

Interaction of Open Innovation and Business Ecosystem

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Abstract

Open innovation breaks the original innovation border of organization and emphasizes the use of suppliers, customers, partners, and other internal and external innovative thinking and resources. How to effectively implement and manage open innovation has become a new business problem. Business ecosystem is the network system of value creation and co-evolution achieved by suppliers, users, partner, and other groups with self-organization mode. This study began with the risk analysis of open innovation implementation; then innovation process was embedded into business ecosystem structure; open innovation mode based on business ecosystem was proposed; business ecosystem based on open innovation was built according to influence degree of each innovative object. Study finds that both sides have a mutual promotion relationship, which provides a new analysis perspective for open innovation and business ecosystem; at the same time, it is also conducive to guiding the concrete practice of implementing open innovation.

KeyWords: *Open Innovation; Business Ecosystem; Self-service Technology; Structural Equation Model*

1. Introduction

Open innovation is an important feature of present technological innovation. It is also a main trend shown by current enterprise when it adapting to the situation of increasingly competitive economic globalization and acceleration of technological innovation. There are some uncontrolled factors in innovation process, so risks are brought for innovation. Enterprise will encounter the question on how to integrate and coordinate internal and external innovation resources (West & Gallagher, 2006) [1] when applying open innovation strategy. Chesbrough (2003) [2] pointed out that there were intellectual property rights, technological dependence and other risks when he initially proposed the concept of open innovation.

Business ecosystem theory gave the overall structure of value creation, value share and the research of new ideas in group co-opetition environment; it stressed cooperation, competition and co-evolution in system and the goal was innovation. Business ecosystem theory solved problem how to achieve synergies through cooperation in open network environment and broke through the limitations of traditional analytical methods. In addition, business ecosystem provided a new theoretical framework for innovation.

In recent years, some scholars have put forward innovative research ideas from the perspective of ecological system. West (2008) [3] presented major challenges in open innovation management by the case research of Symbian ecosystem. Li Haijian(2008), *et al.*, [4] considered that enterprises have to seek external cooperation at various stages of innovation, and brought public sector, users, suppliers and other external resources into innovation ecological communities; Chen Jin, Chen Yu-fen (2006), *et al.*, [5] considered the status of users, suppliers and partners should be enhanced, knowledge and resources of internal and external were fully used and integrated, innovative ecological system was built.

However, the existing researches are still lack of the specific research that combines business ecosystem with open innovation.

2. Literature Review

2.1. Open Innovation

In the late 20th century, with the development of information technology, the growth and diffusion rate of knowledge were speeded up. Therefore, market competition was intensified and product life cycle became shorter; complex and integration degree of technology was strengthened; thus research and development pressure enterprises faced was increased, and the close innovation of vertical integration no longer had continuity. Professor Chesbrough firstly proposed the concept of "open innovation" in 2003. It means that enterprises should change the original innovation thinking way, and combine internal and external technology with valuable originality organically. In open innovation mode, organizational boundaries are permeable and transparent and innovative ideas are generated inside organization. Organizational boundaries can also be obtained from outside by crossing organizational boundaries, including users, upstream and downstream enterprises and competitors in order to obtain innovation success.

Open innovation has been widely recognized, and becomes hot issues of research in the academic field of innovation in recent years. Scholars studied and explored open innovation from innovation stakeholder, technological innovation resource configuration, impact analysis of innovative resources, effective innovation management. Innovative mode, intellectual property rights, external resource acquisition, organizational structure, and other aspects are also included in their studies.

Bamford *et al.*, (2003) [6] thought that open innovation made competition become competition among systems teams. In open innovation context, organizations relationship played a vital role in the process of innovation motivation (Perkmalm, 2006) [7]. Simard (2005) [8] classified network relationships for the promotion of open innovation. Maula, *et al.*, (2006) [9] analyzed open innovation from the view of systematic innovation. He thought that enterprises should cooperate with suppliers and users and also need to cooperate with competitors as necessary. Chesbrough and crowther (2006) [10] studied the external validity problem of open innovation.

Rigby and Zook (2002) [11] put forward that whether enterprise and its industry were suited to adopt open innovation mode was judged from different latitudes. West (2006) [12] thought that enterprises had to establish a broad and deep relationship in order to implement open innovation. Dodgson and Gann (2006) [13] thought that in the open innovation mode, external knowledge was able to be identified, obtained and absorbed. However, it can be achieved only when enterprise developed new organization path and changed its organizational structure & culture Lichtenthaler (2007) [14] thought if enterprise wanted to adopt open innovation and similarly faced challenges like inefficiencies rate of external technology market, how to identify appropriate technical trading partners.

Yang Wu (2006) [15] summarized four backgrounds produced by open innovation. Zhang Jun (2008) [16] thought innovative capabilities of enterprises were enhanced through interactions of enterprises, research institutions, users and suppliers as well as government. Cooperation of provider, suppliers, users and partners with leading technology is conducive to getting market information and technical resources (Chen Yu-fen, 2009) [17]. Chen Jin and Chen Yu-fen (2006, 2007) [5, 18] thought that open innovation system should absorb more innovative elements and form multiage innovative mode based on stakeholder; they proposed that knowledge and resources of internal and external were fully used and integrated to build open innovation ecosystem and the success rate of innovation was improved.

2.2. Business Ecosystem

Moore used ecological theory to explain business operations in 1996. He suggested business ecosystems were considered from users, markets, products, processes, organization, risk takers, government and other aspects to lay a foundation for business ecosystem theory. Business ecosystem was one expansion system formed by mutual support organizations, including core producer, customers, suppliers, service providers, industry associations and government departments, *etc.* (Moore, 1996) [19]. In 1999, Moore proposed a business ecosystem structure and thought that core ecosystem included direct suppliers, sales channels, direct users, *etc.*; extended ecosystem contained suppliers of suppliers and users of users except core ecosystem; complete business ecosystem also included government departments and risk partaker as well as competitors, research institutions *etc.*

The research results with business ecosystem theory focus on the framework of basic concepts, ecosystem characteristics and other aspects.

Moore (1993, 1996, and 1998) [19-21] and Teece (2007) [22] described the basic characteristics of business ecosystem. It included complexity, openness, dynamic nature, competition and cooperation coexistence, evolution symbiosis, centrality, diversity, self-organization and flexibility. They also stressed that business ecosystem had vague boundary and presented network structure; it was an open system existing dynamic interaction between each symbiotic enterprises or between system and surrounding environment, so the relationships were competition and cooperation, and co-evolution; system was built around core enterprise, and members presented diversity, *etc.*

Adner (2006) [23] put forward that responsiveness of technology and market, co-innovation, *etc.* affected the health of business ecosystem. Iansiti (2004) [24] found that cooperative relationships of mutualism and co-opetition were built which was conducive to the long-term development of core enterprise and business ecosystem. Letellier (2005) [25] discussed commercial ecosystem building strategies of software middleware. Kasimoglu and Hamarat (2003) [26] discussed the impact of overlap degree of niche between enterprises on competition symbiotic relationship. Tian Xiu-Hua and Nie Qingkai (2006) [27] built the model on interaction relationship among enterprises in commercial ecosystem.

Business ecosystem surpasses the physical boundaries of traditional enterprise and is inter-enterprise architecture. It is a network of enterprises mutual contact and resource and information exchanges, and its core is based on the co-evolution of a mutually beneficial manner. Enterprise in business ecosystem shares the same breath and has a common fate. If wanting to develop and grow, enterprises have to be co-evolution with related members and mold an open businesses ecosystem with strong resistance. In business ecosystem, the enterprises form ecological co-prosperity sphere through complementary resources and capabilities. They research and develop new products through cooperation or competition and provide customers with core products and services.

3. Open Innovation Mode Based on Business Ecosystem

3.1. Open Innovation Risk

Open innovation breaks organization boundary, pays attention to the use of internal and external resources, and stresses labor division and cooperation. Because open innovation is implemented in relatively open environment and is a loose, flexible innovative mode. Although more new ideas and innovative thinking can be brought in, the difficulty and cost of management are also increased at the same time. In open innovation mode, enterprise can obtain necessary technology through outside world to reduce costs and improve product quality so that competitiveness can be improved. However, if it

excessively relies on suppliers and partners, the technical health state itself may be affected.

- **External technology dependent** For external environment of open innovation, enterprise can more easily obtain advanced knowledge and technology from suppliers, partners or research institutions. Therefore, enterprise independent innovation or motivation in search of other cooperation will be weakened. If enterprise excessively relies on specific suppliers. When problem appear in cooperation, there is also no substitute or other partners, which will likely lead to the collapse of original system and formation of technological dependence.
- **Complex process management** Open innovation eliminates the organizational boundary. The increase of innovation subject, difference of technology, management and resource capabilities and extension of innovation process increase the difficulty of process control and management complexity. Therefore, so various conflicts are produced among innovation subject and uncooperative phenomenon can occur at any moment.
- **Difficulties in intellectual property protection** Open innovation has contributed to the rapid diffusion of knowledge among service providers, suppliers and partners. However, this may lead to that part of innovation subject loses control of knowledge ownership. Under present intellectual property protection condition, as corresponding laws and regulations is not healthy, when enterprises use open innovation mode, the core technology may be difficult to be protected. Therefore, it will be difficult to produce the advantages of open innovation.
- **Market information leakage** For enterprise borders open, disclosures of core knowledge and business secrets maybe occur for project cooperation and information exchange in innovation process. Theft of product and user information by service providers and market strategic information caught by suppliers may occur in cooperation process. Information leakage and other things occur during users participate in innovation process.
- **Resource capacities are mismatched** In open innovation mode, the resources and capacity of each subject are uneven and mismatched which will often create obstacles on some key nodes of innovation activity. They affect the overall innovation process, which will be transferred to external subject of innovation.
- **Other risks** Target predicted by innovation has uncertainty, and each subject has inconsistent understanding for innovation goals. Other factors such as the sharing degree of technology and information, heterogeneity of corporate culture, complementary effect of technical resources and so on. They will all lead to the risk of open innovation.

3.2. Construction of Open Innovation Model Based on Business Ecosystem

The core of open innovation is that users, suppliers and partners can be integrated into design and development processes. Under open innovation paradigm, when the technological innovation capability is improved, the statuses of users, suppliers and partners should be enhanced. Knowledge and resources of internal and external are fully utilized and integrated. For system and standardized managements of innovation resources and enhancement of innovation participation efficiency, this partnership should be solidified, and innovation ecosystem is built; innovation technology and market uncertainties are reduced, and continuous innovation ability is created.

Core enterprise is able to organically unite users, suppliers, partners, competitors, and other members into a whole through business ecosystem. This is because the interests of all parties are solidarity. Bilateral cooperation is based on complementary of resources

and technical capacity, and various elements together will produce great benefits. In innovation cooperation, a relatively stable cooperative relation can be formed; there is a common goal and a cooperation platform, cooperation processes and management standards are established; a stable innovative community is gradually formed to reduce risks brought by open innovation.

According to open innovation mode and business ecosystem structure, open innovation process is embedded into business ecosystem framework. Then, a theory model of open innovation based on business ecosystem is built which is shown in Figure 1.

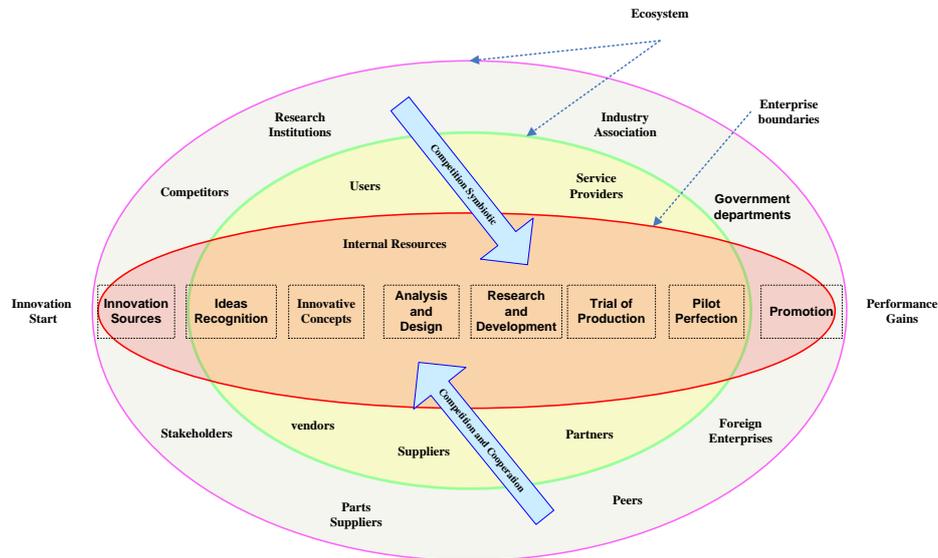


Figure 1. Open Innovation Model Based on Business Ecosystem

Under open innovation scenario based on business ecosystem, managers and employees of internal enterprise and external users, suppliers, partners, et al. are important innovation resources and participants. They play important roles in innovation. This model contains multiple main innovators such as producers, users, suppliers, partners and external environment, *etc.* It reflects the open innovation process of business ecosystem formed by many subject.

- **Innovation sources** Innovative ideas can be from managers and employees within enterprise and also from users, suppliers, partners, and et al. of business ecosystem to increase the channels of creative sources. They can be beneficial to obtaining more thought and increase choices margin.
- **Ideas recognition** Creative identification can be completed by enterprise itself and also made by with the other members of ecosystem together; they together screen out immature undesirable innovative ideas to improve innovative feasibility.
- **Innovation concepts** Originality forms innovative concept through identification process, and users, suppliers, *et al.*, of business ecosystem participations help to accelerate maturity and stereotypes of innovative concept.
- **Analysis and design** After the formation of innovative concepts, users, suppliers, et al. will provide analytical thinking according to its own technology and market capacity; information exchange in ecosystem helps core enterprise to make decision on their own research and development. It offers to other members of business ecosystem according to the direction of eco-development.
- **Research and development** Other members in business ecosystem participate in research and development stage which is particularly critical; user participation can

ensure product direction and experience goodness, and suppliers can provide a variety of technology support; on the premise that ecosystem stability is ensured, innovation activities are jointly led by core enterprise, suppliers, partners, *et al.*

- **Trial of production** In trial process, the suppliers and partners of system members can provide good technology platform and essential trial service to lower huge cost required by alone trial of core enterprise.
- **Pilot perfection** Experiments on product can be made in users, suppliers and peers of ecosystem, and product quality is improved, which will increase the innovation success rate according to pilot condition.
- **Promotion** Members of ecosystem jointly improve technology platform, interface and product according to pilot condition, make optimized products quickly marketed to gain income and achieve exaltation of innovation performance.

3.3. Perspective Open Innovation Analysis of Business Ecosystem

In implementation process of open innovation, according to the status of its own resources, the best members should be selected in different innovation stages to form a business ecosystem. Through effective connection with the external factors of innovation, external innovation resources are obtained from multi-channel to compensate for the lack of internal resources so as to promote innovation.

In the market, core enterprise select suppliers, service providers or partners separated from their own ecological niche to form a business ecosystem for co-innovation. Various members form a community of interests through co-opetition to reduce the risks and costs of innovation and maintain the balance of business ecosystem. Generally speaking, core enterprise focuses on design, research and development of product; suppliers provide necessary technical platform support; service providers provide technical services; for ecological niche separation of various members, there is no competition relationship, thereby a formed business ecosystem is relatively stable.

Government departments, industry associations and other external stakeholders are external causes for impact and maintenance of business ecosystem functioning. Government departments play their rigid constraints with alternating complementary action in business ecosystem through legal and institutional arrangements. Government departments also gather core business, suppliers and users together to form a stable ecosystem to promote the success of technological innovation.

Relationships established by core enterprise and other members in business ecosystem are based on trust, cooperation, win-win situation and a strategic partnership of information sharing, risks sharing, common benefits; innovation cooperation relationship of various parties is all-around, and information sharing between them maintains coherency and consistency. Various members take full advantage of system's resources and information, jointly design, develop, produce and sell through labor division and cooperation, gain benefits together finally, and achieve mutualism.

4. Case Study of Business Ecosystem under Open Innovation Mode

Although the trend of open innovation can be predicted, open innovation does not apply to every technology and industry class. The self-service technology is a kind of new services business mode based on software and hardware technologies. When measured from versatility of innovation, incremental innovation requirement, innovative multi-style, multi-subjectivity of innovation process and the novelty of business mode, it is suitable for open innovation mode.

China's self-service technology was first used in banking industry. At present, electronic business distribution rate of large bank is generally up to 70%, one of the most common application is automated teller machine (ATM) and internet banking; at the same

time, since ATM innovation contains hardware technology led by suppliers and parts suppliers, the commercial bank's ATM is selected as empirical study object. And, the conclusions will have universality.

4.1. Relationship Model of ATM Open Innovation

ATM is a complex combination system of software and hardware; hardware includes host computer, cash access module, card reader, password keyboard, *etc.*, and software has system platform, service pack and applications system. In innovation process, bank focuses on service products, and the improvements of hardware technologies needs the help of whole machine providers and parts suppliers. ATM technology innovation characteristics decide that open innovation mode should be used. In innovation process, it is necessary to enhance the status of customers, suppliers, *etc.* It is also important to take full advantage of and integrate knowledge and resources inside and outside banks, form a business ecosystem system and create continuous innovative ability. According to long-term observation and analysis, the open innovation relationship model of commercial bank's ATM is shown in Figure 2.

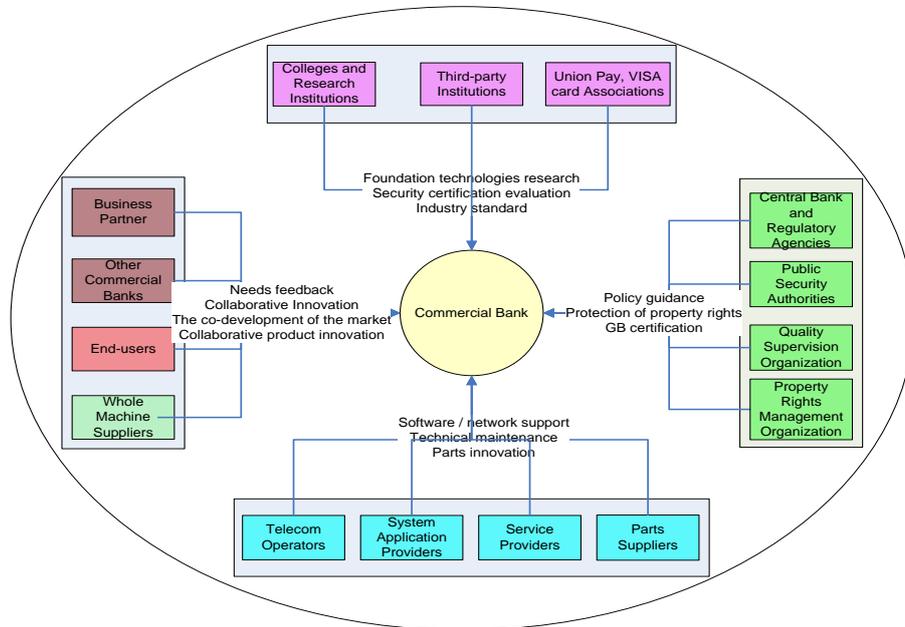


Figure 2. Open Innovation Relationship Model of ATM

4.2. Mechanism Analysis of Open Innovation on ATM

- **Users** The result of technological innovation is to meet users' needs; ATM main function is to provide users with query, deposits, withdrawals and other financial self-services, and user needs are the most important source of innovation. To improve user's perception, layout, control design, location design of hardware components and man-machine interface of ATM are all built on the basis of in-depth and accurate understanding user needs. In the process of innovation and design, user involvement and experience play very important roles.
- **Suppliers** At present, financial functions have become more and more complex. Many product innovations need the support of hardware technology and cannot be completed if solely relying on the bank's own R & D department. Therefore, supplier participation will improve the efficiency of innovation and reduce costs; in turn, good interaction of banks and suppliers provide innovative source for suppliers.

- **Business partners** In ATM innovation, the business partner's knowledge, information and technology are important sources of innovation. Micro-payment, purchase water, phone recharge and other middle business products are typical cases of co-innovation. Innovative cooperation is conducive to quick access to development stage of service product; meanwhile, as partners have an accurate grasp of market information, the costs and risks of innovation can be effectively reduced.
- **Service providers** Service providers are in the first line of equipment technical maintenance. They clearly know equipment operation, performance, hardware and software technology situations in the actual use are playing a more important role in equipment suppliers. Therefore, service providers were often invite to participate in ATM innovative projects.
- **System application providers** ATM is a combination of hardware and software. In some project of innovation and the participation of system, application providers are needed to provide necessary technical solutions for banks in the field of special technology.
- **Industry association** In ATM inter-bank product innovation, it is essential to take into account Union Pay, VISA card and other industry association actions. At the same time, industry association also share market information with banks and provide the users needs of products for banks, which will improve the success rate of innovation.
- **Peers** Peer is both competitors and may be also the object of innovation and collaboration. Peer collaboration helps to jointly expand, cultivate market and spread technology diffusion so as to obtain final innovation success. In innovation process, market demand is known by tracking advanced technology and products dynamic of industry leader.
- **Research institutions** Research institutions as the providers of technical resources and innovative ideas, provide technologies, products and management knowledge to make up for the lack of internal innovation resources. Colleges are knowledge gathering place, so banks often cooperate with them to hold product originality contest in order to extend ideas for product innovation.
- **Government departments** Government departments provide policy support environment conducive to innovation for bank by formulating relevant laws, regulations and technology policies. In current Chinese financial environment, policies and regulations have major impacts on bank's ATM innovation.

4.3. Research Methods

To verify impact situation of each main subject in ATM open innovation process, by the reference of related literature on open innovation and service innovation, data was collected by questionnaire. Survey selected experts and staffs who were engaged in ATM's management or participated in research and development project in A bank head office, R & D centers and various branches; 196 questionnaires were collected, after collation and summary, a total of 151 valid questionnaires were get.

Data were analyzed by using SPSS 18.0, and KMO coefficient of scale was 0.830, then convergent validity was suit for factor analysis. The measurement factor loading of scale was between 0.555 and 0.90; the alpha coefficients of each measurement were between 0.710 and 0.880, and convergent validity and reliability of measurement data were better.

Validation analysis of innovation relationship model was made using structured equation model; that fitness of measurement data of scale and model was better known after computations were done using AMOS18.0 software and concrete path analysis results are as shown in Table 1.

Table 1. Analysis Results of Impact Factors of ATM's Open Innovation

Variable Relationships	Estimate	C.R.
Users→ATM Innovation	0.489	7.668
Suppliers→ATM Innovation	0.356	4.658
Partners →ATM Innovation	0.312	3.810
Service Providers →ATM Innovation	0.073	2.518
Peers→ATM Innovation	0.013	2.238
Government Departments →ATM Innovation	0.205	2.302
Research Institutions →ATM Innovation	0.026	3.318
Parts Suppliers →ATM Innovation	0.156	2.867
Industry Organizations→ATM Innovation	0.016	1.980

Note: ATM - Automated Teller Machines

It can be concluded that users, suppliers and cooperation partners, service providers, government departments, *et al.*, with ATM innovation are all significantly positive correlation from verification and analysis results. The participations of users, supply providers and other innovation subject promote the innovation of ATM.

It is realized from the path coefficients of measurement model and measurement scores of observed variables that the participations of users and suppliers improve ATM innovation success rate more significantly than other subject. User demand is the directions of new product ideas of ATM, and the perceptions of users on innovative products and service are the most important factor determining whether innovation is successful or not. Because suppliers are familiar with hardware technology and peripheral systems knowledge, intimate communication with suppliers can reduce design uncertainty and product development risks in product innovation process.

Partners' impacts are second only for user and suppliers which differs with original thoughts. In current competitive market, the reinforcement of technical cooperation between enterprises becomes an important way to break through the constraints of their own resources. Large enterprises as commercial banks with great capability also realize this. It will be able to introduce service products that are more in line with customer needs to obtain a competitive advantage.

Although parts suppliers have positive role on ATM innovation, and even though the role paths to suppliers are added, and the impact is also not obvious. Banks are generally in a dominant position in innovation cooperation, and technological innovation requirement of parts suppliers is often conducted through whole machine supplier.

Research institutions have influence on ATM innovation, but it is not obvious, viewing from data analysis. ATM is a mature application technology and rarely involves basic technology innovation. At the same time, ATM is a cash-equivalent technology platform and perception risk and safety has impact, and the bank is relatively conservative during innovation. It is found from the survey that investigators generally agree that ATM innovation can learn from the latest research results of scientific research institutions. However, in the actual process of innovation, the role of research institutions is limited.

Analyses results show that peer and service provider have limited impact on ATM, so it can be seen that the both have difficulty in playing key roles in successful innovation. For peer, possibly out of competition attitude, respondents thought that peer have not play a role in ATM innovation. For service providers, their main factors are similar to parts suppliers.

Union Pay, VISA and other industry organizations have certain roles on ATM innovation. Through further analysis, in survey about whether industry organizations are conducive to innovation, management and R & D design persons gave more positive answers. However, applications investigators were fewer. The former is familiar with ATM innovation process, and it is thought that in product innovation. It is necessary to consider the role of industry organizations, and is expected to share market information

with them to improve the success rate of innovation; but to the latter, service product innovation process is relatively transparent, so they think that industry organizations cannot play very important roles in innovation.

As the respondents were generally technology managers of bank, and for government departments influences in ATM product innovation, they mostly gave positive replies. Currently, protecting awareness of public on their own information grows stronger; meanwhile, ATM is terminal equipment to face mass users. Therefore, in ATM innovation, whether it is compliance with the policy of government departments and regulatory requirements is an important factor which should be considered. The survey data also show that government departments have very significant roles on ATM innovation.

4.4. Business Ecosystem of ATM Implementing Open Innovation

According to SEM analysis results, for the ATM innovation of commercial banks, impacts given by users, suppliers and partners are the great. Government departments and parts suppliers are second, the last are industry organizations, peers, research institutions, and service providers. By combining structure characteristics of business ecosystem, business ecosystem of ATM's open innovation is built as shown in Figure 3. Users, suppliers and partners belong to core business ecosystem. Government departments and parts suppliers are members of extended business ecosystem, while industry organizations and peers are attributed to complete business ecosystem. Compared with Moore's business ecosystem structure, the core ecosystem members of ATM innovation basically agree. At the same time, government departments have more significant impacts on ATM innovation. They enter extended ecosystem from complete ecosystem which is slightly different with system structure proposed by Moore.

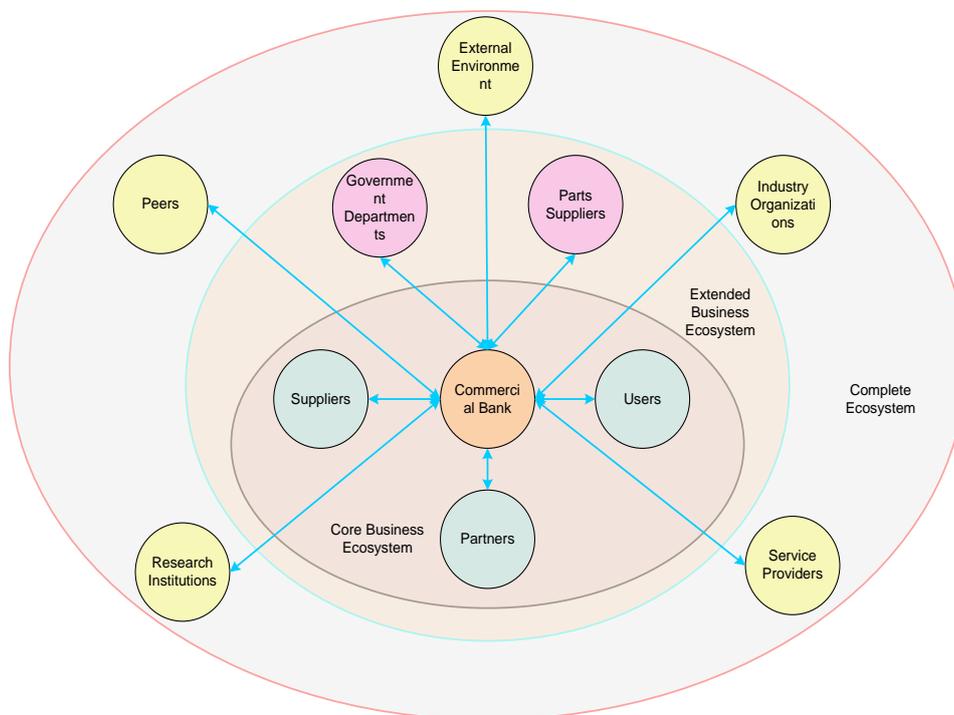


Figure 3. Business Ecosystem Structure Model of ATM in Implementing Open Innovation

4.5. Business Ecosystem Analysis of Open Innovation on ATM

In business ecosystem of ATM open innovation, because all members markets are not the same, mutual competition is not produced among banks, users, partners and suppliers, as well as research institutions, service providers, *et al.* Due to the use of same resources, and dependent parasitic relationship does not exist between banks and suppliers. Therefore, commercial banks and suppliers, partners are a symbiotic relationship; innovation cooperation can achieve the sharing of technology and resource, reach the complementation of platform advantages, and overcome the defects of single innovation. User involvement in innovation allows commercial banks to develop products more suitable for their own needs; partners expand business channels through cooperation with banks. Suppliers participate in innovative projects to optimize technical equipment and platform; equipment demand is increased in turn. Various members establish a reciprocal symbiotic relationship, which is conducive to multi-win and the long-term development of business ecosystem.

According to the theory of business niche, resources demands of commercial banks, users, suppliers, partners, service providers, *et al.*, have low similarity. Product technology and market are not close, so their niche overlap degree is low, and there is no competitive relationship basically. In current environment, for banks or users and suppliers, the niches widths are all very long and optional range is larger.

Viewed from capital, technology, talents and other enterprise resource endowments, banks in the business ecosystems occupy a major niche and have a big influence on the whole system. The system stability depends on whether bank has a strong innovation ability to develop new products, and if products launched by banking innovation are not accepted by users. They will fall behind in fierce market competition and decline in demand for equipment to directly affect suppliers; to customers and partners, they will have to choose other banks so as to increase conversion cost. Therefore, in the ecosystem, bank's ability to implement open innovation determines the stability and robustness of ecosystem.

In ATM innovation process, as commercial banks occupy certain leading role, they easily organize members such as suppliers, users and partners. They can quickly respond to market conditions and changes, provide users with better products and services and improve the competitiveness of business ecosystem. In actual survey, it is found that as a result of a "interdependent prosperity or loss" relationship between all parties, compared with banks, suppliers and parts suppliers have weaker strength and have the strong sense of belonging to banks as core enterprises. Therefore, the binding force of ATM innovation business ecosystem is high and the ability to jointly withstand external short-term risk is also strong.

5. Conclusions

In response to the new challenges of technology and market, enterprises should choose open innovation route. However, transparent organizational boundaries and characteristics of many subject participation determine that there exist risks such as technology dependent, complex process management and mismatching resource capabilities. Business ecosystem theory provides co-opetition analyses of multiple groups, evolution and innovation. This study started from the analysis of open innovation risk; then open innovation process was embedded into business ecosystems and open innovation mode of business ecosystem perspective was explored. At the same time, using case study method, on the basis of influence condition of each subject of open innovation, a business ecosystem was built. The study shows that business ecosystem promotes open innovation, and open innovation strengthens the business ecosystem in turn.

5.1. Open Innovation Promoted by Business Ecosystem

- **Extension of innovative source** In open innovation mode, innovation is based on multiple stakeholders, the value creation is achieved. From the view of stakeholders, business ecosystem including users, suppliers, partners and government departments, which are just internal and external innovation sources of open innovation mode. By forming a business ecosystem, the innovation participation enthusiasms of system members are aroused. Then a full range of open innovation is truly realized to achieve multi-agent and multi-angle dynamic cooperation in various stages of innovation process.
- **Promotion of information exchange** By building a business ecosystem, a mechanism for mutual trust is established to achieve information exchange and knowledge sharing of various members. Business ecosystem has a clear goal in allusion to different stakeholders, closes relationship among various members, constantly improves its system range through information feedback mechanism. It absorbs various kinds of knowledge outside system and creates network system for promotion of information with knowledge conversion in order to achieve open innovation.
- **Reduction of innovation risk** Each member is ultimately tied to the destiny of business ecosystem; the formation of business ecosystem strengthens contact of enterprise with suppliers and user, and innovation has more pertinence. At the beginning stage of innovation, user participation reduces blindness. Through partners in system, market blank areas can be aimed at, and product is innovated, then product structure is adjusted. Supplier participation makes technology platform with service products have better adaptability to increase innovative success rate and these will all reduce innovation risk.
- **Improvement of innovation management efficiency** Business ecosystem allows various enterprises to regulate members relations problem within ecosystem from the perspective of whole and development. Management plan of innovation process is deployed in business ecosystem members; various members cooperate with each other and advance toward a common goal to reduce innovative conflict, improve the synergy of innovation. They shorten innovation management process and make innovation process controllable. The establishment of business ecosystem is conducive to the implementation of effective management to ensure that enterprise is able to accept and take full advantage of innovation. Different members can provide good assessment feedback mechanism; easily form a kind of innovative support atmosphere.
- **Innovation performance upgrading** Business ecosystem can enhance links among various members; because the ecological prospect restricts enterprises development, the health and the development of business ecosystem affecting the development of various members. The good cooperation relations among system members can enhance technical capacity and opportunity window. Good communication among members and a higher degree of interdependence are convenient for the sharing of resources and capabilities; trust with each other can reduce transaction costs, which is beneficial to reducing friction in innovation process and mutual cooperation between each other so as to promote the enhancement of financial performance.

5.2. Business Ecosystem Strengthened by Open Innovation

- **Reinforcements of system robustness** Open innovation breaks the innovation boundary of enterprise; capital, technology, talent and other resources can be derived

from exterior. R & D activities can be completed through cooperation to improve innovation capacity and technical ability of interior, which helps to enhance the robustness of business ecosystem. Open innovation is based on complementary knowledge and resources. In innovation cooperation, a reasonable distribution of benefits and incentive mechanism can be formed so as to form relatively stable innovative community and enhance the stability of business ecosystem.

- **Promotion of symbiotic evolution** Through open innovation, innovation resource sharing and complementary advantages are achieved, which will overcome the defects of single innovation and unit resource lack. Innovation members share information resources and innovative expertise with each other to promote business ecosystem mutualism. Open innovation can create self-organizing and self-catalytic competition mechanisms to promote self-regulation and self-repression symbiotic mechanisms and lead the occurrence and development of business ecosystem.
- **Prevention of niche overlap** Open innovation extends the ecological widths of innovative subject, ensure that each innovation member does not produce the same kind of products. It has the same users group, and unlikely the same niche to cause niche overlap. Through open innovation, enterprises can sell others new technologies who will not present a threat to their own and transfer own demand understanding to suppliers and users. This process avoids competition with members within business ecosystem and prevents niche overlap.
- **Increase of system diversity** Open innovation promotes many types of technology elements. Its activities which can ensure that each subject has continuous adaptability on changes in business ecosystem environment, form differentiation resources and capabilities and fill niche vacancies. They are beneficial to enriching repository of business ecosystem, increasing system diversity, and improving the stability of ecosystem.

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