Chapter 5
Conclusions

5.1 Overview

The emerging paradigms of collaborative networked organizations could fundamentally change the organizations of commercial industry, culture and social activities. New project-based collaborative organizations are appearing, especially in fields such as manufacturing, software development and film making. These networks of organizations can support small and medium enterprises (SMEs) to identify and explore new business potentials, boost innovation and improve their knowledge.

An enterprise that detects a new business opportunity, but can not explore it individually, perhaps can select previously unknown partners for collaboration. Since the participants may come from diverse industries and various countries, the requestor enterprise has to adopt a systematic method to select his partners in a distributed environment.

In a collaborative environment, the enterprise needs to share privacy and strategic information, such as financial reports, manufacturing schedules and inventory, to his collaborative partners. The enterprise partner should not only be competent, but also have care, concern and honesty. Partner selection in traditional transaction-based B2B environments was based on candidate claims about their abilities, and considered competence or capability. The reputation system previously applied in B2C or C2C environments is based only on subjective ratings and general measures. Therefore, the conventional methods for partner selection and reputation system are not appropriate for choosing an unknown candidate with good competence, goodwill and predictability / consistent behavior in B2B environments.

This study developed a model that makes the partner selection for collaboration more systematic and fair than conventional approaches, which only utilize subjective perception, and ask for testimonies from candidates themselves. Experiment results indicate that the best candidates were selected far more often than other competitors in one

round of CPS, and obtained high means and low standard deviation in specific factors combinations.

5.2 Key Findings

There are four experiments applied to test the RBPS model and proven to be an effective way to select a suitable partner. The key findings we observed from these experiments listed as follows:

- In the first experiment, the results indicate that the best candidate AH was selected far more often than other competitors during the experiments PS1 and PS4, and obtained high level of means and low level of standard deviation during the experiments MPS1 and MPS4. We observed that good performance only result from some specific factor combinations; that is, not all the factor combinations can make the RBPS model to select a fine trustee AH.
- In the second experiment, the results indicate that the number of friends of the trustor (as IFNo) and searching depth (as SDNo) in referral networks are critical factors. It is reasonable that if we search someone in a referral networks, the more searching width and depth, the easier to identify the target. The IFNO implies the searching width, and SDNo implies the searching depth. In the real world, if we increase our friends to search a wanted resource for a long period of time in a social network, the probability to find the resource would enhance.
- In the third experiment, the results demonstrate that the greater number of friends of the trustor and searching depth in referral networks made our RBPS model to select a fine collaborative partner AH with high means and low variance. The key findings listed as below:
    1. The trustee agent as a newcomer (RaNo and ReNo < 4) with fine characteristics can be easily selected by the trustor agent whose IFNo ≥ 5 and SDNo ≥ 6.

2. The newcomers with less friends in social networks may scarcely select a fine partner candidate, and hardly to be selected by the trustor. On the other hand, the enterprise with more friends and raters can easily identify a fine partner candidate and easily to be selected by the trustor. This effect makes the enterprise with more friends has more chance to build relationships with new friends and then easily to identify the fine partners to collaborate. In the real world, the result matches the phenomenon that if someone has more resources, he can create even more resources.
3. The results showed that the SDNo is more critical than the factor IFNo; furthermore, the appropriate value of SDNO is '6', for it can cause the trustee AH to be selected with high means and low variation. The result matches the concept proposed by Milgram (1967) that the average path length between any two nodes in the social networks fell around 'six', namely 'six degrees of separation'.

- In the last experiment, the trust type 'predictability trust' was identified as the critical trust type that most affect the results for selecting a fine trustee. The definition of 'predictability' mentioned previously is "the consistent behaviors of trading partners that allow another trading partner to make predictions and judgments based on prior experiences." That is, the enterprise wants to identify a partner with consistent behaviors in competence and goodwill. This result matches the phenomenon that people likes to make friends with steady temperament.

5.3 Research Contributions

The contributions of this study are described in the following:

- The contributions to academy theory:
  1. The partner selection in traditional transaction-based environment is based on self-claimed ability and focus on the competence or capability to conduct the contract, so it is not

suitable for selecting an unknown candidate to be a partner to share and co-develop sensitive information. Our model adopts the reputation system and referral networks to obtain the testimonies from third parties about three trust types to evaluate the level of initial trust of partner candidates, and the trustor enterprise may select an unknown partner but with high initial trust.

2. The reputation system in traditional B2C or C2C is based on the subjective rating and general measure. This study adopts the objective testimonies, subjective ratings and variation of past behaviors to evaluate the partner candidates; additionally, we filter out unfair ratings of extremely high or low and give the older testimonies less weight. It makes the process of partner selection more fair and robust.
3. Josang (2007) depicted that “low incentive to provide ratings” was the problem in the reputation system. In this study, we adopt the concept of social network to propagate the testimonies (see section 3.4.2.1) that the recommender AG_2 notifies his friend AG_3 about the propagation event issued from the trustor. This concept can motivate the participants willingness to provide the testimonies or recommendation due to the social behavior and social relationship among friends and friends of friends like human beings.
4. Josang (2007) depicted that “change of identities” was the problem in reputation system; in detail, a party with low reputation may change his identity in order to cut with the past and start from fresh. The party change his identity will become a newcomer in the industry and it will be hard to be selected in our RBPS model. That is, the RBPS model can mitigate the problem above mentioned, but it also missed out to select a newcomer with fine temperament.
5. In the RBPS model, the concept of symmetric key was introduced for mitigating the problem like fake rating from the raters who had never interacted with the trustee. This

mechanism can keep the privacy of transaction records of trustees from releasing to the unrelated trustor. Also, it can secure the sensitive information transmitted in the public network.

6. This study develops a model for selecting a partner, with high level of initial trust, who has excellent competence, goodwill and predictability, based on subjective and objective testimonies using reputation system and referral networks. In contrast with AHP method, the RBPS model does not consider the weights of the criteria, but instead addresses how to identify the testimonies from the third parties and the weights of the raters. AHP method and RBPS model are complementary; that is, the weights of the criteria can be defined by AHP, and then the testimonies and the weights of raters are derived by using the proposed method.

- The contributions to practice and business:
  1. In a centralized propagation environment for selecting partners, enterprises select their partner from the limited number of partner candidates in the database. Therefore, our proposed method propagate the candidates based on the distributed propagation approach, it makes the enterprise to select partners from every possible industries, countries and technical fields.
  2. Camarinha-Matos and Afsarmanesh (2003) proposed a VE breeding environment (VBE) that was described in Chapter 2. The trustor can select trusted partners from the centralized repository, or find external partners in case some skill or capabilities are not available internally. The VBE (as centralized approach) and the RBPS model (as distributed approach) are complementary for selecting trusted partners internally and externally respectively.
  3. The RBPS model contains two phases to select the trusted partner. During the discovery phase, the trustor enterprise obtains the enterprises as partner candidates with the intention

of collaboration and gathers specific information such as trustee's industry ID. Thus, during the partner selection phase, it reduces the number of candidates and the trustor may only ask for his friends associated with the specific industry, and it can narrow down the searching scope and speed up the searching performance in the referral networks.

4. The RBPS model can really help the enterprise selects a reputable partner during the initial step of collaboration by using a systematic and quantitative way. For practice and business, this model can be implemented as an intelligent agent system and decision tool due to the complexity and complication in the process for propagation and aggregating these testimonies, and it can reduce the searching cost and accelerate the implementation of collaboration.

5.4 Limitations

- Discrimination and nepotism are the problems in the reputation system lead to unfair ratings that the raters always provide high ratings to the trustee due to the friendships of them. This study omits these two problems and assumes the raters give the fair ratings.
- The RBPS model can be implemented as a decision tool that automate the process of partner selection in the partner explore step, but can not substitute the human decision in the negotiation step.
- The quality of the testimonies for evaluating the trustees was assumed to be guaranteed in this study.
- This study tests the RBPS model by using data from computer simulation, not by the empirical data from the enterprise.
- The security issues in RBPS model for transmitting the messages among the participants are not the focus in this study.
- The newcomers with fine characteristics can not gain the advantage in reputation system and RBPS model.

- This study proposed the three trust types and related criteria to evaluate the partner candidates, but not defines the operational definition of criteria.
- This study develops the experiments as computer simulations to test the RBPS model as an effective method to select partner candidates with fine temperaments, but does not implement it to be a decision making tool.

5.5 Future Research Directions

- For newcomers, the future work of our RBPS model is to develop a mechanism that can filter out the newcomers with bad reputation in the past, but retain the newcomers with fine characteristics.
- Hartono (2004) depicted that the collaboration contains five phases, namely: (1) goal and purpose recognition, (2) partner exploration, (3) direction institution, (4) implementation and (5) termination. The main works in the third phase as “direction institution” are the negotiation about future collaboration between the participants. This study focuses on the second phase to identify a suitable partner. Next, we aim to develop a model for e-negotiation among the parties and it can be implemented via automated software agents.
- The weakness of the distributed reputation system is hard to evaluate the quality of testimonies provided by the identified raters. The future works are to develop a mechanism to examine the quality of the subjective ratings and objective records.
- To motivate the raters who will provide the testimonies via social relationships is not sufficient. The future research about this issue are to design a mechanism, includes rewards and punishments for the participants in the referral networks, to motivate the testimonies providers.
- The RBPS model can be implemented as a decision making tool by intelligent agents system using the agent modeling method like GAIA, Prometheus, Tropos and MASE. During the modeling, the

roles (as trustor, recommender, rater and trustee) will be defined, and the interaction between these roles can be described.

- To develop the mechanism for RBPS model that can mitigate the problems of unfair ratings due to discrimination and nepotism.
- To develop the operational definitions of the criteria about three trust types in each specific industry.
- To develop the security mechanisms for transmitting the messages among parties in the RBPS model due to the security issues are the critical factor in the B2B fields.