Towards new framework for modelling project selection in crowdfunding platforms

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Towards new Framework for Modelling Project Selection in Crowdfunding platforms

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Abstract. Crowdfunding is a form of public funding via the internet to the entrepreneurs. The crowdfunding covers various models that range from simple donations to risky investments. The aim of this paper is to introduce a new framework for modeling project selection in crowdfunding platform using two artificial intelligence approaches: fuzzy logic and agent-based simulation. We propose a new model based on both donation and interest-free lending and we compare its performance with a pure donation.

Keywords: Agent based modelling and simulation · Fuzzy logic· Donation based crowdfunding· NetLogo

1 Introduction

New entrepreneurs have difficulties attracting external funding during their initial stage through classical means such as bank. or equity capital [9] [6] [4].

As such many enterprises are unfunded because of no successful attempts to attract enough funds [26] [17] [14] [8][5].

To mitigate against this problem , crowdfunding was a new source that relies on the power of the crowd in collecting funds. In the case of crowdfunding, the objective is to collect money for investment, generally by using online social networks. In other words, instead of raising money from a small group of sophisticated investors, crowdfunding helps firms obtain money from large audiences (the "crowd"), in which each individual provides a very small amount. 1).

Crowdfunding is rooted in crowdsourcing [18] [15] [3]. The latter relies on the collection of ideas feedbacks, solutions to develop business operations. this makes them non-reliant on single source of funding(Fig. 1)

The form of crowdfunding can take many form equity purchase, loan, donation, or pre-ordering of the product [1] [2][19] [22]

In our case we will focus on developing a new model that combines donations-based crowdfunding and lending based crowdfunding. We will compare our model with a purely donation-based model in terms of the success rate. Despite the fact

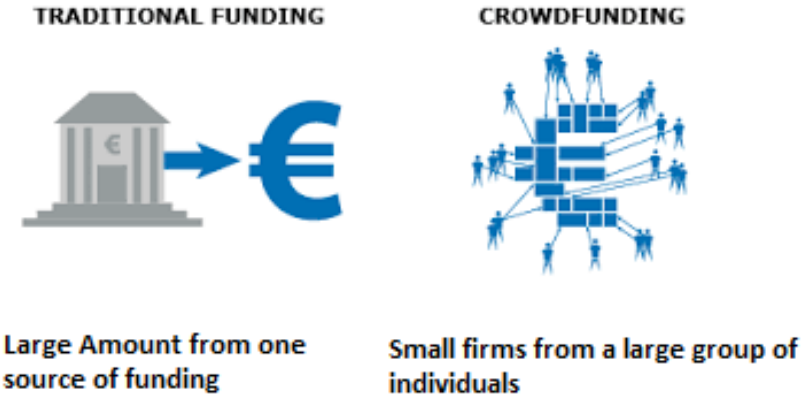

Fig. 1. The Crowdfunding business model

that here are many success measures for a crowdfunding platform (please see [27], [7] [20] [11] [12][28][25][7]) for a comprehensive success measure literature), we focus on using the success rate as the percentage of entrepreneurs who have applied for crowdfunding and managed to be successful in getting their required funds. The remaining of this paper is organized as follows: in the next section we present the development process of an agent based model, the section three introduces the proposed model, the section four shows some results of the study, last but not least the section five provides a conclusion and some perspectives.

2 The development process of an agent based model

An Agent based model, as the name indicates, relies on computer simulation that is based on agents interacting with autonomous decision making and behavioural rules [29] [13]. For instance, our model has entrepreneurs as agents who have properties such as "project", "wealth" and "productivity" as well as decision making process to select a new project. Macal et al.[21] emphasize that the main feature of an agent is its ability to make independent decisions that can range from simple rules to complex adaptive ones.

ABM can be a useful choice when the problem under investigation relies on autonomous and heterogeneous entities (agents) evolving over time and when both their micro-level behaviour and the result of their interactions (macro-level patterns) are of interest [29] [13][24]. The ABM is best suited when the interaction between agents is nonlinear; such agents can learn from their previous experiences and adapt their strategies.

Steps in the development of an ABM To ensure the robustness of the outcome from an Agent-Based Model it is necessary to ensure that certain fundamental steps (Fig. 2) are adhered to:

1. Design the mode
2. Implement the model
3. Validate and verify the model [31][10]
4. Use model as a decision making tool

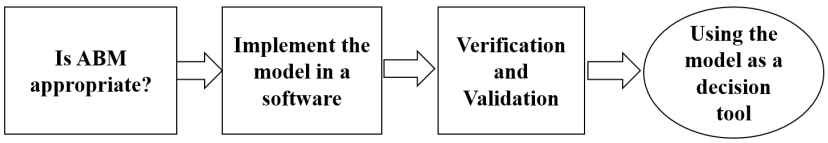

Fig. 2. The ABM Process

Why Fuzzy logic? Fuzzy logic can help translating linguistic information into an artificial language.[30]. This can help for example in evaluation how good or bad is a situation in a numerical format [23]. Fuzzy logic is also a very good useful method to be combined with [16] agent-based models with artificial agents.

The donor decision of whether to select a project or not and, hence, give donation is subject to a number of factors that the donor considers before deciding on the quality (eg. Very Good, Good, Bad) of a project. This creates an interference of thoughts in the donor's mind. Therefore, this creates an ideal environment for treating the donor's decision in a fuzzy framework [23]. Even more, a fuzzy framework is very useful in building an agent-based model through fuzzy rules[16].

Hence, To decide whether to give donation or not, a donor (agent) is equipped with a Fuzzy Inference System (FIS) (Fig. 4). The donor makes a decision based on the entrepreneurs' Specific characteristics: (1) their proximity (geographic, family, friends...), (2) the quality of information about them and their projects, and (3) the expected project's social return. When accessing the platform, a donor gives a score to each entrepreneur and then selects the one with the highest score to be awarded the donation.

3 The Model

Our model relies on combining two artificial intelligence approaches : Agent based simulation and Fuzzy logic. The figure below presents the steps in developing the model:

3.1 Selecting project and giving donations

In this study, to decide whether to give donation or not, a donor (agent) is equipped with a fuzzy inference system(Fig.4). The donor makes a decision based

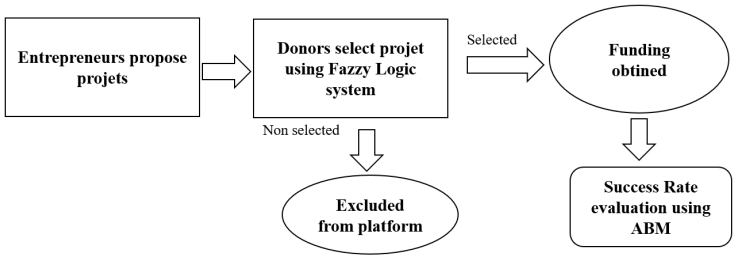

Fig. 3. Flowshart for the crowdfunding Model

on the entrepreneurs' characteristics, precisely, their proximity (geographic, family, friends...), the quality of information about them and their projects, as well as the social return perceived from their projects. When he/she accesses to the platform, a donor gives a score to each entrepreneur and then selects the one with the higher score to give him a donation.

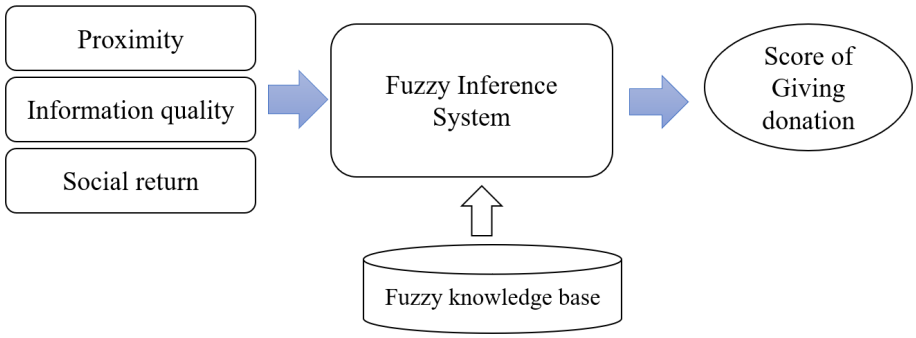

Fig. 4. Donors' decision-making system

The description and the shapes of the different membership functions (MFs) used in the simulation are described as follows:

Table 1. The membership functions description

Factors	MF 1	MF 2	MF 3	shape
Proximitys	Neutral	Close	NA	Guassian
Social Return	Low	Medium	High	Gaussian
Information Quality	Weak	Medium	High	Gaussian
Giving Donation	Likely	2 Unlikely	NA	Gaussian

4 Simulation

We want to compare two models:

- Model 1: This is our proposed model. Donors donate funds to the Crowdfunding platform based on selected projects prospects. The Crowdfunding platform, in turn, channels the fund via an interest free loan, to the entrepreneurs
- Model 2: This is a standard Donation-based crowdfunding without any loan obligation to the entrepreneur. i.e. funds are channelled to the entrepreneur free of any loan obligations.

we simulate the results in an agent based simulation tool :NetLogo's BehaviorSpace version tool (version 5.3.1)[4]

In each scenario, the model runs for 6 years and with 10 different random seeds (experiments). then we compare the success rate of both models in terms of their ability to secure funding.

To insure fairness in comparing the two models integrity, both models' simulations run under the same parameters. The only difference between the two is the (loan obligation) making model 1 distinguishable from Model2:

Table 2. Model's 1 and 2 characteristics

Models Characterestics	Model 1	Model 2
Number of entrepreneurs	10	10
Required Fund	15000	15000
Funding period	2 months	2 months
Number of donors per day	5	5
Donation Mean	250	250
Simulation horizon	6 years	6 years
Loan obligation	Yes (interst free loan)	No

Table 3. Model's 1 and 2 characteristics

Models Characterestics	Model 1	Model 2
Success Rate	47.85	35.68

Running the experiment for 10 simulations and getting the median we get the success rate of each model:

[4] NetLogo is a multi-agent programmable modelling environment. It is used by many tens of thousands of students, teachers and researchers worldwide. It also powers HubNet participatory simulations. It is authored by Uri Wilensky and developed at the CCL. You can download it free of charge. You can also try it online through NetLogo Web : https://ccl.northwestern.edu/netlogo/

The following two figures show the two models success rate for the 10th experiment. the last experiemnt shows almost 50% success arte while the scond model shows a 35% success rate

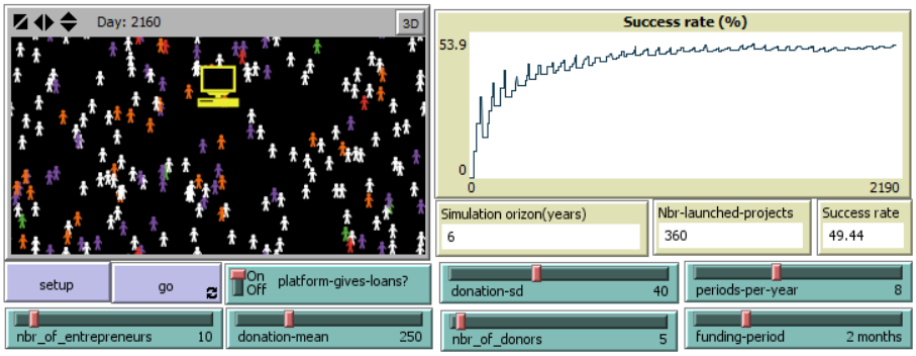

Fig. 5. The success rate according to the proposed model

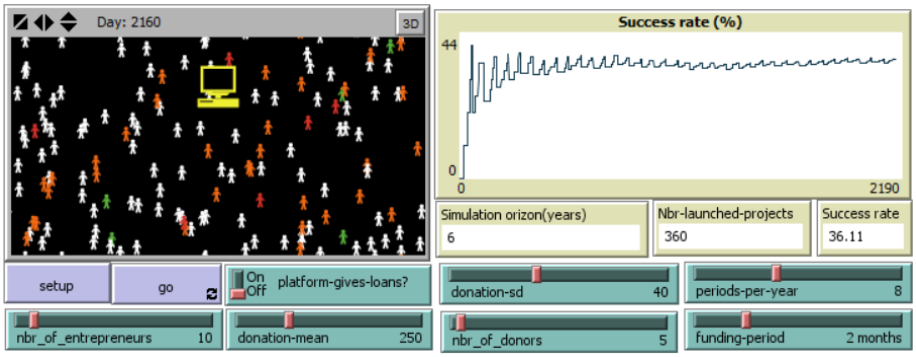

Fig. 6. The success rate according to the pure donation based model

We can notice that our model performs better in terms of securing funding to a large portion of entrepreneurs who have applied for the funding.

5 Conclusion and perspectives

Our paper tried to propose a combined model of donation and lending based crowdfunding and compare it to a pure donation based funding. We used fuzzy logic for the donor to make selection decision and used ABM to evaluate the success rate of the model in securing more funding. We found simulation evidence

that if donation is combined with a lending scheme, it can lead to an improved rate of funding and therefore enlarging the number of enterprises. The proposed model can be extended to include neighbours' effect (i.e. herding behaviour) between donors in project selection.

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