressions with each of the cultural variables considered separately. The results are not materially different for individualism. The cultural variable for individualism on its own has a coefficient of −0.000789 and is significant at the 1% level, which is just slightly less than the estimate of −0.001 in Table 3. The uncertainty avoidance variable coefficient, however, is not robust. As such, the data provide the strongest support for the importance of low levels of individualism in facilitating crowdfunding. In other words, in view of the externalities of cleantech discussed in Section 2, above, with respect to being non-excludable and non-rival, individualism is the most important cultural factor affecting the frequency of cleantech crowdfunding campaigns. This evidence strongly supports H2, at least with respect to the individualism cultural trait.

Finally, the data in Table 3 show some support for the role of legal protections in facilitating cleantech crowdfunding campaigns, but this effect is significant in Model 3 (when estimating without macroeconomic and cultural variables) and not robust in the other models.

Table 4 presents regressions for the characteristics of the crowdfunding campaign for cleantech versus non-cleantech, controlling

[9] In unreported analysis, we also examined the impact of a short window of 3 months. The impact is weaker. However, given the time required to prepare a cleantech project, a longer window, such as 6 months, seems more appropriate for the analysis.

for other project characteristics, macroeconomic conditions, cultural conditions, and legal conditions. Several fixed effects are also included. Regression 1 presents an analysis of factors that affect the size of the campaign goal. Cleantech goals are, on average, much more likely to be higher goals, and this effect is significant at the 1% level. In terms of the economic significance, cleantech deals are, on average, 16.0% higher than the average goal of $21,039. Model 2 shows that cleantech deals have, on average, 32.1% more gallery items relative to the average level of 6.81 items, and this effect is significant at the 1% level. Model 3 shows that video pitches are 8.7% more likely for cleantech versus non-cleantech deals. Model 4 shows that cleantech deals have, on average, 1947.11 more words than non-cleantech deals in the full text description, which is 41.8% higher than the 4661 average number of words across all campaigns. Finally, Model 5 shows that cleantech deals have a readability score that is 1.2 higher, on average, which is 7.7% higher than the average readability score of all campaigns. Overall, therefore, the data highlight the fact that cleantech campaigns are significantly different than other campaigns. The data are consistent with the view that entrepreneurs use more detailed information to mitigate the risk associated with the campaigns.

The control variables in Table 4 are significant in ways that we might expect. For example, KIA projects are associated with smaller goals, less use of video pitches, and shorter full-text length. These results are consistent with the view that the KIA funding model is used in smaller and less risky projects (Cumming et al., 2014). Note that we do not use goal size as a factor that explains the other left-hand-side variables in Models 2–5, because it is arguably endogenous; but, when we do include the goal size variable, the cleantech variable's statistical significance is not affected, and there is merely a trivial effect on its economic significance. One thing to note in Table 4 is that the only factor that consistently affects all 5 left-hand-side variables is the cleantech variable. Overall, therefore, the data strongly support H3.

Table 5 presents further robustness checks on the models presented in Table 4. In particular, we use propensity score matching on the campaign goal, funding model, subcategory, and date, to ascertain whether or not the findings still hold. The matching was made based on the cleantech sample: every cleantech project was matched with the closest non-cleantech project in terms of the sub-category, campaign goal, funding model, and date. In Panel A, we report measures of the accuracy of our matching process. The standardized percentage bias, expressed as

**Table 5**
Crowdfunding campaign presentation based on propensity score matching.

Panel A: Matching accuracy
This table shows *t*-tests for equality of means between cleantech and non-cleantech projects subsamples before and after propensity score matching for matched variables (except for subcategories). It also reports the standardized percentage bias (percentage of the square root of the average of the sample variances in cleantech and non-cleantech groups) and the variance ratio between the two subsamples.
†Variance ratios that exceed the 2.5th and 97.5th percentiles. *, **, ***Significant at the 10%, 5%, and 1% levels, respectively.

| Variable | Unmatched (U) | Mean | | %bias | % reduction | Mean diff test | Variance ratio |
|---|---|---|---|---|---|---|---|
| | Matched (M) | Cleantech | Non-Cleantech | | bias | t-stat | |
| Keep-it-all dummy | U | 0.93144 | 0.94878 | −7.3 | | −3.08*** | na. |
| | M | 0.93144 | 0.93913 | −3.2 | 55.7 | −0.91 | n.a. |
| Goal | U | 26,080 | 20,643 | 19 | | 8.10*** | 1.38† |
| | M | 26,080 | 25,373 | 2.5 | 87 | 0.68 | 1.06 |
| Start date | U | 19,365 | 19,350 | 7.7 | | 3.04*** | 0.96 |
| (Days relative to 01.01.1960) | M | 19,365 | 19,366 | −0.7 | 90.9 | −0.21 | 1.03 |

Panel B: Regressions using propensity score matching
This table provides OLS regressions for the campaign number of gallery items, the length of the text describing the campaign, the readability score of the text, and a probit regression for the probability of the use of a video pitch. The sample is composed by 1684 cleantech projects matched with 1684 non-cleantech projects. The propensity score matching is based on the project subcategory, size (goal), the funding model (keep-it-all or all-or-nothing), and the project launch date. *, **, ***Significant at the 10%, 5%, and 1% levels, respectively. Variables are as defined in Appendix 2.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Gallery | Gallery | Video Pitch | Full Text Length | ARI |
| *Project characteristics* | | | | | |
| Cleantech dummy | 1.622*** | 1.476*** | 0.078*** | 1823.094*** | 1.161*** |
| Keep-it-all dummy | | −1.797* | −0.076*** | −1154.574*** | 0.047 |
| Verified non-profit | | 1.702** | 0.099*** | −341.915* | 1.089*** |
| *Macroeconomic conditions* | | | | | |
| Oil Price Evol 6M | | −0.093** | −0.001 | 2.756 | 0.016 |
| Oil price at start | | 0.068 | −0.003 | 4.215 | −0.002 |
| Oil price at end | | 0.006 | 0.000 | −9.623 | −0.004 |
| *Cultural dimensions* | | | | | |
| Power distance | | 1.453 | 0.052*** | 536.335 | 0.006 |
| Individualism | | −1.09 | 0.003 | −281.587 | 0.059 |
| Masculinity | | 0.491 | −0.010*** | 140.388 | −0.047 |
| Uncertainty avoidance | | 1.485 | 0.001 | 445.220 | −0.238 |
| Long term orientation | | −0.853* | −0.011*** | −246.141 | −0.001 |
| Indulgence | | 4.877 | 0.051** | 1528.664 | −0.424 |
| *Legal conditions* | | | | | |
| Strength of min. inv. protect. index | | −53.577 | 0.002 | −16,328.982 | 7.388 |
| Constant | 7.414*** | −13.894 | −3.980** | −10,057.679 | 3.749 |
| Sub-category fixed effect | No | Yes | Yes | Yes | Yes |
| Semester fixed effect | No | Yes | Yes | Yes | Yes |
| Country fixed effect | No | Yes | Yes | Yes | Yes |
| Observations | 3384 | 3151 | 3151 | 3151 | 3151 |
| R-squared | 0.004 | 0.088 | 0.091 | 0.15 | 0.127 |
| Adjusted R-squared | 0.004 | 0.064 | 0.067 | 0.128 | 0.105 |

the percentage of the square root of the average of the sample variances in the cleantech and non-cleantech groups (Rosenbaum and Rubin, 1985), are now reduced by 87%, 56%, and 91%, respectively, for the goal, funding model, and start date. Differences in mean *t*-tests between cleantech and non-cleantech projects are, thus, no longer significant for matched samples in terms of the project size (goal), funding model, and start date. The results reported in Panel B are very consistent with those reported in Table 4. Likewise, other matching criteria (considered and available on request), such as for cultural and legal conditions, do not change the main findings.

Finally, Table 6 presents an analysis of project success for cleantech versus non-cleantech projects. Seven alternative specifications are provided to highlight robustness. Models 1–5 examine the full sample to ascertain whether, on average, cleantech projects are, more or less, successful than non-cleantech projects, using the following measures of success: the total amount pledged by backers, the number of backers, the Completion Ratio, and the Success Dummy (i.e., whether the completion ratio is at least equal to 1). We find no evidence of any significant effect, with the sole exception of Model 1, where there is suggestive evidence that is significant at the 10% level (but not robust to alternative specifications considered and available on request). Models 6 and 7, therefore, present regressions for the separate subsample of cleantech (Model 6) versus non-cleantech (Model 7) subsamples. Models 6 and 7 are very informative, as they highlight the differences in the sensitivity of different factors of success in terms of achieving the funding goal in ways that are consistent with H4.

Models 6 and 7 in Table 6 show that, relative to non-cleantech campaigns, the success of cleantech campaigns, in terms of achieving funding goals (the variable Success Dummy), is 9.1% more economically sensitive to the campaign's goal size, 86.2% more sensitive to being not-for-profit, 11.5% more sensitive to being an all-or-nothing campaign, and 105.5% more sensitive to having a video pitch. However, the data also indicate that cleantech success is 31.4% less sensitive to the gallery items and 34.4% less sensitive to the full-text length, implying that excessive photos and excessive wordiness is less relevant in cleantech campaigns. Apart from these project characteristics, the macroeconomic, cultural, and legal condition variables in Table 6 are statistically insignificant in Table 6 Model 6 for cleantech investments. Overall, this evidence in Table 6 is consistent with the findings in Tables 4 and 5; cleantech campaigns must overcome more pronounced information asymmetries, and, as such, cleantech entrepreneurs are more successful when they make better use of mechanisms to mitigate such information asymmetries.

In other robustness checks for Table 6, we considered other specifications, such as propensity score matching, as done in Table 5 relative to Table 4. The findings were not materially different and, therefore, not explicitly reported, but they are available on request. Finally, we have considered other macroeconomic and institutional variables from the World Bank for each of the tables, but the results were not materially different.

## 5. Conclusions

This paper provided, for the first time, an empirical analysis of crowdfunding in the cleantech or alternative energy sector. We examined over 20,000 different projects from 81 countries around the

**Table 6**
Success of cleantech projects.
This table provides OLS regressions for the success of the campaigns. Regressions 1, 2, and 3 show success as proxied by the total amount pledged, the number of backers, and the percent funded. Models 4, 5, 6, and 7 show results of probit regressions for the probability of success in terms of meeting or exceeding the funding goal. Regressions 4 and 5 are based on the full sample, and regressions 6 and 7 compare subsamples of cleantech and non-cleantech campaigns. *, **, ***Significant at the 10%, 5%, and 1% levels, respectively. Variables are as defined in Appendix 2.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | Pledged | Backers | Completion ratio | Success | Success | Success—cleantech | Success—non-cleantech |
| *Project characteristics* | | | | | | | |
| Cleantech dummy | −1685.142* | −13.162 | −0.021 | 0.016 | 0.016 | | |
| ln(goal) | 3673.846*** | 34.874*** | −0.192*** | | −0.093*** | −0.101*** | −0.092*** |
| Verified non-profit | 1026.573*** | −1.340 | 0.074*** | | 0.056*** | 0.097*** | 0.052*** |
| Keep-it-all dummy | −4567.670*** | −64.447*** | −0.210*** | | −0.203*** | −0.224*** | −0.201*** |
| Gallery's items | 198.511*** | 1.602*** | 0.008*** | | 0.003*** | 0.002** | 0.003*** |
| Video pitch dummy | 505.621* | 8.329 | 0.040 | | 0.040*** | 0.077*** | 0.038*** |
| Full text length | 0.699*** | 0.007*** | 0.00002*** | | 0.000006*** | 0.000004* | 0.000006*** |
| Social networks | −158.900** | −0.332 | −0.005 | | 0.0001 | 0.004 | −0.00008 |
| A.R. index | −54.369* | −1.517** | −0.0006 | | 0.0010 | −0.004 | 0.001 |
| *Macroeconomic conditions* | | | | | | | |
| Oil Price Evol 6M | 41.924 | 0.845 | 0.0005 | | 0.0006 | −0.0008 | 0.0008 |
| Oil price at start | −127.544** | −3.068** | −0.006 | | −0.001 | 0.004 | −0.001* |
| Oil price at end | 113.922*** | 0.49 | 0.001 | | 0.0002 | 0.0007 | 0.0002 |
| *Cultural dimensions* | | | | | | | |
| Power distance | −67.400 | −0.145 | −0.024*** | | −0.039*** | 0.025 | −0.038*** |
| Individualism | 91.343*** | 1.223*** | 0.0002 | | −0.003** | 0.001 | −0.003* |
| Masculinity | −2.538 | −3.666 | 0.026*** | | 0.047*** | −0.000006 | 0.043*** |
| Uncertainty avoidance | 45.553 | 0.075 | 0.012*** | | 0.021*** | −0.014 | 0.020*** |
| Long term orientation | 5.146 | 0.386 | 0.0004 | | −0.0007 | −0.012 | −0.0005 |
| Indulgence | −38.844 | 1.613 | −0.025*** | | −0.042*** | 0.011 | −0.040*** |
| *Legal conditions* | | | | | | | |
| Strength of min. invest. protec. index | −3070.032*** | −12.772 | −0.301*** | | −0.429*** | 0.142 | −0.416*** |
| Constant | −12,002.847 | 154.306 | 5.099*** | 0.176*** | 4.887*** | −1.109 | 4.819*** |
| Sub-category fixed effect | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Semester fixed effect | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Country fixed effect | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Observations | 21,838 | 21,838 | 21,838 | 22,875 | 21,838 | 1530 | 20,308 |
| R-squared | 0.047 | 0.026 | 0.028 | 0.000 | 0.072 | 0.121 | 0.071 |
| Adjusted R-squared | 0.042 | 0.021 | 0.024 | 0.000 | 0.068 | 0.074 | 0.067 |

world on the Indiegogo platform, where 7.4% were cleantech campaigns. Cleantech campaigns are more common when oil prices are rising and in countries with low levels of individualism. The evidence further shows that cleantech entrepreneurs make more use of soft information to inform the crowd about their projects, which is consistent with the view that alternative energies are viewed as being more risky, so investors face greater information asymmetries relative to other types of investment projects. Finally, the data are consistent with the view that cleantech entrepreneurs who use these soft mechanisms to mitigate these information problems are more likely to have a successful fundraising campaign. The mere fact that a project is a cleantech, however, does not affect the campaign outcome in itself.

Our analysis extends the prior literature in a few important respects. We extend the analysis of the financing of alternative energies from other investors, such as the publicly listed market and the venture capital market, to the crowdfunding arena. Crowdfunding is a relatively new area of study, and no prior paper has examined crowdfunding of alternative energies. By examining the crowdfunding marketplace, we can infer from the wisdom of the crowd the factors that influence success for alternative energies. Furthermore, the analysis of crowdfunding allows an analysis of entrepreneurial actions regarding the use of mechanisms to mitigate information asymmetries faced by investors. Crowdfunding is particularly interesting with respect to studying the financing of technologies, such as alternative energies that have non-rival and non-excludable properties. Also, the fact that crowdfunders are not directly seeking financial returns on this type of platform allows us to study support for cleantech projects beyond the traditional support from financial markets.

As the crowdfunding market grows over time and different types of crowdfunding are adopted in different countries and on different platforms, further analyses of the crowdfunding of alternative energies can be carried out. We hope that this type of analysis in future work can help to inform entrepreneurs, investors, academics, and policymakers to get the most out of the financing of alternative energies so that cleantech can fill a greater role in society in the coming years.

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## Appendix A. Supplementary data

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