A new perspective of innovation-driven agricultural sustainable development: a case of China

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Abstract. The experience of many countries shows that the agriculture relying on factors input is unsustainable and technological innovation is the support for improving productivity and comprehensive strength. In the critical period of transformation and upgrading, China's launch of an innovation-driven development strategy which is an inherent demand for the sustainable development of multiple industries, including agriculture. Among the entities undertaking this task, innovation-driven agricultural subjects are an important carrier. However, due to the inherent limitations and high risks of technological innovation, they are subject to strong constraints under the traditional model. In order to solve this bottleneck, innovation-driven agricultural subjects have a strong desire to seek innovation channels, and agricultural crowdfunding mode meets their requirements.

1. Introduction
Innovation-driving can be viewed as a rational resource allocation mode in which knowledge, technology, regulation, management, and other innovative elements are the main driving forces for development. It is a strategic option different from traditional elements-driving [1], and its essence is to rely on independent innovation to improve the science and technology's contribution rate to the agriculture. At present, innovation-driven agricultural subjects have become a significant power in technological innovation but their intrinsic limitations make them have to suffer many restrictions under traditional mode [2]. However, agricultural crowdfunding provides an alternative way to solve this problem.

Crowdfunding derives from micro credit [3] and crowdsourcing [4],[5], the main purpose is to seek resources from the public to provide innovation-driven agricultural subjects the capital or other resources to launch the project [6]. This mode does not require the innovation-driven agricultural subjects any mortgage or guarantee, just need to publicly display the project on the agricultural crowdfunding platform website and then get the resources including technology and capital supports from the public who accept this project [7].

Will financing constrains curb innovation? To what extent can crowdfunding help innovation-driven agricultural subjects to solve the restriction? Which factors will influence these innovation-driven agricultural subjects to successfully crowdfunding? Existing researches have discussed more about that financing restriction inhibits innovation, Bi, etc. found that quality signal
and electronic word-of-mouth have a significant positive impact on resource suppliers’ investment decision-making [8]. Li et al., [9] reached similar conclusion regarding Chinese innovation-driven agricultural subjects they found that improving the reputation of products, strengthening the promotion of activities, and diversification of incentive schemes can increase the expectations of the crowd. On the other hand, some scholars make clear that innovation-driven agricultural subjects can exchange human and material resources through Internet platform and provide access services on Internet platform [10], but quantitative research is relatively lack and crowdfunding’s risk still need to discuss [11]. According to the above problem, this article mainly discusses how innovation-driven agricultural subjects can acquire necessary resources for sustainable agricultural development through crowdfunding, so as to provide guidance for practice.

2. Theoretical analysis

2.1. Resource acquisition capability and agricultural subjects innovation

Innovation requires continuous capital flow and information flow, while innovation-driven agricultural subjects are vulnerable to resource restrictions for their limitations and innovative features, which make the resource acquisition capability matter. In line with enterprises growth theory [12], finance resources are the most fundamental for an agricultural subject and resource acquisition capability is the significant factor affecting the innovation-driven agricultural subjects. Obviously, it can be seen that whether to get enough resources becomes the key for innovation-driven agricultural subjects to continuously develop.

Innovation-driven agricultural subjects have to continuously innovate to survive and compete owing to their own restrictions. And the resources they need are of high-investment, high-risk and high-return. But there is serious information asymmetry among resource suppliers, innovators, and agricultural subjects, which results in adverse selection in the process [13]. The main body of agriculture technology innovation has professional knowledge and understand projects’ value at risk. But potential resource suppliers can hardly tell the good projects from the bad ones. So, to ensure profits, they have to charge a higher yield rate comparing to other normal projects. Thus, under traditional mode, innovation-driven agricultural subjects can hardly get loan from financial institutions and get technical support from professional technicians. Resource shortage becomes the “bottleneck” for innovation and capital acquisition capability is the key factor affecting their continuous innovation [12].

Thus, we propose that:

H1: Restricted by resource acquisition capability, innovation-driven agricultural subjects may be more inclined to crowdfunding.

2.2. Crowdfunding skill and resource acquisition availability

For innovation-driven agricultural subjects, crowdfunding can not only greatly reduce the financing threshold, but also test the market demand via the platform. However, not all projects can get attention from Resource suppliers, some may even fail and quench the innovation enthusiasm. As a result, in order to get enough resources, there needs some skills when crowdfunding on the platform. In general, project quality determines the result of financing. But owing to information asymmetry, innovation-driven agricultural subjects have to release relevant signals [14].

Thus, we propose that:

H2: Quality signal is directly related to the result of crowdfunding; high quality will increase the resource acquisition availability.

3. Data and variables

3.1. Data

Zhongchou platform is a reward crowdfunding platform, its operational mode is typical in China. This platform has relatively abundant and intact project data which makes it a data source. We use two methods to obtain data: self-programmed automatic collection and manual collection, and we have
done careful proofreading to ensure the completeness and accuracy of the data. Capital is a key resource that restricts innovative agricultural subjects. The amount of capital obtained in crowdfunding not only reflects the financing ability, but also reflects the attention of investors, which in turn brings a series of resources including production technology guidance and management experience sharing. Therefore, this article uses financing capacity to represent resource acquisition capacity. To make the data more representative, we remove the projects of extreme money amount (pre-fund <500, or >1,000,000, actual fund =0) and the ones with initiators not living in China Mainland. The final sample includes 781 items.

3.2. Variables

• Financing goal (goal): the pre-set financing amount when project was initiated. To compare the preset and founded amount, we add funded perception variable (perc-funded) into the descriptive statistics.
• Resource suppliers information (sources): the information sources by which resource suppliers know the project.
• Duration days(duration): the days projects crowdfunding on the platform.
• Topic updates(updates): a topic updating faster with high frequency to a certain extent indicates better quality.
• Video design(video): whether a project attaches a video.

Table 1. Variable categories and brief descriptions.

| Pre-installed objective (k) | goal | the scale (capital demanded) of the projects |
|-----------------------------|------|--------------------------------------------|
| Publicity channel (ψ)      | sources | represents the accessibility of other resources |
| High-quality signals(θ)    | duration | the shorter the duration is, viewed as good quality project [15] |
|                             | updates | the higher frequency of updates, viewed as good quality project |
|                             | video  | uploading video, viewed as good quality project |

Zhouchou platform follows an “all or nothing” model [16], so agricultural subjects’ pledge money is only collected if the goal is reached, that also means the project Crowdfunding is successful. Thus, we set whether successful Crowdfunding as the dependent variable (status), its value equals to 1 when success and 0 otherwise. To make variables more in line with normal distribution, we take the natural logarithm of goal and construct the following Logistic Regression model [17] to analyze by virtue of stata12.0:

\[
p(Y_i=1|X_i) = \frac{1}{1 + \exp(-a_0 - a_1k - a_2ψ - a_3θ)}
\]

There into:

\[
X_i = (k, ψ, θ)
\]

4. Empirical analysis

4.1. Descriptive statistics

From the data in Table 1, we can see that innovation-driven agricultural subjects have relatively small capital demand and traditional investment channel cannot meet it but crowdfunding can do so. It indicates that restricted by financing channel, crowdfunding is an effective way to solve the capital bottleneck for innovation-driven agricultural subjects.
Table 2. Descriptive statistics.

| Variable | All Mean | Failed Mean | Success Mean | t-statistics failed-success |
|----------|----------|-------------|--------------|----------------------------|
| goal     | 16,451.3700 | 19,457.2800 | 13,025.4700 | 2.3413 **                  |
| funded   | 13,007.5900 | 1,685.2500  | 25,911.9600 | -7.9582 ***                |
| perc_funded | 1.2274 | 0.1525       | 2.4524       | -13.7823***               |
| source   | 4.9001    | 2.3245      | 7.8356       | -10.7841***               |
| duration | 41.4481   | 42.2404     | 40.5452      | 1.4151                    |
| video    | 0.4123    | 0.3966      | 0.4301       | -0.9476                   |
| updates  | 10.7209   | 6.8365      | 15.1480      | -4.5994 ***               |
| status   | 0.4673    | 0           | 1            | -                         |
| ln_goal  | -0.2119***| -0.6883***  | -0.7444***   |                           |
| source   | 0.5332*** | 0.5304***   |               |                           |
| duration | -0.0142** | 0.0938      |               |                           |
| video    | 0.4295**  | (0.0058)    |               |                           |
| updates  | 0.0132**  | (0.0065)    |               |                           |
| Constant | 1.7271*** | 3.8653***   | 3.9315***    |                           |
| Observations | 781 | 781 | 781 |               |
| chi2     | 13.4800   | 349.7800    | 0.3241       |                           |
| p        | 0.0000    | 0.0000      | 0.0000       |                           |
| Pseudo R²| 0.0125    | 0.3070      |               |                           |

*p < 0.1; **p < 0.05; ***p < 0.01.

4.2. Regression results and hypothesis test

4.2.1. Regression results. The sample took into regression according to the variable, get three models 1-3. The Pseudo R² of three models are 0.0125, 0.3070 and 0.3241 separately. With the variable adding, Pseudo R² increases gradually, model has explanation power to a certain extent. Details in Table 3.

Table 3. Regression results.

| VARIABLES | (1) Model 1 | (2) Model 2 | (3) Model 3 |
|-----------|-------------|-------------|-------------|
| ln_goal   | -0.2119***  | -0.6883***  | -0.7444***  |
|           | (0.0586)    | (0.0856)    | (0.0938)    |
| source    | 0.5332***   | 0.5304***   |               |
|           | (0.0452)    | (0.0547)    |               |
| duration  | -0.0142**   | 0.0938      |               |
|           | (0.0058)    | (0.0073)    |               |
| video     | 0.4295**    | (0.1968)    |               |
|           | (0.1968)    | (0.0132)    |               |
| updates   | 0.0132**    | (0.0065)    |               |
| Constant  | 1.7271***   | 3.8653***   | 3.9315***    |
|           | (0.5175)    | (0.6882)    | (0.7382)     |
| Observations | 781         | 781         | 781          |
| chi2      | 13.4800     | 349.7800    | 0.3241       |
| p         | 0.0000      | 0.0000      | 0.0000       |
| Pseudo R² | 0.0125      | 0.3070      |               |

Regression method is logistic regression; Standard errors are clustered by listing and reported in parentheses under parameter estimates. *p < 0.1; **p < 0.05; ***p < 0.01.

4.2.2. Hypothesis test. (1) H1 test. To emphasize the importance of goal to successful funding, model 1 only contains this variable, thus Pseudo R2 is just 0.0125. But this variable is positively related to
status at the 1% significant level, even with adding more variables subsequently (model 2 and model 3), this relationship is still significant. It indicates that innovation-driven agricultural subjects are more inclined to crowdfunding to gather enough capital. And mode 2 contains another variable: investors sources, the result is significantly positive at 99% confidence intervals, which means accessibility of social contact has significant effect on project success. So far H1 is proven.

(2) H2 test. We plug (quality signal for high quality project) into model 2 to formulate model 3. Empirical results show that visitors and updates have a positive effect on successful funding, even we control for other variables, the visitors' positive effect is obvious in 0.1 level, updates are obvious in 0.01 level. It indicates that projects with good preparation and innovation can attract more attention from resource suppliers. Further test shows that quick-reply, professional, sincere-words projects can not only win capital support, but also attract more views the first day they start, which are consistent to Kuppuswamy & Bayus and Mollick’ research conclusions on Kickstarter [15,18].

Duration is negatively related to dependent variable and obvious in 0.1 level, showing that to a certain extent, resource suppliers believe agricultural subjects who have the confidence will set a short duration time; supporters source and number have a significantly positive correlation with dependent variable, indicating that for projects with good quality, resource acquisition availability is stronger. Thus, H2 is proven.

5. Conclusions
Innovation is the main power for Chinese transformation and innovation-driven agricultural subjects are the driving force that can’t be ignored. However, owing to their own limitations, weak resource acquisition capability is harmful to development. But crowdfunding provides an alternative way to solve the problem. Research shows that innovation-driven agricultural subjects prefer crowdfunding, but only the subjects with good quality signals can get supports.

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