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Research Article

Motivation Mechanism Prevents Adverse Selection in Industrial Technology Innovation Strategic Alliance

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Choosing proper partners is the key to the success of the alliance. Based on the analysis of the characters of the Industrial Technology Innovation Strategic Alliance, a new kind of cooperative organization occurred in China in recent years. The problem of "adverse selection" at the stage of the its establishment is discussed in this paper. The game model is built based on motivation theory and the principle-agent theory and then proved by examples. The conclusions can be got from the model. By setting the ranges of funds, preferential policy, and sharable profits and designing membership rules, the organizer of the Industrial Technology Innovation Strategic Alliance can motivate the risk neutral applicant to reveal his real capacity and the one with higher capacity to participate intothe alliance more actively and even can set capacity threshold for applicants implicitly.

1. Introduction

Along with the practice and research of the industry-university-research combination, a new type of organization for technological innovation, the Industrial Technology Innovation Strategic Alliance occurred in China in recent years. The first four pilot programs, technology innovation strategic alliances for circulation flow of iron and steel, new generation of coal (energy resources) chemical industry, exploitation of coal, and agricultural equipment, started in 2007. According to the definition by Chinese six ministries and commissions in 2008, the Industrial Technology Innovation Strategic Alliance (ITISA) is a cooperation organization for technology innovation, which is combined by enterprises, universities, scientific research institutions, and other organizations, based on the common needs and interests, ensured by legal contracts. It aims to improve the industrial technical innovation ability via joint exploitation, complementary advantages, pooling of interest, and risk [1].

As a kind of cooperation forms among organizations, the alliance is considered significant for product innovation widely. Effective alliance is regarded as the engine for growth or profit in markets [2]. The enterprises are more and more dependent on alliances to develop cooperation, create values, and succeed in intensive market competition. Yet there are indications that the alliance is not perfect. The failure rate of it is estimated to reach 60–70% [3]. The opportunism of the partner is regarded as one of the serious threats to the survival and success of the alliance [4–7]. The alliance has been threatened by high risk of opportunism along with its development [8]. The opportunistic behavior at the stage of building mainly takes the form of "adverse selection," behaviors like hiding real capability, "bad money drives out good," and so on, due to information asymmetry, which would harm the success of the alliance. The opportunistic behaviors make the trusting relationship among the partners difficult to be established, raise the transaction costs among them, destroy the foundation of the alliance, and then affect the performance of the alliance, and even they cause the alliance fail [2]. How to motivate the member to reveal his real information is the key to partner selection, and the latter is the key to the success of the alliance [9–11]. The dynamics of social relationships, such as friendship or partnership patterns, is a complex field of study [12].

As a new type of technology innovation cooperation organization occurred in China in recent years, yet it does not have such organization abroad which is completely in conformity with the definition of the ITISA. While interiorly, contrasting to the surging practical activities of the ITISA, corresponding theoretical researches are few, the research

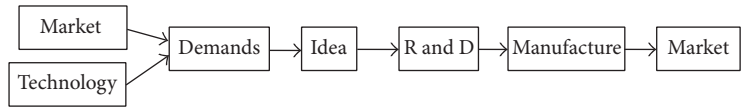

Figure 1: The ITISA constitutes complete technology innovation chain.

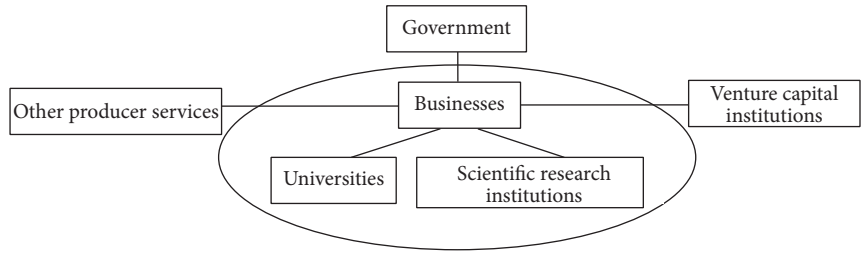

Figure 2: The ITISA consists of organizations from several different fields.

about the motivation preventing "adverse selection" is almost blank especially. Most existing researches about the "adverse selection" are theoretical, providing some methods and principles for motivating members to reveal real information [13–15]. In this research, we try to discuss practical motivation mechanism to prevent the "adverse selection" in the ITISA.

This paper is divided into six parts. First, the subject is put forward based on existing research findings. Then, the special problem of the "adverse selection" in the ITISA caused by its characters is discussed in Section 2. Based on motivation theory and principal-agent theory, the game model is built to design the motivation mechanism to resolve the special problem in Section 3, discussed in Section 4, and proved by some examples in Section 5. A summary and prospect for the research will be put forward finally in Section 6.

2. The Incentive Problem of Adverse Selection in ITISA

2.1. The Peculiarities of the ITISA. The ITISA is based on technology, guided by market. Its members come from government, business, universities, scientific research institutions, and other producer services such as finance, venture investment. They constitute a complete chain of technology innovation (Figure 1) containing scientific research, design, engineering, manufacture, and market.

The businesses are the best supports for the combination of technology and market, will be the dominant and key force in the alliance consequentially. The university and scientific research institution have the comparative advantages of knowledge and technology may be the main forces in technology R&D (or collaborate with the enterprises). The government mainly works as pusher, guider, supporter and technology spillover promoter, confirms with leading enterprises the technology innovation projects according to the industrial goal, market prospects and the technical problem in practice, assists to introduce the venture capital organization, but not participates in the operation of the alliance. The venture capital organization provides effective ways to get capital and evade the risk. Other producer services participate in the technology innovation process as essential auxiliary bodies, obtain compensation mainly by transaction (Figure 2).

Compared with other kinds of alliances, the ITISA has special strategic orientation, cooperation organization promoted by government, aimed at promoting the industrial technology innovation ability with high technical risks. So, besides the general characters of common alliances, such as looseness, dynamics, definition, and mutual benefit, the ITISA has some unique personalities [1, 16] as follows. (1) It is the promotion of national innovation system in industry, the participants are more wide-ranging, and the comprehensive benefits of economy and society are more remarkable. (2) It should aim to solve the key and general technical problems in key fields or in strategic industries identified in the Outline of National Medium and Long Term Science and Technology Development Planning (2006–2020). (3) The technological innovation activities should favor concentrating innovational resources to form industrial technological innovation chain. (4) It should spread the techniques to promote the development of the whole industry. The goal of it is to form industrial core competitiveness and strengthen industrial sustainable innovation ability. (5) The members of the ITISA, as legal persons, set up long-term contractual relationship based on related laws.

ITISA is guided by needs of important technological innovation in some key fields and strategic industries. It is devoted to the research and development of the industrial generic and key technologies. The technologies needed to be overcome by the ITISA will be more difficult, and the risk faced by the ITISA will be higher than other kinds of alliances. The issue that the members come from several different fields such as industry, academe, research, politics, and finance makes the ITISA more complicated. The differences of culture and interests among the members are more outstanding; some seek economic interests, some seek technology improvement, some seek organizational reputation, and some seek good relations of cooperation. All these make it more difficult to manage [17].

After the technical breakthrough, the ITISA should be devoted to promoting the development of the whole

industrial technology, aim at forming industrial core competitiveness and strengthening the industrial sustainable innovation ability. It should not only pursue economic interests, but also emphasize comprehensive social benefits. So, the technical achievement of it will be more like public goods. These particularities determine that the ITISA is often promoted by government, supported by many preferential policies. It also raises the opportunistic behaviors of the members to a certain extent.

So, compared with other kinds of alliances, the ITISA faces three kinds of risks: failure of technology research and development, the opportunism of the members, and complicated management, and even the risks would be higher.

2.2. The Incentive Problem of Adverse Selection in ITISA. Since the ITISA is often promoted by government with many supporting and preferential policies, its problem of "adverse selection" would be more serious. The probability of the information hiding would not decrease effectively with the increase of the qualified standard, but it would increase rapidly with the increase of trust from the leader [14]. So, how to design reasonable mechanism to motivate the members to reveal real information will be the key to success of the ITISA.

In the principal agent relationship at the stage of the ITISA establishment, the leading institution will be the principal and the other applicants will be the agents. The problem of preventing adverse selection is mainly how to design mechanism to motivate the applicants to reveal real information and the one with higher capabilities to join in more actively.

3. Model

Essentially, the ITISA is a technological innovation project team. As being aimed at the indivisible efforts and outputs in alliance, some theories and methods like work breakdown structure (WBS), project activities list, and so on in project management can be used as reference. The resources input of each project activity can be estimated. The member could choose one or several project activities as his task. This would be the basis for motivation or profit distribution.

3.1. Problem Description. Suppose that one technology innovation project Wconsists of n project activities ($W = \sum_{k=1}^{n} w_k$). In order to facilitate the management and evaluation, every activity would be resolved to be done by one member. The corresponding ITISA is formed by s members. Any member can engage in χ ($1 \le \chi \le n$) project activities. υ ($1 \le \upsilon \le s$) leading organizations in the industry form the organizer Z, and other members e_i ($i = 1, 2, \ldots, s - \upsilon$) will be selected from $A = \sum_{k=1}^{n} u_k$ applicants. The organizer Z has absolute advantages in technology or market; it is the main power for technology innovation and is responsible for organizing the ITISA and choosing other members. Other members e_i are also essential cooperative partners with some complementary capabilities for technology innovation.

Concretely speaking, any member e_i of the ITISA can enjoy preferential policies which can be used to evade the risk or reduce the risk cost, reflect the importance of the government participation, and enjoy profits shared according to inputs. On the other hand, should pay unreturned funds for maintenance and coordination of the ITISA, which are essential for the development of such complicated combination and are then put in resources for technology innovation.

Since the applicants of the ITISA come from many different fields, the organizer cannot know the real capability t_{ki} of applicant a_{ki} ($i = 1, 2, \ldots, u_k$); it only judges from his report q_{ki}. The organizer sets the funds f_k, preferential policy m_k, and shareable profit r_k of project activity w_k and designs the game rules—funds f_{ki} according to q_{ki}, preferential policy m_{ki}, and shareable profit r_{ki} according to t_{ki} to motivate the applicant to reveal his capacity truthfully ($q_{ki} \to t_{ki}$) and the one with higher capacity to participate in more actively. The member e_i participates in the ITISA with resources input and income share in the conditions of participation constraint and incentive compatibility constraint.

3.2. Variable Design. Although the risks of technology innovation are very high, the applicants participate in the alliance with high activities because of so many preferential policies. So, we can assume the applicants are all risk neutral.

The resource input c_k for project activity w_k is assessed by organizer Z or together with the third party. It is a common view. The funds f_k, preferential policy m_k, and the shareable successful income r_k of project activity w_k are given by the organizer. Other variables in model are as follows.

t_{ki} is the real capability of the applicant a_{ki}, $0 \le t_{ki} \le 1$. Only the applicant himself knows this at the stage of alliance establishment, but he can shine through in latter activities.

q_{ki} is the reported capability of the applicant a_{ki}, $0 \le q_{ki} \le 1$. q_{ki}, and t_{ki} are independent.

θ_{ki} is the probability of membership of the applicant a_{ki}. It is positively correlated with q_{ki}, $\theta_{ki} = gq_{ki}$ (g is a constant, set $g = 1$, $\theta_{ki} = q_{ki}$).

p_{ki} is the probability of the success of the alliance estimated by the applicant a_{ki}. It is positively correlated with t_{ki}, $p_{ki} = ht_{ki}$ (h is a constant, set $h = 1$, $p_{ki} = t_{ki}$).

f_{ki} is the unreturned funds paid by the member a_{ki}. It is based on f_k and is positively correlated with q_{ki}, $f_{ki} = q_{ki}f_k$.

m_{ki} is the preferential policies enjoyed by every member a_{ki}. It is a constant m_k.

c_{ki} is the resources that should be put into the ITISA by the member a_{ki}. It is based on c_k and is positively correlated with t_{ki}, $c_{ki} = t_{ki}c_k$.

r_{ki} is the income that the member a_{ki} shared when the alliance succeed. It is based on r_k and is positively correlated with c_{ki}; that is, it is positively correlated with t_{ki}, $r_{ki} = t_{ki}r_k$.

Besides the preferential policy and sharable success, the reputation of participating into the national strategic industries and touching advanced technologies, other immeasurable benefits are not reflected in E_{ki}. So, we suppose

the retained earnings of the applicant are 0. Since all the applicants are risk neutral, the decision of participating into the ITISA is mainly affected by his expected revenue E_{ki}. The expected revenue of the applicant a_{ki} would be

$$E_{ki} = \theta_{ki}\left[p_{ki}\left(m_{ki} + r_{ki} - f_{ki} - c_{ki}\right) + \left(1 - p_{ki}\right)\left(m_{ki} - f_{ki} - c_{ki}\right)\right] + \left(1 - \theta_{ki}\right)\cdot 0 \tag{1}$$

$$\Longrightarrow E_{ki} = t_{ki}^2 q_{ki} r_k + q_{ki} m_k - q_{ki}^2 f_k - t_{ki} q_{ki} c_k. \tag{2}$$

3.3. Model Building. The organizer Z motivates the applicant a_{ki} to report real capability and the one with higher capability to participate into the ITISA actively. The incentive model can be expressed as [18]

$$\begin{aligned} \min \quad & \left|q_{ki} - t_{ki}\right| \\ \text{s.t.} \quad & \text{(IR)}\ E_{ki} \geq 0 \\ & \text{(IC)}\ \frac{\partial E_{ki}}{\partial q_{ki}} = 0 \\ & \frac{\partial E_{ki}}{\partial t_{ki}} \geq 0 \\ & \text{all the variables are nonnegative real numbers} \\ & 0 \leq t_{ki} \leq 1, \quad 0 \leq q_{ki} \leq 1. \end{aligned} \tag{3}$$

3.4. Model Solution. Put the variables into the model and analyze the following.

By constraint condition $E_{ki} \geq 0$ and $0 \leq q_{ki} \leq 1$, the following inequality can be got:

$$r_k t_{ki}^2 + m_k - f_k q_{ki} - c_k t_{ki} \geq 0. \tag{4}$$

By constraint condition $(\partial E_{ki}/\partial q_{ki}) = 0$, the following equality can be got:

$$r_k t_{ki}^2 + m_k - 2 f_k q_{ki} - c_k t_{ki} = 0. \tag{5}$$

When equality (5) is true, inequalities (4) must be established and

$$\frac{\partial^2 E_{ki}}{\partial q_{ki}^2} = -2f \leq 0. \tag{6}$$

It can be found from (1), (5) and (6) that the $E_{ki}(t_{ki}, q_{ki})$ can reach the maximum when $q_{ki} = ((r_k t_{ki}^2 - c_k t_{ki} + m_k)/2 f_k)$.

By constraint condition $(\partial E_{ki}/\partial t_{ki}) \geq 0$ and $0 \leq q_{ki} \leq 1$, the following inequality can be got:

$$2 r_k t_{ki} - c_k \geq 0 \Longrightarrow t_{ki} \geq \frac{c_k}{2 r_k}. \tag{7}$$

So, the problem can be changed to the following in the case of $t_{ki} \geq (c_k/2r_k)$:

$$\begin{aligned} \min \quad & \left|q_{ki} - t_{ki}\right|, \\ \text{s.t.} \quad & \frac{\partial E_{ki}}{\partial q_{ki}} = r_k t_{ki}^2 + m_k - 2 f_k q_{ki} - c_k t_{ki} = 0. \end{aligned} \tag{8}$$

And it is expected to reach $\min |q_{ki} - t_{ki}| \to 0$.

According to Lagrange multiplier method, set

$$\begin{aligned} f\left(t_{ki}, q_{ki}\right) &= \left|q_{ki} - t_{ki}\right|, \\ \varphi\left(t_{ki}, q_{ki}\right) &= r_k t_{ki}^2 + m_k - 2 f_k q_{ki} - c_k t_{ki}, \\ F\left(t_{ki}, q_{ki}\right) &= f_{ki}\left(t_{ki}, q_{ki}\right) + \lambda \cdot \varphi_{ki}\left(t_{ki}, q_{ki}\right), \end{aligned} \tag{9}$$

where λ in it is a constant. So

$$\begin{aligned} \frac{\partial F}{\partial q_{ki}} &= 0, \\ \frac{\partial F}{\partial t_{ki}} &= 0, \\ \varphi\left(t_{ki}, q_{ki}\right) &= 0. \end{aligned} \tag{10}$$

The following equalities can be got from (10):

$$\begin{aligned} t_{ki} &= \frac{2 f_k + c_k}{2 r_k}, \\ q_{ki} &= \frac{r_k t_{ki}^2 - c_k t_{ki} + m_k}{2 f_k} = \frac{4 f_k^2 - c_k^2 + 4 r_k m_k}{8 r_k f_k}. \end{aligned} \tag{11}$$

All the variables are nonnegative real numbers, $0 \leq t_{ki} \leq 1$ and $0 \leq q_{ki} \leq 1$, and the following statements can be got:

$$m_k \leq r_k, \tag{12}$$

$$f_k \leq \sqrt{r_k m_k}, \tag{13}$$

$$\min\left\{2\sqrt{r_k m_k}, 2r - 2f\right\} \geq c_k, \tag{14}$$

$$4 f_k^2 + 4 r_k m_k - 8 r_k f_k \leq c_k^2, \tag{15}$$

$$\left|q_{ki} - t_{ki}\right| = \left|\frac{4 r_k m_k - \left(2 f_k + c_k\right)^2}{8 r_k f_k}\right|. \tag{16}$$

Comprehensively, if (7) is true, the $(\partial E_{ki}/\partial t_{ki}) \geq 0$ will be permanently established. When $2\sqrt{r_k m_k} - 2 f_k \to c_k$, $\min |q_{ki} - t_{ki}| \to 0$ in the conditions of (11)–(15), the goals of motivating the applicants to reveal real capability and the one with higher capability to participate into the ITISA more actively can be achieved.

4. Analysis of the Model

4.1. The Result of the Model. In the case that the input c_k of project activity w_k is the common view the organizer of the ITISA can motivate the applicant with risk neutral to reveal real capability ($\min|q_{ki} - t_{ki}| \to 0$), by designing the membership rules: whether the applicant a_{ki} can be accepted and his unreturned funds f_{ki} are decided by his reported capability q_{ki}, every member can enjoy the preferential policy m_k and the sharable benefits r_{ki} is decided by his real capability t_{ki}; assigning the value of f_k, r_k, and m_k meets the conditions of $m_k \leq r_k$, $f_k \leq \sqrt{r_k m_k}$, $c_k \leq \min\{2\sqrt{r_k m_k}, 2r - 2f\}$, and $4 f_k^2 + 4 r_k m_k - 8 r_k f_k \leq c_k^2$. If $t_{ki} \geq (c_k/2r_k)$, then $(\partial E_{ki}/\partial t_{ki}) \geq 0$. So the organizer can motivate

Table 1: $2\sqrt{r_k m_k} - 2f_k < c_k$, $q_{ki} = ((r_k t_{ki}^2 - c_k t_{ki} + m_k)/2f_k)$, and the index values change with t_{ki}.

t_{ki}	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
q_{ki}	0.75	0.63	0.54	0.49	0.47	0.49	0.54	0.63	0.75	0.9	1
$q_{ki} - t_{ki}$	0.75	0.53	0.34	0.19	0.07	−0.01	−0.06	−0.07	−0.05	0	0
E_{ki}	10.1	7.12	5.3	4.33	4.03	4.33	5.3	7.12	10.1	14.8	21.45
$\partial E_{ki}/\partial t_{ki}$	−37	−23	−13	−6.1	0	6.1	13.5	23.5	37.3	56.3	75
$\partial E_{ki}/\partial q_{ki}$	0	0	0	0	0	0	0	0	0	0	3.28

Table 2: $2\sqrt{r_k m_k} - 2f_k = c_k$, $q_{ki} = ((r_k t_{ki}^2 - c_k t_{ki} + m_k)/2f_k)$, and the index values change with t_{ki}.

t_{ki}	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
q_{ki}	0.85	0.71	0.6	0.54	0.52	0.54	0.6	0.71	0.85	1	1
$q_{ki} - t_{ki}$	0.85	0.61	0.4	0.24	0.12	0.04	0	0.01	0.05	0.1	0
E_{ki}	10.9	7.51	5.46	4.39	4.06	4.39	5.46	7.51	10.9	16.2	23.1
$\partial E_{ki}/\partial t_{ki}$	−43	−27	−15	−6.8	0	6.76	15.1	26.5	42.7	62.5	75
$\partial E_{ki}/\partial q_{ki}$	0	0	0	0	0	0	0	0	0	1.22	8.1

the applicant with higher capability to participate in the ITISA more actively by assigning the value of r_k cleverly and even can set capability threshold t_{ko} ($t_{ko} = (c_k/2r_k), t_{ki} \geq t_{k0}$) for the applicants implicitly.

4.2. Discussion. The mechanism got from the model can only motivate the applicants whose real capability $t_{ki} = ((2f_k + c_k)/2r_k) \geq (c_k/2r_k)$. How to achieve this condition is still a knot since the organizer cannot know the real capability t_{ki} of the applicant a_{ki} beforehand. This problem concerns the following two respects.

(1) How to Identify the Applicants with $t_{ki} \geq t_{k0} = (c_k/2r_k)$? This problem can be translated into how to confirm t_{k0} and lead it into the motivation mechanism. The value of t_{k0} can be confirmed by the evaluation mechanism beforehand. The evaluator could be organizer, professional assessment agency, or other organizations. A is the real capability of the applicant a_{ki}; B is the evaluation of the real capability of the applicant a_{ki} by the evaluator. A^-, A^+ means the real capability t_{ki} of the applicant a_{ki} is less, not less than t_{k0}, respectively. B^-, B^+ means the evaluation π_{ki} of the real capability of the applicant a_{ki} is less, not less than t_{k0}, respectively. Suppose $p(A^-) = \xi$, $p(B^-/A^-) = \eta$, $p(B^+/A^+) = \delta$. According to practical experience, it is easy to recognize the one with poor ability and prove $\lim_{\eta \to 1} p(A^+/B^+) = 1$. So, with the aid of confident evaluation ($p(B^-/A^-) = \eta \to 1$), the organizer can choose members from the applicants whose $\pi_{ki} \geq t_{k0}$ directly. Yet this method may miss some applicants ($t_{ki} \geq t_{k0}$) in probability $p(A^+/B^-) = ((1 - \xi - \delta + \xi\delta)/(1 - \xi - \delta + \xi\delta + \xi\eta))$ or accept some applicants ($t_{ki} < t_{k0}$) in probability $p(A^-/B^+) = ((\xi - \xi\eta)/(\xi + \delta - \xi\delta - \xi\eta))$. It should be improved in future research.

(2) How to Motivate the Applicants with $t_{ki} \neq ((2f_k + c_k)/2r_k)$ and $t_{ki} \geq t_{k0} = (c_k/2r_k)$? We can get the conclusions from the model: In self-interest driven ($(\partial E_{ki}/\partial q_{ki}) = 0$), if $t_{ki} = ((2f_k + c_k)/2r_k)$, then $2\sqrt{r_k m_k} - 2f_k \to c_k^{\pm 0} \Leftrightarrow q_{ki} \to t_{ki}^{\pm 0}$. So, the applicant would report his real capability when $2\sqrt{r_k m_k} - 2f_k = c_k$; the applicant would report higher capability when $2\sqrt{r_k m_k} - 2f_k > c_k$ and lower capability when $2\sqrt{r_k m_k} - 2f_k < c_k$. $2\sqrt{r_k m_k} - 2f_k$ farer away from c_k, the reported capability is farer away from the real capability.

How to motivate the overwhelming majority applicants with $t_{ki} \neq ((2f_k + c_k)/2r_k)$? In another words, how to motivate all the applicants by a mechanism in the circumstance that the real capability of the applicant is unknown? We try to discuss this problem with the help of a large number of examples in the following Section 5.

5. Examples

Suppose the input into project activity w_k is $c_k = 50$. It is a common view. When $t_{ko} = 0.4$, $p(B^-/A^-) = \eta \to 1$. So the organizer only selects and motivates the applicants with $\pi_{ki} \geq 0.4$ according to $\lim_{\eta \to 1} p(A^+/B^+) = 1$. The organizer sets m_k, f_k, and r_k according to the membership rules and conditions $m_k \leq r_k$, $f_k \leq \sqrt{r_k m_k}$, $c_k \leq \min\{2\sqrt{r_k m_k}, 2r - 2f\}$, $4f_k^2 + 4r_k m_k - 8r_k f_k \leq c_k^2$, and $t_{ki} \geq t_{k0} = c_k/2r_k$. Suppose the applicants make decision and action in self-interest driven ($q_{ki} = ((r_k t_{ki}^2 - c_k t_{ki} + m_k)/2f_k), (\partial E_{ki}/\partial q_{ki}) = 0$). The model and result will be discussed and proved by the following examples.

5.1. $2\sqrt{r_k m_k} - 2f_k < c_k$, t_{ki} Can Take Any Value. Suppose $r_k = 62.5$, $m_k = 27.12$, and $f_k = 18.17$; that is, $2\sqrt{r_k m_k} - 2f_k = 46 < c_k$. Discuss and prove the decision and action of the applicants with any real capability. The result of calculation is in Table 1.

5.2. $2\sqrt{r_k m_k} - 2f_k = c_k$, t_{ki} Can Take Any Value. Suppose $r_k = 62.5$, $m_k = 25.6$, and $f_k = 15$; that is, $2\sqrt{r_k m_k} - 2f_k = c_k = 50$. Discuss and prove the decision and action of the applicants with any real capability. The result of calculation is in Table 2.

5.3. $2\sqrt{r_k m_k} - 2f_k > c_k$, t_{ki} Can Take Any Value. Suppose $r_k = 62.5$, $m_k = 30.29$, and $f_k = 16.51$; that is, $2\sqrt{r_k m_k} - 2f_k = 54 > c_k$. Discuss and prove the decision and action of

Table 3: $2\sqrt{r_k m_k} - 2f_k > c_k$, $q_{ki} = ((r_k t_{ki}^2 - c_k t_{ki} + m_k)/2f_k)$, and the index values change with t_{ki}.

t_{ki}	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
q_{ki}	0.92	0.78	0.69	0.63	0.61	0.63	0.69	0.78	0.92	1	1
$q_{ki} - t_{ki}$	0.92	0.68	0.49	0.33	0.21	0.13	0.09	0.08	0.12	0.1	0
E_{ki}	13.9	10.2	7.86	6.62	6.23	6.62	7.86	10.2	13.9	19.4	26.3
$\partial E_{ki}/\partial t_{ki}$	−46	−29	−17	−7.9	0	7.92	17.3	29.4	45.9	62.5	75
$\partial E_{ki}/\partial q_{ki}$	0	0	0	0	0	0	0	0	0	2.89	9.77

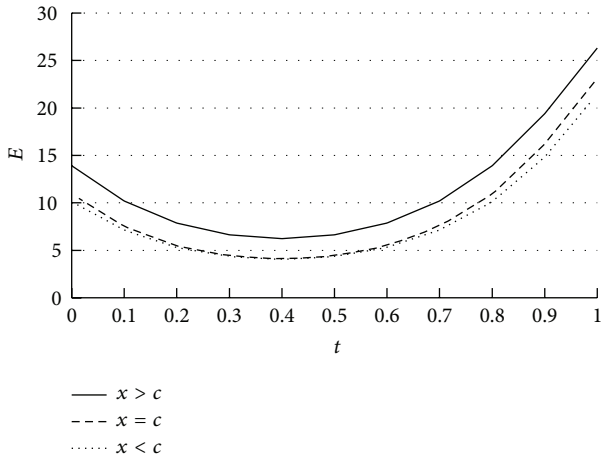

Figure 3: E_{ki} varies with t_{ki} and $x = 2\sqrt{r_k m_k} - 2f_k$.

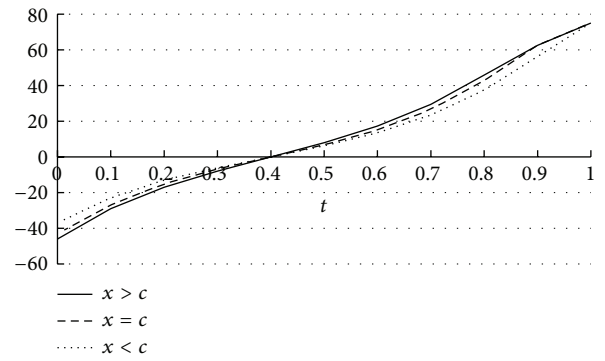

Figure 4: $(\partial E_{ki}/\partial t_{ki})$ varies with t_{ki} and $x = 2\sqrt{r_k m_k} - 2f_k$.

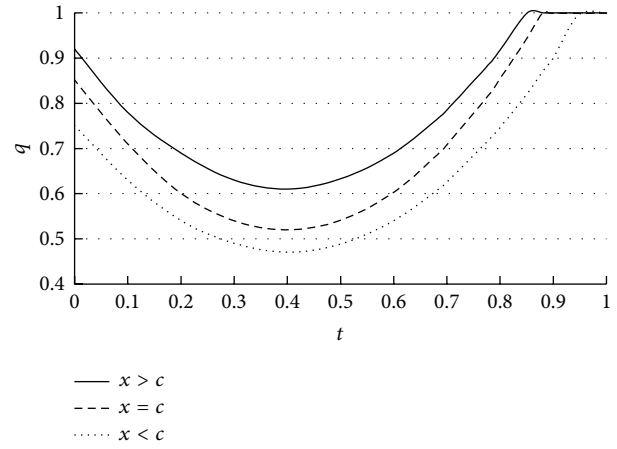

Figure 5: q_{ki} varies with t_{ki} and $x = 2\sqrt{r_k m_k} - 2f_k$.

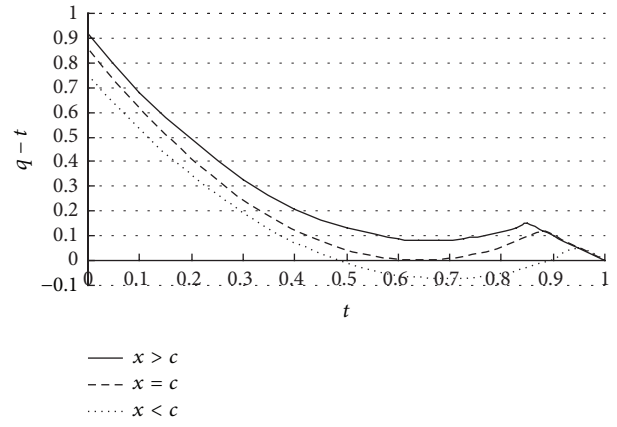

Figure 6: $q_{ki} - t_{ki}$ varies with t_{ki} and $x = 2\sqrt{r_k m_k} - 2f_k$.

the applicants with any real capability. The result of calculation is in Table 3.

5.4. Summarization. We can get the variation trends of the variables from Tables 1, 2, and 3 as shown in Figures 3, 4, 5, and 6.

The same relationships among the variables can be got with other values. We can get and prove the following conclusions by the above examples (Tables 1–3 and Figures 3–6).

Thesis 1. $(2\sqrt{r_k m_k} - 2f_k) \uparrow \Rightarrow E_{ki} \uparrow$, the initiative of the applicant to participate into the ITISA would be higher with higher $2\sqrt{r_k m_k} - 2f_k$; $t_{ki} \le t_{k0} = (c_k/2r_k) \Rightarrow (\partial E_{kij}/\partial t_{ki}) \le 0$, to the applicant with capacity lower than $t_{k0} = (c_k/2r_k)$, the initiative of the applicant would be higher with lower capacity; $t_{ki} \ge t_{k0} \Rightarrow (\partial E_{kij}/\partial t_{ki}) \ge 0$, to the applicant with capacity higher than $t_{k0} = (c_k/2r_k)$, the initiative of the applicant would be higher with higher capacity.

Thesis 2. $(2\sqrt{r_k m_k} - 2f_k) \uparrow \Rightarrow q_{ki} \uparrow$, the reported capability of the applicant would be higher with higher $2\sqrt{r_k m_k} - 2f_k$, and when $2\sqrt{r_k m_k} - 2f_k \ge 2\sqrt{r_k m_k} - r_k t_{ki}^2 + c_k t_{ki} - m_k$, $q_{ki} = 1$; $t_{ki} \le t_{k0} = (c_k/2r_k)$, $t_{ki} \uparrow \Rightarrow q_{ki} \downarrow$, to the applicant with capacity lower than $t_{k0} = (c_k/2r_k)$, the reported capability of the applicant would be higher with lower capacity; $t_{ki} \ge t_{k0} = (c_k/2r_k)$, $t_{ki} \uparrow \Rightarrow q_{ki} \uparrow$, to the applicant with capacity higher than $t_{k0} = (c_k/2r_k)$, the reported capability of the applicant will be higher with higher capacity, and when $t_{ki} \ge ((c_k + \sqrt{c_k^2 - 4r_k m_k + 8r_k f_k})/2r_k)$, $q_{ki} = 1$.

Thesis 3. $2\sqrt{r_k m_k} - 2f_k \geq c_k \Rightarrow q_{ki} - t_{ki} \geq 0$, when $2\sqrt{r_k m_k} - 2f_k \geq c_k$ the applicant would incline to report higher capacity than real one. The problem would be more serious with higher $2\sqrt{r_k m_k} - 2f_k$ or $|t_{ki} - ((2f_k + c_k)/2r_k)|$. But the room between them would decrease when $2\sqrt{r_k m_k} - 2f_k \geq 2\sqrt{r_k m_k} - r_k t_{ki}^2 + c_k t_{ki} - m_k$ or $t_{ki} \geq ((c_k + \sqrt{c_k^2 - 4r_k m_k + 8r_k f_k})/2r_k)$ since $0 \leq q_{ki} \leq 1$.

Thesis 4. The applicant would incline to report higher capacity than real one when $2\sqrt{r_k m_k} - 2f_k < c_k$ and $t_{ki} \leq (((2f_k + c_k) - \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)$ or $t_{ki} \geq (((2f_k + c_k) + \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)$. The problem would be more serious with higher $2\sqrt{r_k m_k} - 2f_k$ or $|t_{ki} - (((2f_k + c_k) \pm \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)|$. But the room between them would decrease when $2\sqrt{r_k m_k} - 2f_k \geq 2\sqrt{r_k m_k} - r_k t_{ki}^2 + c_k t_{ki} - m_k$ or $t_{ki} \geq ((c_k + \sqrt{c_k^2 - 4r_k m_k + 8r_k f_k})/2r_k)$ since $q_{ki} = 1$.

Thesis 5. The applicant would incline to report lower capacity than real one when $2\sqrt{r_k m_k} - 2f_k < c_k$, $(((2f_k + c_k) - \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k) \leq t_{ki}$ and $t_{ki} \leq (((2f_k + c_k) + \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)$. The problem would be more serious with lower $2\sqrt{r_k m_k} - 2f_k$ or higher $|t_{ki} - (((2f_k + c_k) \pm \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)|$.

Thesis 6. When $2\sqrt{r_k m_k} - 2f_k = c_k$ and $t_{ki} = ((2f_k + c_k)/2r_k)$, or $2\sqrt{r_k m_k} - 2f_k < c_k$ and $t_{ki} = (((2f_k + c_k) \pm \sqrt{(2f_k + c_k)^2 - 4r_k m_k})/2r_k)$, the applicant would report his real capability.

6. Conclusions and Future Research

Whether the partner selection is proper is the key to the success of the alliance. According to the analysis of the characters of the ITISA, a new kind of cooperative organization occurred in China in recent years and the problem of "adverse selection" at the stage of the its establishment is discussed in this paper. Based on the motivation, project management, and game theories and methods, the motivation model preventing the "adverse selection" is built and then discussed and proved by examples. The conclusions can be got from the model. The organizer of the ITISA can motivate the applicant with risk neutral to reveal real capability ($\min|q_{ki} - t_{ki}| \to 0$) by designing reasonable membership rules, setting the ranges of funds f_k, preferential policy m_k and sharable profitsr_k of each project activity to meet the following conditions:

$$\begin{gathered} m_k \leq r_k, \\ f_k \leq \sqrt{r_k m_k}, \\ c_k \leq \min\left\{2\sqrt{r_k m_k}, 2r_k - 2f_k\right\}, \\ 4f_k^2 + 4r_k m_k - 8r_k f_k \leq c_k^2, \\ \left(2\sqrt{r_k m_k} - 2f_k\right) \longrightarrow c_k. \end{gathered} \tag{17}$$

If $t_{ki} \geq c_k/2r_k$, then $\partial E_{ki}/\partial t_{ki} \geq 0$, so the organizer can motivate the applicant with higher capability to participate in the ITISA more actively by assigning the value of r_k cleverly and even can set capability threshold t_{ko} ($t_{ko} = (c_k/2r_k), t_{ki} \geq t_{k0}$) for the applicants implicitly.

Besides referring to some existing research findings, we make some new attempts: introducing the evaluation mechanism and conditional probability into the research for preliminary selection of the applicants, introducing the theory and methods of WBS in project management into the research for discussing the inputs of the ITISA, and introducing the funds for the ITISA into the model. The conclusions are practical and comprehensive.

This research is aimed at designing practical motivation mechanism for preventing "adverse selection" of the risk-neutral applicants. The improvement and further research would be launched in two directions: how to confirm the applicants with $t_{ki} \geq t_{k0}$ and how to motivate the applicants with other kinds of risk appetites.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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