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Crowdfunding for environmental ventures: an empirical analysis of the influence of environmental orientation on the success of crowdfunding initiatives

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ABSTRACT

The realisation of many environmental ventures requires funding from external parties, which is not always easy to obtain. Crowdfunding offers a new potential source of financing, which is frequently expected to favor environmentally oriented ventures. However, little is known if and how crowdfunding can be effectively used for such ventures. The article empirically examines this phenomenon by analysing how the environmental orientation of crowdfunding projects influences their likelihood of successful funding. Surprisingly, no positive connection between environmental orientation and crowdfunding success can be observed in the dataset used. Therefore, reasons for the relatively low rate of success of environmentally oriented crowdfunding projects are discussed and potential measures to assist in the more effective use of crowdfunding in the context of sustainability are suggested.

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1. Introduction: the relevance of crowdfunding for environmental ventures

Research from various disciplines emphasises that mankind is exceeding critical thresholds of environmental pollution with regard to climate change, biodiversity loss and other dimensions of environmental sustainability (Rockström et al., 2009; Steffen et al., 2015). Since the 1960s, a growing societal concern for these problems of environmental unsustainability can be observed (cf. Carson, 1962; Du Plessis and Brandon, 2014). As environmental problems become more and more pressing, businesses are increasingly dealing with issues of environmental sustainability. Since companies have a large impact on environmental issues, their contributions to address these challenges have increasingly been discussed (e.g. Amini and Bienstock, 2014; Lozano, 2012; Lozano et al., 2014).

Several authors highlight that sustainable entrepreneurship is the most effective form of corporate sustainability management (e.g. Schaltegger, 2002; Schaltegger and Wagner, 2011; Schaper, 2010). Unlike other forms of sustainability management (e.g.

environmental administration or environmental management), sustainable entrepreneurship goes beyond reducing negative environmental and social impacts of business operations. Instead, it explicitly aims at contributing to the solution of a specific problem related to sustainability by placing sustainability issues at the core of its activities (Schaltegger, 2002; Schaltegger and Wagner, 2011; Schaper, 2010). Following Lehner (2013, 2), sustainable entrepreneurship can therefore broadly be defined as “all kinds of ventures that have a social or environmental mission as their primal goal, which aim to be financially and legally independent and strive to become self-sustainable by means of the market”.

According to Thompson et al. (2011), environmental entrepreneurship should not be regarded as separate from sustainable entrepreneurship, but can be regarded as a specific context for analysing the link between entrepreneurship and sustainable development. It is characterised by a strong focus on the environmental dimension of sustainability. Environmental ventures typically deal with opportunities which exist due to environmental problems and are frequently considered to be an effective means to address environmental market failures (Dean and McMullen, 2007).

Similar to other forms of entrepreneurial activity, environmentally oriented ventures usually require initial investments.

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However, environmental ventures commonly experience difficulties to acquire funding (Brown and Murphy, 2003; Fedele and Miniaci, 2010; O'Rourke, 2010). This phenomenon can be explained by different fundamental logics between conventional investors and environmental entrepreneurs. Many such entrepreneurs lack a business education and related experiences. They frequently focus on the environmental impact of their business, and do not sufficiently consider the financial aspects (cf. Brown and Murphy, 2003; Ridley-Duff, 2009). Consequently, they often fail to successfully communicate with conventional financiers (Lehner, 2013), who regard expected yields, security of the investment and accounting liquidity as the most important investment criteria (O'Rourke, 2010). Furthermore, conventional financiers might consider the legal and organisational structures of some environmental ventures as unprofessional (Agrawal et al., 2011; Gundry et al., 2011).

In sum, Ortas et al. (2013) draw attention to the lack of funding as a central obstacle that hinders sustainable development. To overcome this obstacle, crowdfunding is increasingly discussed in the media as an alternative means to finance sustainability-oriented ventures and clean production technologies (e.g. Harte, 2013; Park, 2012; Thorpe, 2014). Crowdfunding is defined in this paper as “the efforts by entrepreneurial individuals and groups – cultural, social, and for-profit – to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the internet, without standard financial intermediaries” (Mollick, 2014, 2). Similar definitions of crowdfunding are provided by Bartenberger and Leitner (2013), Lambert and Schwiembacher (2010) and Lehner (2013).

To investigate whether crowdfunding can indeed serve as a new, promising mechanism for financing environmental ventures, this paper explores the relationships between environmental orientation of crowdfunding projects and funding success. It provides empirical indication that the frequently expected positive relationship between environmental orientation of crowdfunding projects and their funding success cannot be taken for granted.

The following section presents an overview of the extant literature on crowdfunding and develops the research question of this paper (section 2). Section 3 describes the methods and the dataset used to address the research question. The results of the empirical analysis on crowdfunding for environmental ventures are presented in Section 4. Section 5 highlights the relevance of the findings, which are compared to previous research in this subject area. Finally, Section 6 draws conclusions and practical implications for crowdfunding in the context of environmental ventures based on the findings of this paper.

2. Literature review: theoretical foundations and research objective

Crowdfunding was first used for rather small-scale projects in the music and movie industry (Lambert and Schwiembacher, 2010). As time passed and popularity grew, ventures in other domains (e.g. conventional businesses, gaming, culture) started to make use of crowdfunding as well, and thus the scope of crowd-funded projects has increased. ‘Trampoline Systems’ is sometimes reported to be the first project which raised more than one million US-Dollars by crowdfunding (Lambert and Schwiembacher, 2010). Recently, the public debate on crowdfunding and sustainability has been fuelled by very successful crowdfunding initiatives, like the US American project ‘Solar Roadways’. ‘Solar Roadways’ aims at making solar panels for road- and path-construction ready for the market. The project funded US\$ 2.2 million (more than twice the targeted amount) from 48,473 supporters, making use of the online crowdfunding platform “Indiegogo.com”. In many countries,

crowdfunding is also receiving increasing political and legal attention. The most prominent example of legislation on crowdfunding can be found in the United States, where equity-based crowdfunding has been legalised by the JOBS act (Stemler, 2013).

Despite the increasing public attention, crowdfunding has just entered the academic debate (see e.g. Belleflamme et al., 2014; Mollick, 2014; Pitschner and Pitschner-Finn, 2014). Agrawal et al. (2010) as well as Mollick (2014) empirically analyse general characteristics of crowdfunders' behaviour and suggest that crowdfunders share many characteristics of professional, conventional investors, like rational decision making on the likelihood of success of a project. However, an important difference to conventional financing is that a small number of highly professional investors, such as banks or business angels who contribute large amounts to a project, are replaced by a high number of individuals who all contribute relatively small amounts of capital, but collectively they are able to finance even larger projects (Lehner, 2013).

In the literature, different models of crowdfunding are distinguished: Donation-based crowdfunding (aka the patronage model) can be regarded as the most traditional form of crowdfunding (Lehner, 2013; Mollick, 2014). With this model, funders do not receive any reward for their donations. As the demand and consequently the competition for such ‘free’ donations has risen, initiators have increasingly become challenged to provide funders with incentives to support their specific project. Therefore, in *passive investment crowdfunding*, funders receive some kind of reward for their support, which can range from honorary recognition to receiving the final product or service funded or even profit sharing (Lehner, 2013). Within this model, two sub-types of passive investment crowdfunding can be distinguished (Mollick, 2014): the lending model, i.e. funders receive monetary compensation for their support (i.e. profit-sharing); and the reward-based model, i.e. funders receive non-monetary compensations. According to Mollick (2014), the reward-based model is currently the most prevalent approach and is most frequently operationalised using a kind of pre-selling or pre-ordering of the final product (sometimes for a reduced price). As a third type, *active investment crowdfunding* (also known as equity crowdfunding) has emerged (Lehner, 2013; Mollick, 2014). Here, funders are treated in a similar way as conventional investors who receive shares or similar rights in return for their contribution. In addition, funders not only support the project financially, but sometimes also actively take part in further aspects of the project (e.g. proposing, designing or testing new features or products), which can help to improve the project's legitimacy. However, this third type is currently not frequently used, primarily due to legal concerns.

With regard to the possible functions of crowdfunding, most publications emphasise its potential being a source of financial capital and thereby concentrate on its role as seed capital for start-ups (e.g. Mollick, 2014; Schwiembacher and Larralde, 2012; Ward and Ramachandran, 2010). However, Lehner (2013) points out that crowdfunding can also be used by established businesses to finance growth and expansion activities.

Besides this primary role (i.e. financing ventures), crowdfunding can serve for multiple other purposes. Based on a conceptual framework developed from the existing literature, Lehner and Nicholls (2014) stress its legitimising function for corporate activities because crowdfunding is frequently perceived to be a more democratic form of financing. Additionally, crowdfunding can support the marketing activities of entrepreneurs, since it frequently attracts attention in the media and the general public, and thereby increases awareness of the funded products and services (Lambert and Schwiembacher, 2010; Mollick, 2014). Lastly, crowdfunding can be used to test and validate the market potential of commercial ideas (Belleflamme et al., 2014).

In a survey among 21 crowdfunding initiators, Lambert and Schwienbacher (2010) evaluated the relative importance of these different functions. They found the financing function to be the most important (assessed as highly relevant or relevant by 100% of the initiators), followed by the function to raise public awareness (85.7%) and product or service validation (57.1%). The legitimising function was not addressed in their survey.

Looking beyond the functions and possibilities of crowdfunding, some general limitations and problems associated with crowdfunding should not go overlooked. Lambert and Schwienbacher (2010) address the problem that those ventures especially attracted by crowdfunding might have already failed to receive funding from conventional sources, and thus potentially do not fulfil the criteria which are important for long-term entrepreneurial success. Particularly in this context, it seems problematic that currently no or only limited mechanisms exist which guarantee funders to actually receive the promised rewards (Mollick, 2014). Furthermore, some researchers challenge whether crowdfunding per se really is democratic (Lehner, 2013). In this context, it needs to be thematised that crowdfunding usually does not follow the 'one man one vote' principle, which is essential to modern democracies, but allows a stronger influence of wealthier actors. Lastly, the transaction costs of crowdfunding are obviously high and most likely higher than that of conventional sources of funding because funders need to put a lot of effort into gathering information on the project.

Among the existing research on crowdfunding, there are only very few quantitative studies conducted on a grand scale. Drawing on a survey among the initiators of 19 crowdfunding campaigns, Belleflamme et al. (2013) analyse the general characteristics of crowdfunding campaigns in a quantitative manner. In contrast, Mollick (2014) as well as Pitschner and Pitschner-Finn (2014) use data provided by crowdfunding platforms. Concerning the drivers of success of crowdfunding campaigns, several authors hypothesize that non-profit-oriented campaigns tend to be more successful than profit-oriented campaigns (Belleflamme et al., 2013; Pitschner and Pitschner-Finn, 2014). This assumption is derived from contract failure theory (Chillemi and Gui, 1991; Glaeser and Shleifer, 2001), which expects that non-profit organisations are more effective in acquiring contributions for activities that are of interest for the general public. According to contract failure theory, non-profit organisations have an advantage in this context, as non-profit orientation signals a reduced focus on maximising profits and a stronger focus on the quality of the outcome. The empirical findings by Belleflamme et al. (2013) as well as by Pitschner and Pitschner-Finn (2014) confirm these assumptions as they highlight that non-profit oriented crowdfunding initiatives are on average more successful than profit oriented projects.

The empirical results of Mollick (2014) analysis document the important influence of the size of the social networks the campaign initiators can make use of as well as of the signalled quality of the funding project on its funding success. Additionally, Mollick (2014) finds that successful crowdfunding projects usually succeed by a very small margin (i.e. the targeted amount is reached but not exceeded by a large share), whereas unsuccessful projects usually do not even come close to their targeted amount. Even though on most platforms no control and punishment mechanisms exist for the case that the initiators of successful projects do not provide the contributors with the promised reward (in case of passive investment crowdfunding; cf. Lehner, 2013), Mollick (2014) finds that 96.5% of all projects indeed deliver the promised reward. However, delivery is delayed in most cases (Mollick, 2014).

The influence of environmental orientation on successful outcomes of crowding projects has not been dealt with in any of the existing quantitative analyses. Generally, only very little research is

conducted on the connections of sustainability and crowdfunding (for exceptions see Bartenberger and Leitner, 2013; Lehner, 2013). This may appear surprising, given that numerous academics agree that further sources of funding for environmentally oriented ventures are needed (cf. Ciccozzi et al., 2003; Huhtala, 2003; Ortas et al., 2013; Painuly et al., 2003), and highlight that additional research is necessary in this field (Wüstenhagen et al., 2008).

Consequently, Lehner (2013, 1) states that "the context of social ventures has remained largely unexplored" in the context of crowdfunding.¹ He specifies that it is necessary to analyse the functions, influential factors and implications of crowdfunding in the context of social entrepreneurship in order to be able to better understand the behaviour of the crowd. These suggestions can help to use the potential of crowdfunding in the context of environmental ventures more comprehensively (Lehner, 2013). Due to the scarce literature on these types of crowdfunding, other authors highlight that generally more research on crowdfunding and specifically on potential factors influencing the success of crowdfunding campaigns is needed (Bartenberger and Leitner, 2013; Mollick, 2014).

As the empirical literature does not investigate the relationship between environmental orientation and crowdfunding success, it is particularly worth to examine the conceptual studies in the field and to apply existing theories in the context of crowdfunding for environmental ventures. The vast majority of the conceptual literature generally expects a positive influence of sustainability orientation on the likelihood of success of crowdfunding campaigns. Lehner (2013, 2) reasons this expectation by stating that "crowd investors typically do not look much at collaterals or business plans, but at the ideas and core values of the firm". With reference to Belleflamme et al. (2014), Drury and Stott (2011) and Rubinton (2011), Lehner (2013, 6) furthermore assumes that "the crowd will thus select the social ideas it deems worthy and needed", while monetary incentives or any other rewards are expected to be less important (Lehner, 2013). Hemer (2011) as well as Ibrahim and Verliyantina (2012) even regard crowdfunding an "established way to fund social and/or not-for-profit projects" (Ibrahim and Verliyantina, 2012, 391). Similar statements can be found in Bartenberger and Leitner (2013, 81) who emphasize the huge potential of crowdfunding "to contribute to forms of economic growth that also address social and environmental needs".

Mollick (2014) makes use of information economics and the Matthew Effect (Merton, 1957) as theoretical underpinnings in the context of crowdfunding. He identifies the nature of the project, and most importantly, its quality as the major drivers of success for crowdfunding campaigns. Mollick (2014, 6) assumes that if these factors are indeed dominant, crowdfunding are likely to act similar to conventional financiers as they "evaluate the quality of the product, the team, and the likelihood of success". According to the Matthew Effect (Merton, 1957), quality signals are multiplied in contexts such as crowdfunding because high quality will attract such funders who are able to signal the quality of the project to further funders or might even attract media attention (Mollick, 2014). Applying these elements derived from information economics and the Matthew Effect to this paper, it can be expected that other variables (i.e. mainly the signalled quality of the project) will be more important for the project's funding success than environmental orientation.

¹ Lehner (2013, 2) defines social ventures and social entrepreneurship in a way that explicitly includes environmental ventures as well: "As for a definition of social entrepreneurship, the author addresses all kinds of ventures that have a social or environmental mission as their primal goal, which aim to be financially and legally independent and strive to become self-sustainable by means of the market."

Alternatively, rational choice theory and considerations on collective goods (Blume and Easley, 2008; Sen, 2008; Vriend, 1996) can be used as a theoretical underpinning to investigate the relationship between environmental orientation and crowdfunding success. As stated by several authors (e.g. Geels, 2011; Perman et al., 2003; Wagner, 2011), many aspects of environmental protection are collective goods (sometimes also called public goods). Collective goods differ from conventional goods (i.e. pure private goods), since they are non-excludable and non-rival in consumption. From a rational choice perspective, crowdfunders will be less likely to invest in crowdfunding projects with collective goods as outcomes, because the benefits of such projects will also be available to those who did not contribute to the project. This would imply that crowdfunders share many characteristics of conventional financiers, and in general they would rather be interested in their individual benefits than in supporting a public good. Consequently, following a rational choice perspective, environmental orientation of crowdfunding campaigns can be expected to have a negative effect on their likelihood of success if the project focuses on creating public goods.

As stated above, none of the existing empirical studies deals with the influence of environmental orientation on crowdfunding success. Therefore, based on current research, the three theoretical considerations hypothesising (a) a positive connection between environmental orientation and crowdfunding (cf. Bartenberger and Leitner, 2013; Lehner, 2013), (b) no connection (cf. Merton, 1957; Mollick, 2014) or (c) a negative connection between the two concepts (cf. Blume and Easley, 2008; Sen, 2008; Vriend, 1996) cannot be assessed. To address the research gap, this paper deals with the following research question:

How does environmental orientation of crowdfunding projects influence their likelihood of successful funding?

Hereby, the success of crowdfunding projects is understood as their capability to acquire the capital needed to realise the respective project. This research contributes to the existing literature by offering potential theoretical underpinnings for the existing conceptual works as well as by conducting a first empirical test of the different theoretical explanations. Therefore, this research can help to better assess the potential crowdfunding has in financing environmental ventures and provides insights into how this potential can be comprehensively used.

3. Material and methods

This paper builds on existing conceptual and early empirical work by exploring the relationship between environmental orientation of crowdfunding projects and their likelihood of success. As crowdfunding can be considered an emergent topic in the evolving field of sustainable entrepreneurship, such an exploratory approach seems most promising in order to develop initial empirical insights on the relationship between environmental orientation and crowdfunding, and to identify and structure potential for further research (cf. Mollick, 2014).

The statistical analysis builds on a dataset of crowdfunding projects taken from Indiegogo.com. Indiegogo.com was chosen as it is one of the largest crowdfunding platforms worldwide. Unlike other platforms, it is neither restricted to projects with a fixed funding target nor restricted to funders from the United States, which extends the applicability of the results of this research (cf. Mollick, 2014). The dataset contains all projects on Indiegogo.com, which ended in the period between 15th and 22nd of June 2014. The sample includes 585 crowdfunding campaigns. However, two campaigns had to be deleted from the final dataset, because their project pages on Indiegogo.com were deleted immediately after the end date of the campaign, so not all relevant information could be

Table 1
Descriptive characteristics of the dataset.

Characteristic	Result
Number of projects (n)	583
Share of verified non-profit campaigns	12.7%
Share of fixed funding targets	5.7%
Share of projects with rewards	89.2%
Average funding target (mean)	US\$ 310,032
Median funding target	US\$ 6900
Category	Number of projects
Film	98
Community	95
Music	62
Education	52
Small Business	32
Health	30
Art	29
Theatre	29
Technology	22
Dance	20
Sports	18
Writing	14
Video/Web	13
Other (Religion, Politics, Transmedia) ^a	11
Animals	10
Environment	10
Food	10
Fashion	9
Gaming	7
Design	6
Photography	6

^a Due to a small number of cases, the categories Politics (4), Religion (3) and Transmedia (3) were merged to one single category ("Other").

gathered. The basic characteristics of the final dataset are displayed in [Table 1](#).

Drawing on earlier research, two different measures were used to capture the success of crowdfunding initiatives for the descriptive analysis (Lambert and Schwienbacher, 2010; Mollick, 2014; Pitschner and Pitschner-Finn, 2014). First, success can be defined as reaching the funding goal set by the initiators of the crowdfunding campaign. On Indiegogo.com, like on most other platforms, the initiators a priori define a target amount they need for realising their projects. Following Pitschner and Pitschner-Finn (2014), a project can be coded as "successful" if the target amount defined by the initiators is reached and as "unsuccessful" if the project fails to fund the targeted amount. For this purpose, a dummy variable was set up differentiating successful from unsuccessful projects. Second, to analyse the extent to which the target amount has been exceeded or missed, a quotient was set up, dividing the actual funding amount by the a priori set target. As noted in the literature review, Mollick (2014) found crowdfunding projects to either succeed by a very small margin or to fail by a relatively large margin. Therefore, it can be expected that the success of crowdfunding projects is captured quite well using the dummy variable differentiating successful from unsuccessful projects.

In the second step of the analysis, the dummy variable on funding success was used to estimate the following binary logistic regression model (cf. Lourenco and Branco, 2013; Menard, 1995):

$$P(Y_i = 1) = \frac{1}{1 + e^{-(\alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i})}}$$

where e represents the exponential. Successful projects are coded as $Y = 1$ whereas unsuccessful projects are coded as $Y = 0$ and

$$\begin{aligned} x_1 &= \text{ENV}; \\ x_2 &= \text{NP}; \end{aligned}$$

$x_3 = \text{LnTarget}$;
 $x_4 = \text{FILM}$;
 $x_5 = \text{DURATION}$;
 $x_6 = \text{REWARD}$;
 $x_7 = \text{FIXED}$.

The independent variables were derived from the project characteristics provided on Indiegogo.com and are defined as follows: On Indiegogo.com, the funders need to group their projects into one of 23 categories (see [Table 1](#)), one of these categories being environmentally oriented projects. This information was used to distinguish projects which are initiated and marketed as primarily environmentally oriented [ENV = 1] from projects focusing on other aspects [ENV = 0]. A list including all environmentally oriented projects can be found in the [appendix](#).

In addition to environmental orientation, multiple control variables were included in the analysis because earlier research demonstrates their influence on the success of crowdfunding initiatives: First, campaigns which were tagged as officially approved non-profit campaigns on indiegogo.com [NP = 1] were distinguished from conventional campaigns [NP = 0] (cf. [Belleflamme et al., 2014](#); [Mollick, 2014](#); [Pitschner and Pitschner-Finn, 2014](#)). Second, it can be expected that campaigns with higher targeted funding amounts will be less likely to reach these higher targets.

Therefore, the target level was included as another control variable. As normal distribution of this variable and of its error terms could not be confirmed using histograms and QQ-plots, the variable was logarithmised to reach normal distribution [LnTarget]. Third, with reference to [Mollick \(2014\)](#), the existence of a video which presents the project on Indiegogo.com [FILM = 1] was used as a proxy for project quality, since shooting a film requires the investment of time and other resources. Fourth, it can be found that the duration of projects on Indiegogo.com varies broadly. As short durations are likely to negatively affect probability of success of crowdfunding projects, the duration of the funding phase was included as a control variable [DURATION]. Fifth, crowdfunding projects may hold out the prospect of receiving rewards for funders, which can range from honorary recognition to receiving an actual product (cf. [Lehner, 2013](#); [Mollick, 2014](#)). To differentiate projects which offer rewards [REWARD = 1] from projects without rewards [REWARD = 0], an additional control variable was set up. Lastly, the initiators of campaigns can decide to set either a fixed target amount [FIXED = 1] or a flexible target amount [FIXED = 0]. In the former case, the initiators will only receive the funds in case the targeted amount is reached. If less than the targeted amount is reached, the initiators do not receive any of the funds but the funds will be paid back to the contributors. In contrast, with flexible targets the funders receive the funded amount regardless of the

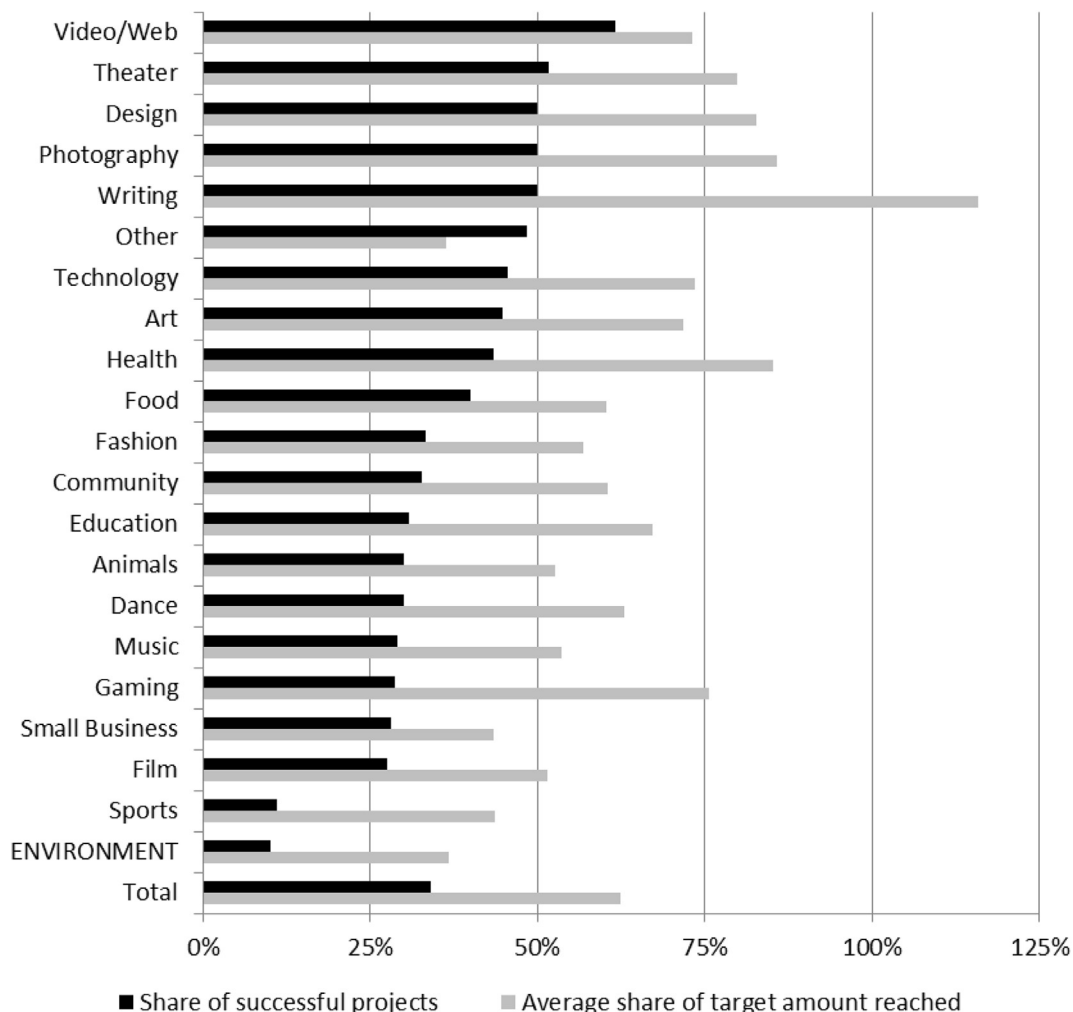


Fig. 1. Crowdfunding success by project category.

outcome of the campaign. As the logic behind both mechanisms (i.e. fixed vs. flexible funding) differs substantially, a dummy variable is used to differentiate these cases.

The following section will display descriptive and inferential results on the variables described above.

4. Results

As a first step of analysis, the different categories of crowdfunding projects were compared descriptively with regard to funding success. Fig. 1 highlights that environmentally oriented projects achieve the lowest values for both indicators of success: Whereas on average 34.0% of all crowdfunding projects included in the dataset achieved their funding targets, only 10.0% of the environmentally oriented projects were found to be successful. Similarly, environmentally oriented projects on average funded 36.7% of their respective target amount. In the full sample, the average share of the target amount achieved is nearly twice as high (62.4%). The highest share of successful projects can be found in the category 'video/web' (73.1%) and the highest average share of the target amount achieved can be found for projects in the category writing, which fund on average 115.8% of the targeted amount.

To test whether these descriptive differences can be confirmed using inferential statistics and to investigate the effects of other possible influencing factors, the binary logistic regression described in section 3 was performed (Table 2). For this analysis, the dummy variable differentiating projects that reached the funding target from projects that did not reach the funding target was used as the dependent variable. The analysis thereby investigates which factors foster the likelihood of achieving the self-set funding target.

The model is found to be significant ($p < 0.01$) and it explains a relevant share of the variation of the dependent variable (Nagelkerke's Pseudo $R^2 = 0.213$). The low values for the value inflation factors (VIF) indicate that no problems with regard to multicollinearity occur ($VIF_{\max} = 1.124$).

Table 2
Binary logistic regression.

Model summary		
	Dependent variable	Funding Success ^a
	Pseudo R^2 (Nagelkerke)	0.213
	Significance of the model	0.000
	VIF_{\max}	1.124
Test of likelihood quotients	Independent variable	Chi ²
	ENV	2.724*
	LnTarget	87.134***
	DURATION	3.931**
	FILM	7.678***
	NP	2.732*
	FIXED	4.353**
	REWARD	0.921
Parametric rating	Independent variable	B
	Constant term	3.460***
	ENV	-1.495
	LnTarget	-0.735***
	DURATION	0.012**
	FILM	0.639***
	NP	0.474*
	FIXED	0.884**
	REWARD	0.309

*** Significance level: 0.01.

** Significance level: 0.05.

* Significance level: 0.1.

^a Funding success is measured using the dummy variable, which differentiates projects that reach the funding target from projects that do not reach the funding target.

As can be seen from the test of likelihood ratio quotients, the targeted funding amount, the duration of the project, the existence of a film presenting the project and the dummy variable 'fixed funding' significantly influence the success of crowdfunding projects, with a probability of error of $p < 0.05$ or even $p < 0.01$. Similarly, for environmental orientation and non-profit status a significant influence can be observed, but only if a higher probability of error ($p < 0.1$) is accepted. In contrast, based on the dataset used for this analysis, no significant effect of rewards can be found.

Additionally, analysing the parameter estimates can serve to confirm these findings and to interpret the direction of the effects of the independent variables. The highly significant, negative regression coefficient for the logarithmised funding target reveals that, as expected, projects with higher funding targets are less likely to belong to the group of successful projects (-0.735^{***}). Similarly, the duration of the project is positively related to its likelihood of success (0.012^{**}), the existence of a film presenting the project on the project's website significantly increases the likelihood of reaching the funding target (0.583^{***}), and non-profit status is found to increase the likelihood of reaching the funding target (0.474^*). For environmental orientation, the results are less clear-cut, because the regression coefficient is not found to be significant, even though the test of likelihood quotients revealed an effect significant on the level of $p < 0.1$. However, according to Menard (1995), the test of likelihood quotients which showed a significant influence of environmental orientation ($p < 0.1$) is the most accurate test to examine the influence of single regressors in logistic regressions. Nevertheless, the results concerning environmental orientation should be interpreted with great care.

5. Discussion

Concerning non-profit orientation, this study reinforces the findings by Belleflamme et al. (2013) as well as by Pitschner and Pitschner-Finn (2014) that non-profit projects tend to be more successful in funding. The results on non-profit orientation also confirm conceptual propositions derived from contract failure theory (Belleflamme et al., 2013; Lehner, 2013). Furthermore, in line with intuition and an earlier analysis by Mollick (2014), the analysis finds that projects with higher funding targets are less likely to reach their funding targets. However, concerning the variable 'duration', the results of Mollick (2014) study were not confirmed by the analysis in this paper. While Mollick (2014) found the duration of crowdfunding projects to be negatively related to the success of crowdfunding campaigns, in this analysis a positive relationship is observed. This implies that if a project allows more time for the funding of the target amount, it is more likely to reach its funding aim. With regard to the funding mode (i.e. fixed versus flexible funding), the existence of a fixed funding target is found to positively influence the likelihood of reaching the funding goal.

So far, no prior quantitative studies have addressed the connections between the environmental orientation of crowdfunding projects and their likelihood of success. Earlier conceptual works suggest a positive relationship between environmental or sustainability orientation and the likelihood of success of crowdfunding projects (e.g. Bartenberger and Leitner, 2013; Hemer, 2011). However, a different picture emerges from the dataset analysed in this paper. In the regression analysis, no positive effect of environmental orientation could be observed. In contrast, it even provides initial indication that environmental orientation could negatively affect the success of crowdfunding projects. Similarly, the descriptive analysis reveals that environmentally oriented projects are less likely to reach their funding targets than any other category of projects analysed and achieve the lowest average share of the targeted amount. This finding may be surprising not only

because it contradicts earlier conceptual works, but it also challenges earlier empirical studies that assume crowdfunders to be more likely to be motivated by non-monetary values (Belleflamme et al., 2014; Drury and Scott, 2011). Apparently, environmentally oriented projects currently do not profit from these tendencies.

However, at the second glance, the fact that no positive influence of environmental orientation could be observed seems less surprising. As described in the literature review, rational choice theory expects individuals to be less likely to contribute to the creation of goods which are non-excludable and non-rival in consumption. Indeed, many environmentally oriented crowdfunding projects aim at such public goods which do not share the characteristics of excludability and rivalry (c.f. Geels, 2011; Perman et al., 2003; Wagner, 2011). Therefore, the arguments proposed by rational choice provide interesting potential reasons for the relatively low likelihood of success of environmentally oriented crowdfunding projects which create public goods and do not provide individual incentives to contribute to the project via crowdfunding. However, various studies and theories dealing with rational choice (e.g. bounded rationality; theory of planned behaviour) document that central assumptions of rational choice need to be questioned when compared to actual human behaviour (Fellner et al., 2009; Hines, 2009; Sparks and Shepherd, 2002). Therefore, it is worthwhile to address how these modifications and constraints of rational choice affect funding behaviour in the context of crowdfunding. In this regard, it is interesting to note that the analysis does not reveal a positive influence of rewards on the likelihood of successful funding. This finding suggests that it is probably not the mere existence of any reward that motivates funders to contribute. Instead, the quality of rewards might be more important. Indeed, if the different categories of crowdfunding projects included in Fig. 1 are compared, it becomes apparent that those categories tend to be most successful that create tangible outputs. The crowdfunding category 'video/web' for example shows the highest share of successful projects. The final product of these projects can easily be made accessible exclusively to those who provided funding. The dataset clearly backs this theoretical consideration, as all projects in the category 'video/web' provide rewards for their funders and all but one (i.e. 92%) of these projects promise to deliver a tangible reward which goes beyond honorary benefits. The highest average share of the target amount achieved can be observed for crowdfunding projects in the category 'writing'. Writing projects usually serve to provide an author with the living costs needed to write a book and guarantee the funders a free copy once the book has been released (93% of all writing projects indeed provide tangible rewards). These insights relate to earlier observations by Belleflamme et al. (2013), who found that crowdfunding initiatives which have a product as a final outcome are more successful in attracting capital than those with services as final outcomes. The authors explain this finding by the fact that "crowdfunders may be more tempted to provide money if they expect a tangible outcome" (Belleflamme et al., 2013, 18). This suggests that the initiators of crowdfunding projects are challenged to create tangible individual benefits for contributing to the project. In the reward-based model of crowdfunding, this suggestion has already been adopted since contributors receive rewards for their support (Mollick, 2014). However, the characteristics of these rewards vary from honorary recognition (e.g. the name of all supporters is published online) to receiving an actual product (e.g. a final copy of the book which is financed by the initiative). Consequently, depending on the characteristics of the project it may be more difficult for some projects to create a substantial reward. If, for example, the final outcome of the project is an overall improvement of the state of the natural environment, it is harder for the initiators of crowdfunding projects to create substantial, individual

rewards for contributors than in case the outcome is a tangible product (e.g. a book).

Based on rational choice theory and information economics (cf. Merton, 1957), the expectation was formulated in section 2 that financing via crowdfunding shares a lot of characteristics of conventional funding. In this case, characteristics other than environmental orientation, e. g. quality signals to potential investors, will be more important for funding success. The results of this study confirm this expectation as environmental orientation is found to be of only secondary importance for crowdfunding success. With reference to Mollick (2014), the existence of a video presenting the project was used as an indicator of project quality in this study. The significant positive effect of the variable 'FILM' confirms earlier findings by Mollick (2014), who also observes a significant positive effect of the existence of a film on the project's likelihood of success. Mollick (2014) concludes that as crowdfunders are led by such quality signals, they are likely to act similarly to conventional financiers.

Somehow related to this explanation for the relatively low rate of success of environmental projects, one could argue that the initiators of environmental crowdfunding projects lack the necessary business skills. Indeed, earlier analyses demonstrated that a background in business is relatively uncommon among persons engaging for sustainability and the natural environment (cf. Hesselbarth and Schaltegger, 2014). However, business skills might enable initiators of crowdfunding projects to more successfully communicate the quality of the project and to develop a market strategy which addresses a sufficiently large crowd (e.g. via advertising in social networks) and motivates this crowd to contribute to the respective project.

Two alternative explanations for the rather low likelihood of success of environmentally oriented crowdfunding projects can be found in the context of the donation-based model of crowdfunding (cf. Lehner, 2013). First, many supporters might perceive crowdfunding as a more democratic form of financing. Thus, supporting crowdfunding is per se regarded as serving the public (cf. Lehner, 2014). Therefore, the crowdfunders' desire for a "purchase of moral satisfaction" (Kahneman and Knetsch, 1992, 58) is served by supporting crowdfunding anyway, and it is not perceived necessary to support a crowdfunding project which contributes to a public good.

In contrast, if it is assumed that the majority of crowdfunders wishes to support a charitable purpose, it is important to investigate which characteristics qualify a project to be considered as charitable. Interestingly, in the United States, where most of the crowdfunding projects included in this dataset are based, environmental orientation is not considered an exempt purpose by the IRS (Internal Revenue Service) (Whitman, 2011). This might impede environmentally oriented initiatives from qualifying for tax exemptions and from being officially recognised as charitable projects. While it can be doubted that the fact that environmental orientation is not officially considered an exempt purpose directly influences crowdfunders' willingness to support a project, it can be regarded as a sign that environmental purposes are generally less commonly considered worth contributing to than other projects which aim at a public good.

6. Conclusions and implications

In contradistinction to the expectations formulated in the early conceptual literature, this research found that environmental orientation of crowdfunding projects currently cannot be observed to be positively related to the success of crowdfunding projects. However, conceptual works (e.g. Bartenberger and Leitner, 2013; Lehner, 2013) consistently elaborated that potential for

crowdfunding in the context of sustainable entrepreneurship exists. Furthermore, examples of successful environmentally oriented crowdfunding projects, such as ‘Solar Roadways’ or ‘The Age of Stupid’, a drama-documentary on climate change, practically demonstrated the huge potential for crowdfunding in the context of sustainability. Yet, only very few existing environmentally oriented crowdfunding projects seem to make use of the opportunities connected with crowdfunding. Based on the analysis presented above, some practical implications can be derived which might help to fully release the potential of crowdfunding for environmental ventures:

First, a comparison of the different categories of crowdfunding projects on Indiegogo.com suggests that projects in categories which facilitate creating a tangible outcome (e.g. books, videos) are more likely to achieve their funding aim. Therefore, environmental entrepreneurs who wish to make use of crowdfunding are challenged to strategically search for opportunities which create such tangible outcomes. With regard to this challenge equity-based crowdfunding can serve as an additional strategic option. Equity crowdfunding might provide environmental entrepreneurs whose projects do not aim at creating a product or service for end consumers with a valuable alternative to the reward-based model of crowdfunding, which frequently gives advantage to projects which create a product that can be pre-ordered by the funders.

Secondly, the analysis confirms that projects with an officially recognised non-profit status tend to be more successful. Therefore, environmental entrepreneurs who follow a non-profit approach should make use of this advantage by officially registering as non-profit-oriented. Transferring these insights to environmental orientation, the analysis suggests that it might be insufficient to only claim environmental orientation. Instead, the project coordinators are challenged to provide potential funders with a verification which confirms that the project is indeed charitable. The status of being a verified non-profit organisation seems to be able to provide such a proof. However, other signals or verifications (such as labels or the formal support by recognised environmental organisations) might embody similar effects.

Lastly, like all other crowdfunding initiatives, environmentally oriented projects need to take the general success factors of crowdfunding into account. The analysis confirmed that initiators of crowdfunding projects should be modest about their funding targets, since lower targets are more likely to be met. Therefore, if a venture requires a specific amount and cannot be realised with a smaller amount anyway, the initiators should make use of the benefits coming along with fixed funding targets. Furthermore, they need to take into account that crowdfunding takes time and thus should allow sufficiently long durations for their crowdfunding projects. Finally, initiators need to signal the quality of their projects to potential funders, e.g. in form of a professional video. As suggested in the discussion, many environmentally oriented crowdfunding projects currently seem to not sufficiently consider these factors and might thus fail to consequently use the potential of crowdfunding for environmental ventures.

From a political perspective, the findings on non-profit orientation suggest that the success of environmentally oriented projects could be supported, at least in the United States, if environmental protection was recognised by the IRS as tax exempt activity, which would qualify for the status as a charity organisation. Furthermore, a higher political engagement for environmental issues such as climate change would raise the general awareness for environmental issues. This might signal potential funders the societal importance of environmental challenges and increase their disposition to support environmentally oriented crowdfunding initiatives.

Next, to improve the currently low likelihood of success of environmentally oriented crowdfunding campaigns, it can be argued that a specialised platform would increase their likelihood of success. In this context, [Bartenberger and Leitner \(2013, 83\)](#) find the existing platforms to be “too one-dimensional and small-scaled to facilitate social innovation processes sufficiently”. They criticise purely entrepreneurial platforms for their insufficiently recognising the potential of entrepreneurship in addressing societal problems. From their point of view, on conventional crowdfunding platforms (e.g. Indiegogo.com, [Kickstarter](http://Kickstarter.com)) “social ventures tend to be hidden within the vast number of other unrelated projects” ([Bartenberger and Leitner, 2013, 83](#)). This insight can be easily transferred to the present analysis on environmentally oriented crowdfunding projects, as these only make up a very small portion of all projects on crowdfunding platforms. Combining the findings by [Bartenberger and Leitner \(2013\)](#) with the insights gained by this analysis, a new crowdfunding platform specialised in funding environmental ventures might help to better use the potential of crowdfunding for environmental entrepreneurship. In Austria, the crowdfunding platform Greenrocket.at specialises on funding sustainable start-ups. In Germany, a similar project, Ecocrowd.de, was started in 2014. To guarantee that each project on Ecocrowd.de has a clear link to sustainable development, all suggested projects are checked and consulted by the German Federal Environmental Foundation. The future development of Ecocrowd.de and Greenrocket.at will show the extent to which such specialised platforms are able to mobilise the potential of crowdfunding for the environment.

Based on the finding that currently, environmental ventures are rather disadvantaged than privileged in crowdfunding, the importance of other forms of financing environmental ventures needs to be highlighted. In parallel to the rise of crowdfunding, specialised banks and credit institutions which support ventures with societal benefits have gained increasing attention. In the developing world, [Kiva](#) and the [Grameen Bank](#) are probably the most prominent examples of such organisations. With [Triodos](#) or the [GLS Bank](#) in several European countries, banks specialised in funding social and environmental ventures have gained importance. Besides, several venture capital funds have emerged, which are dedicated to supporting environmental and social ventures.

To sum up, this paper does not neglect the potential of crowdfunding for environmental ventures, but highlights that this potential is currently not sufficiently used. To better mobilise the potential of crowdfunding, practical implications for environmentally oriented entrepreneurs as well as for politics were formulated.

However, this research also comes along with some limitations, which should be addressed by future research. First, the datasets used for this research include only a small number of environmentally oriented projects. Further research should validate the initial indications gained by this research by building on larger datasets using automatic data collection or building on datasets provided by the crowdfunding platforms.

Second, the dataset is nearly completely restricted to reward-based crowdfunding or passive investment crowdfunding (89.5%). Even though this type of crowdfunding is empirically the most important form ([Mollick, 2014](#)), future research should address whether other patterns concerning environmental orientation can be observed if the sample is restricted to other types of crowdfunding such as equity-based crowdfunding or donations-based crowdfunding. Similarly, the dataset includes a very high share of US-based projects (88.2%). This might provide some explanation for the fact that environmental orientation does not positively influence the likelihood of success as some of the possible explanations are especially true for the US. Further research should therefore specifically address the effect of environmental orientation of

crowdfunding projects in different economic, cultural and political settings.

Third, it could be argued that not all crowdfunding initiatives explicitly aim at entrepreneurship. This problem obviously affects most of the publications on crowdfunding in the entrepreneurial context. However, crowdfunding projects are clearly ventures which seek for financial independence and therefore share many characteristics of entrepreneurial activities.

Besides overcoming these limitations, future research is challenged to investigate which factors distinguish the relatively few successful environmentally oriented crowdfunding projects from the vast majority of environmental projects which fail to achieve their funding targets. In this context, comparative case studies seem to be a promising approach. For quantitative researchers, the question remains unsolved which of the identified possible explanations is most relevant for the relatively low likelihood of success of environmental crowdfunding projects. Therefore, quantitative analyses on the effects of rewards, verifications of environmental orientation and the business skills of crowdfunding initiators are needed to evaluate the importance of these obstacles and to finally overcome the barriers for financing environmentally oriented ventures.

Together with the analysis at hand, these future endeavours could help to fully release the potential of crowdfunding in the context of environmental entrepreneurship and contribute to financing ventures which support sustainable development. Hereby, this exploratory paper should rather serve as a starting point for an academic discussion on the relationship between crowdfunding and environmental entrepreneurship than as a final answer to the debate.

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Appendix

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Name of the crowdfunding initiative	Short description/Aims
"GreenRider: the social game for fuel conservation savings"	Development of an app to change car-driving habits in order to reduce fuel consumption.
"Help us install solar electric systems at high-impact community organizations. Let's pave the way for clean energy TODAY!"	Installation of solar electric systems on buildings of community organizations to fight global warming and create savings for community organizations.
"CRPE's Fight to Help the Village of Kivalina, Alaska"	Awareness-raising about climate change based on the example of an island community in Alaska.
"Turning the Tide with the Deschutes Estuary Restoration Team"	Improving the environmental conditions of an estuary and providing people with the concomitant benefits.
"Help Me On My Journey To Travel This Beautiful World"	Financial support of a journey to a native village in Costa Rica in order to assist in the construction of a village school and in the coffee harvest as well as working with local children.
"Support the Coggins Conservation Project"	Preservation of a farm for conservation purposes (e.g. keeping a valuable ecosystem intact).
"Gulf Wild: For Seafood Conservation"	Protecting the Gulf of Mexico and reducing the amount of bycatch.
"Capt. Charles Moore's ORV Alguita to go on July & August 2014 Expedition!"	Research trip to the "Great Pacific Garbage Patch"
"JAMAICA'S MARITIME WATERS"	Funding research on food security and protection of species in the Caribbean ocean.
"YOU can help to promote solutions that overcome global water and food challenges"	Helps existing projects connected to global water and food challenges to grow.

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