

Value Added from Knowledge Collaboration: Convergence of Intellectual Capital and Social Capital

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Abstract

Efficiency of team knowledge management in outsourcing plays a vital role in competitive advantage building. Knowledge collaboration (KC) is a strategy method of knowledge management, which pay more attention not only on efficiency of knowledge cooperation, but also on value added of intellectual capital and social capital. In this paper, the nature of KC and its relations with intellectual capital and social capital has been discussed firstly, then a KC performance evaluation system has been proposed, which combined two aspects, collaboration effect measurement through value added count and cooperation efficiency measurement through accuracy and timeliness calculation. This evaluation system is very benefit for KC research and practicing.

Key Word: *Knowledge collaboration, Intellectual capital, Social capital, value added view, evaluation system*

1. Introduction

Recent organizational trends show an increase in the formation of collaborative networked organizations (CNO) to improve competitive advantage, and provide world class excellence and flexibility to address dynamic and turbulent market conditions. Collaboration of various forms can increase profits by improving chances to capture valuable business opportunities, address market demands and share resources and competences in very competitive and rapidly changing environments. IT service outsourcing is a typical CNO which is comprised of different firms of clients and service providers. Thus, it is very important to collect, share, transfer and use knowledge within virtual team members of IT outsourcing. But there are two tremendous difficulties to balk effective knowledge work, which are widely known as customer knowledge dependence and tacit knowledge transfer. As different firms, outsourcing client and its supplier have different recognition, asymmetric information, variable and opportunism partnership (Zhao, 2012) which usually block knowledge transfer from client to supplier. Even in supplier firms themselves, the team members may be physical distributed, or belong to different teams, or have less understanding of tacit knowledge (Zhou *et al.*, 2012; Divya, 2012; Hongling Li, 2009) which usually block knowledge transfer between knowledge workers, especially the tacit knowledge transfer. In many firms it is difficult to find out who knows who, and who knows what. Employees waste many times on re-researching topics or making decisions that are not based on the company's best thinking.

Knowledge transfer is a field of knowledge management (KM) that transferring knowledge from one set of individuals to another. Transferring knowledge across global boundaries has become an important factor for organizations to success. Most research blames the failure on transferring knowledge is main cause for poor project management together with lack of executive sponsorship (Reich, 2007), and the fact that there is very little knowledge transfer and sharing between project teams has to play a key role in allowing these failures to occur. Since knowledge transfer is usually one of the first tasks of transitioning to an outsourced model, it is sometimes overlooked or under-planned, resulting in a shaky start to the outsourcing relationship (Warner and Brown, 2005).

Knowledge collaboration (KC) is not just as knowledge transfer or sharing. According to Cambridge University Press, knowledge is an understanding of or information about a subject

which has been obtained by experience or study, and which is either in a person's mind or possessed by people generally. Meanwhile, collaboration is when two or more people work together to create or achieve the same thing. So we can understand that Knowledge Collaboration is two or more people collaborate to create and build the knowledge through a structured platform in order to achieve the objective. As we seen now, intangible assets (often another term for knowledge) play a significantly more important role than they ever did before. To take full advantage of their intangible assets, companies are increasingly seeking out knowledge collaboration solutions that combine customer knowledge and widespread innovation in products and markets with sustained improvement of core capabilities and associated business processes, leading to the ultimate competitive advantage.

Current efforts in managing knowledge have concentrated on creating, sharing and storing knowledge while business problems require the combined use of these intellectual resources to enable organizations to provide innovative and customized services. KC has been a new developing research fields (Zehua tong, 2012) of KM. To understand KC well, we can focus on the effectiveness and preciseness of knowledge transferring in details (Glogel *et al.*, 2006), as well as on the '1+1>2' synergy of knowledge cooperation and value added of intellectual capital in the whole(Chen *et al.*, 2002). Knowledge collaboration takes innovative thinking for IT outsourcing companies to improve their performance of KM. Base on KC thinking, IT service vendor can put the add-value evaluation of intellectual capital into an important position to guide the rapid accumulation of business knowledge, so that the problem of customer knowledge dependence should be partly solved as well as the vertical industry advantage can be created gradually. Also they can take the add-value evaluation of social capital in the same way to enhance knowledge transferring/cooperating among employees, customers, team members, so that the dilemma of tacit knowledge transferring should be partly improved and trusts between employee and customers can be built.

This paper is based on the service provider perspective of outsourcing. Firstly, for understanding the requirement background of KC, we first discuss the characteristic of knowledge cooperate in outsourcing virtual team. Secondly, with the considering of intellectual capital theory and social capital theory, we investigate the connotation of KC, aims at the efficiency and effective evaluation of KC of virtual team. Finally, we establish a performance evaluation system of KC and propose its application occasions.

2. Literature Review

2.1. Knowledge Transfer in Outsourcing and its Performance Evaluation

Service outsourcing is a kind of complex and across-organizational relation network which comprised client and provider firms with continuous knowledge interactive. This network is obviously a relationship-oriented, and is accompanied by constantly formal and informal knowledge transfer during project lifecycle. So it is a relation pattern of knowledge-intensive (Zhou *et al.*, 2012). In the knowledge transfer process, service provider should pay more efforts to get business knowledge from client firms, and integrate internal and external knowledge assets to deliver knowledge products conformed to customer requirement. But, service provider firms always face a dilemma of knowledge integration (Zhao&Zuo, 2011). Because of the complexity of knowledge itself, incompleteness of contract, differences of organizations, and protective behaviors of client business knowledge, knowledge transfer between client and provider firms always didn't performed as expectation.

Previous researches have concentrated on the influencing factors of knowledge transfer between client and service provider firms. They also pay more attention on the relationship of outsourcing performance and knowledge transfer (Lee, 2001; Karhu *et al.*, 2007; Liu *et al.*, 2010; Tianye *et al.*, 2011). The research indicated that knowledge sharing among partners, knowledge achieve capabilities of supplier all play more important roles to get better outsourcing performance or outsourcing successful.

When talking about the outsourcing performance, there is a common view that three indexes, project quality, cost and customer satisfaction, are mostly critical(Den *et al.*, 2008;

Zhou *et al.*, 2012). In most cases, social capital has been looked as preconditions, to be studied with knowledge sharing/transfer, KM capability and outsourcing performance (Tian, 2011). With outsourcing project success, few seem to care the change or add-value of enterprise intellectual capital and social capital caused by knowledge sharing/transfer. In fact, if outsourcing vendors focus solely on project itself, ignoring how much new knowledge achieved, how many employees evolved and raised their capabilities, and how much relationship getting better among employees and customers, in summary, ignoring value added of intellectual capital and social capital, they always shouldn't get competitive advantage for long-term sustainable development. Thus, the add-value of intellectual and social capital get from project performance should be pays more attention not only in researching but also in practicing.

2.2. Knowledge Collaboration

Karienzig(2002) proposed the concept of *Knowledge Collaboration(KC)* at first. He considered it as a strategic organizational approach that dynamically builds upon internal and external systems, business processes, technology and relationships (communities, customers, partners and suppliers) to maximize business performance. KC demonstrates the extent to which a corporation has institutionalized processes for knowledge creation, capture, sharing and reuse as a fundamental means of creating value. These capabilities produce the greatest value when they are embedded in the fabric of an organization's culture, values, processes and reward systems, Corporations that want to succeed in the networked economy need to master knowledge collaboration. After that, other scholars defined KC as a knowledge activity(Mckelvey *et al.*, 2003), organization capability(Glogel *et al.*, 2006) or management mode and strategy means(Fang zhiping,2007) at the firm level, and as a special relationship pattern at the industry or supply chain level (Yang Lijun,2011). Tong (2012) defined KC as a multidimensional dynamic process, in which all these factors, involves subject, object, environment of KM, interact to a highly synergy situation, so that the right knowledge or information can be transferred to right object just in time. So it is a highly development phase of KM to integrate knowledge resources and flows. Based on the definition of KC, most researches in China focus on the process analysis of knowledge collaboration up to now (see Table 1). And with this table, we can conclude as follows: firstly, KC aims at knowledge creation, that's means there should be new knowledge produced at the end of KC. Secondly, KC contains many kinds of knowledge transforms, such as knowledge sharing, transfer, internalization and Externalization. Thirdly, in the process of KC, there are knowledge searching, knowledge transfer and creation sub-processes.

Table 1. Literature review of KC Process study in China

Author	Process of KC	Remark
Zen Deming, WenXiao et al.(2010)	Knowledge achievement, transfer and creation to get new knowledge	Supply chain level
Wang Congying, Guan Xiaodong(2009)	A closed-loop process of discovery, innovation, dissemination, and re-discovery.	Industry cluster
Tong Zehua (2012)	Contains requirement of KC, define subject of KC, activity of KC, achievement of KC and so on	Base on process
Shi Huibin (2008)	A 4-tuple process model of KC: environment,activities(relevant, reconstitution, integrate, collide, interact, share), knowledge flows (transfer/transform, internalization/Externalization) and Goals	
Wu Shaobo et al(2008)	Knowledge sharing/transform/KM/knowledge creation	
Wang Yue(2009)	The core processes of KC are knowledge achievement, discovery, processing, dissemination and sharing, use and innovation.	

2.3. Effect Measurement of KC

Synergy means the interaction of elements that when combined produce a total effect that is greater than the sum of the individual elements, contributions, *etc.* KC just is to integrate knowledge resources (elements) to get synergy effect of $1+1>2$. Knowledge synergy is the additional value that is generated by combining two or more information or knowledge objects, creating new knowledge that would not been available to these objects independently. Shi(2008) analyzed the connotation of KC, pointed out that the KC effect is the sum of expectation goals and its additional value, which reflect the aggregation of marginal change in KC activities through the time. Then the effect of KC can be defined as:

$$E = f(k_1, k_2, \dots, k_n) + \varphi(r_1, r_2, \dots, r_m) \quad (1-1)$$

Where as, E is the total effect of KC, $f(k_1, k_2, \dots, k_n)$ is expectation goal effective function, and $k_i (i = 1, 2, \dots, n)$ is knowledge unit attached to behavioral agent. $\varphi(r_1, r_2, \dots, r_m)$ denotes add-value of expectation goal function, which means the synergy of KC, and $r_i (i = 1, 2, \dots, m)$ denotes activities in the collaboration process.

Wang(2009) had a similar understanding about KC effect that it is interrelated with fore factors, subject A , object O , medium M and circumstances C . Then the KC effect of business group can be expressed as a math function:

$$P = F(A, O, M, C) \quad (1-2)$$

Although these researches have discussed the elements and its function of KC effect, but only too qualitative and conceptual. Many problems haven't been noticed and put forward in research, such as the characteristic of add-value, the measurement method of add-value, how to promote the add-value creating, and so on. Thus the mechanism of KC should be analysis deeply and innovation research design.

3. KC and Add-value from Enterprise Capital

The business mode of outsourcing result in the difficulty of KC of virtual teams (Fang,2011). The outsourcing virtual teams are comprised of members belong to different organizations, and even be divide into front-office customer teams and back-office technology teams in offshore-sourcing. The distributed teams cross time and space create the issue of textual lack and tacit knowledge transfer obstacle; the cross organizational team form bring the obstacles of management and coordinate; the cross countries culture made the situation obstacle of knowledge transfer. All these obstacles make it very difficult to manage knowledge sharing or transfer. KC just wants to coordinate multi-subjects to overcome variance difficulties and make a highly effective knowledge cooperate situation.

3.1. Intrinsic of KC

Outsourcing firms bring their excellent intellectual resource into virtual teams, combine business knowledge and IT knowledge into new products delivered to client firms. In this process, it is essential for knowledge workers to frequently cooperate with knowledge transform, to integrate knowledge resources creating new knowledge. KC or synergy is the composite reflect of the process and effect of team cooperation.

In the micro-layer, Leijen and Baets (2002) pointed out that KC is such a situation that, when a knowledge asker recognized his disablement of a problem, and a knowledge provider posses this ability exactly, then they can integrate mutual knowledge to solve this problem just base on their agreement and available time and space. In the macro-layer, Chen&chen(2002) believe that KC enables enterprise to integrate internal and external knowledge resources to get more great value of organization learning, use and creating

knowledge than the sum of independent component. It is aim at the synergy effect of $1+1>2$. In summary, KC's focal point is 'exact and just' in micro-layer and add-value in macro-layer.

Based on the multilayer understand of KC above, four characteristics of KC which is different with knowledge sharing/transfer, are indentified as follows:

Integration, knowledge subject, object, time and environment should be integrated as a whole process.

Accuracy, knowledge or information should be transfer just in time and exactly for the special problem.

Dynamic, the collaboration process is highly associated with time.

Add-value, the KC process has the goal to create new knowledge, and make add-value for social capital and intellectual capital at the same time.

3.2. KC and Social Capital

The concept of Social Capital had been proposed by sociologist Bourdieu firstly. It refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Increasing evidence shows that social cohesion is critical for societies to prosper economically and for development to be sustainable. Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together. Originally, it had been defined as a capability of individual to obtain external resource via social relationship network (Zheng *et al.*, 2008). Soon after it has been extent to many fields and layers, such as group, enterprise, region and country and so on, emphasizing that it is a united capability produced through social mechanism by inner members(Wang Fengbin, 2008). Ke *et al.*, (2007) pointed out that no matter in micro- or macro-layer, social capital has two key characteristics, which are resources employment and social cohesion.

The goal of KC is to create new knowledge, which essentially is a socialization process. In the classical SECI model, three of four knowledge-creation phases all contain social interactions, which are Socialization, Externalization and Combination. Social interactions between individuals lead to social network creation naturally and knowledge creation based on the network. From the epistemology view, there are three patterns of knowledge creation, which are *Cognitivists*, *Autopoietics* and *Connectionists*. Obviously, knowledge creation based on KC is consensus to *Connectionists*. Knowledge individuals triggered the connection between them via collaborated problem solving. Further more, *Connectionists* also introduce the concept of social capital into KC. Social capital is the benefit, value or assets produced by social connection and interaction. In case of analyzing knowledge creation, researchers usually take social capital as one of the most important factors (Nahapiet, 1998). Many empirical researches about knowledge creation often begin with the influence study of social capital (WaHung, 2006 ; Brambila *et al.*, 2008; Artigues, 2009).

Those characteristics of outsourcing virtual team, such as across time and space, across organization boundary, across culture, make it difficult to sharing/transfer knowledge and team members should get social capital via their social network to overcome these obstacles and create new knowledge. Just with social network, they can find out who know what, who know how and why, get information or knowledge lacked themselves, create knowledge they cannot produce independently. As you seen, social capital of virtual teams has positive function in favor of KC. And KC means old connection enhancing or new connection creating in social network, in other words, add-value of social capital.

3.3. KC and Intellectual Capital

3.3.1. Intellectual Capital and its Components

Intellectual capital is just that a capital asset consisting of intellectual material that transforms raw materials (might be physical or intangible) and makes them more valuable. To be considered intellectual capital, knowledge must be an asset able to be used to create wealth. Thus, intellectual capital includes the talents and skills of individuals and groups;

technological and social networks and the software and culture that connect them; and intellectual property such as patents, copyrights, methods, procedures, archives, *etc.* Thus, Knowledge assets, they proposed, could be found in three places: the competencies of a company's people, its internal structure (patents, models, computer and administrative systems), and its external structure (brands, reputation, relationships with customers and suppliers). After some thinking by other scholars, the pieces are now usually called human capital, structural (or organizational) capital, and customer (or relationship) capital. Currently, the concept of intellectual capital and its components, the relationship with enterprise performance are stress research points (Harrison&Sullivan, 2001; Steven Firer, 2003; Li, 2004). Researches had shown that, intellectual capital positively affect enterprise performance, but intensity differently among its components. Further more, human capital can create wealth only when combining with structural capital. When Zhang *et al.*, (2010) introduced relationship capital into intellectual capital category, the relationship of intellectual capital and enterprise performance had been studied. It demonstrated that capitals listed in descending order of importance are *relationship capital, human capital and structural capital*.

On the other hand, Wang(2007) divided intellectual capital into Explicit knowledge assets and tacit knowledge assets base on the convenience of knowledge representation and transfer. In outsourcing, service provider firms can capture business knowledge from client firms, with which they not only can complete outsourcing project on time and with highly quality, but also benefit their development in the future. In the outsourcing process, team member aggregate business and new IT knowledge, internalize them as tacit capital, as well as repository of module, rules and knowledge updated as explicit knowledge capital. So, to be convenient, dichotomy of intellectual capital with tacit and explicit knowledge assets is adopted in this paper.

3.3.2. KC and Intellectual Capital

Intellectual capital is created assets of intellectual activities. KC is a process to create knowledge, in which knowledge worker promoted their ability, new knowledge had been produced and extended, business process and culture had been improved, relationship with customers had been strengthened. All of these are about the add-value of intellectual capital.

From literature up to now, the relationship of KC and intellectual capital has not been aroused by theory study or industry practicing. It is essential to deepen research perspective into the promotion mechanism of intellectual capital by KC in different ways. In addition, because of the characteristic of knowledge-intensive in outsourcing, the accumulation and add-value of intellectual capital caused by KC, especially for tacit knowledge asset, are notable and effective.

3.4 Efficiency of knowledge cooperation and KC

3.4.1. Efficiency of Knowledge Cooperation

Owing to the typical knowledge-intensive team of outsourcing, project success mostly depends on their knowledge capabilities and effectiveness of knowledge transfer among team members. Because of these difficult or dilemma of outsourcing teams, it is very important for them to know *who know what, who know who* to cooperate effectively (Qu&Li,2011) . With such understanding, the characteristic *exact/just* and *add-value* of KC are same as the effective situation of *who know what, who know who* in their nature mean, and they are determined mostly by interplay of social capital and intellectual capital.

The efficiency of information transfer, which determined by timeliness and accuracy of information flow, is a key factor to advancing system degree of order. Similarly, KC is the order parameter of knowledge system in which contains very-large scale mini-transfer activities, then the timeliness and accuracy of knowledge cooperation determine the macro statue of knowledge system. In a stable enterprise knowledge system, timeliness and accuracy of knowledge cooperation the two cannot have both. In a separate knowledge transfer process,

one variable increase always at another variable decrease cost. Increase path and layer of knowledge transfer can effectively improve accuracy, but increase difficulty of searching path and delayed knowledge flow, as well as improving timeliness of knowledge transfer means accuracy cut down. Accordingly, in order to evaluation the order degree of enterprise knowledge system scientifically, this two-factor should be taken into account simultaneously.

3.4.2. Intellectual Capital, Social Capital and Knowledge Cooperation Efficiency

Knowledge activities always adhered into a special social network. Knowledge acquisition and sharing can't do without activities among individuals. Social capital is realistic and potential resources embed in relationship network possessed by individual or social unit, and these resources certainly will affect knowledge activities based on individual interaction. Studies have shown that social capitals have significant positive influence on knowledge acquisition/sharing in an enterprise (Liu, 2013). Conversely, knowledge activities enhance relations of individuals, get more trust from each other, and put forward the shared recognition. Thus it can conclude that intellectual capital have significant positive affection on social capital.

The efficiency of Knowledge cooperation commonly determined by timeliness and accuracy of knowledge flows. Intellectual capitals provide quality and quantity of knowledge object, and social capitals provide path and layer of knowledge flows, either of them affects knowledge workers to locate and find right knowledge in limited times, thus affect timeliness and accuracy of knowledge transfer. For an enterprise, at its different phase of knowledge system developing, intellectual and social capital have various influences on knowledge cooperation efficiency. Just as a learning curve, with increasing of intellectual and social capital, timeliness and accuracy of knowledge transfer goes better; and when this two-capital increased to a certain level, the cost of knowledge searching/identifying increased so fast that knowledge cooperation efficiency will goes bad.

4. Performance Evaluation of KC

4.1. Effect and Efficiency of KC

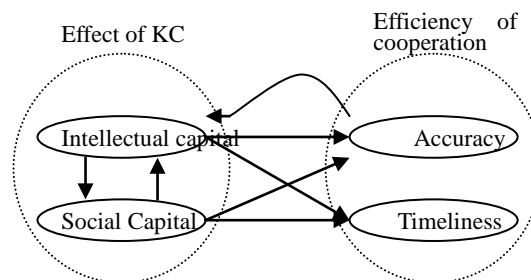


Figure 1. Evaluation Framework of KC

Summary discussions of relationship of KC and intellectual/social capital, knowledge cooperation efficiency, we have a conclusion that the performance of KC refers not only to the effect of collaboration (add-value of social/intellectual capital) but also to the efficiency of cooperation (improving of timeliness and accuracy of knowledge flow). To put forward this research of KC evaluation, authors had make interviews with more than 10 outsourcing firms in Beijing, including famous firms like Beyondsoft Ltd. and Objectivasoft Ltd. There were about thirty engineers had participated in our interviews and Expounded their viewpoint about KC understanding. Then the performanc evaluation framework of KC has been proposed as Figure 1 expressed.

4.2. Method of KC Performance Measurement

4.2.1 Effect Measurement of KC

The effect of KC should be measured with two aspects, add-value of social capital and intellectual capital.

a. Add-value Measurement of Intellectual Capital

Organization for Economic Co-operation and Development (OECD) divided knowledge into tacit and explicit knowledge. **Explicit knowledge** is knowledge that has been articulated, codified, and stored in certain media. It can be readily transmitted to others. The most common forms of explicit knowledge are manuals, documents, procedures, and how-to videos. Works of art and product design can be seen as other forms of explicit knowledge where human skills, motives and knowledge are externalized. **Tacit knowledge** is the kind of knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it. For example, the ability to speak a language, use algebra, or design and use complex equipment requires all sorts of knowledge that is not always known explicitly, even by expert practitioners, and which is difficult or impossible to explicitly transfer to other users. Tacit knowledge is individual or group cooperative knowledge, such as experience, impression and technical knack of individuals, product/technology process, organization culture, custom or routine of enterprise. From this, the collective of explicit knowledge in a firm can be called explicit intellectual assets, and collective of tacit knowledge be tacit intellectual assets.

Because knowledge is intangible, easy-sharing and now-loss, the process of knowledge creation can delivery knowledge product as explicit form and tacit knowledge assets at the same time. In outsourcing, besides of IT service delivering to client firms, there are modules, documents and coding files stayed for reuse and employee capabilities and business processes improved in supplier firm. From the knowledge classification model of Ikujiro Nonaka(1993), to measure the increase value of explicit intellectual assets, all of these knowledge achievements produced by KC should be contained, such as patent, technologies and regulations. To measure the increase value of tacit intellectual assets, tacit knowledge produced in the collaboration should be counted, such as the increase of individual experience and technical skills, the promotion of group capabilities, and the improvement of organization culture and routine.

Table 2. Classification Model by Ikujiro Nonaka

Classification	Individual level	Group level	Organizationlevel	Cross-organization level
Explicit knowledge	Knowledge aggregate	Document of performance analysis	Organization regulation/articles	Patent and technology document of supplier firms
Tacit knowledge	Skill of cross-culture Communication	of group cooperation	Enterprise culture	Attitude and expectation of customer to product

(2) Add-value measurement of social capital

James Coleman(1999) defined social capital functionally as “a variety of entities with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors...within the structure”—that is, social capital is anything that facilitates individual or collective action, generated by networks of relationships, reciprocity, trust, and social norms. In Coleman's conception, social capital is a neutral resource that facilitates any manner of action, but whether society is better off as a result depends entirely on the individual uses to which it is put. Nahapiet and Ghoshal(1998) in their examination of the role of social capital in the creation of intellectual capital, suggest that social capital should be considered in terms of three clusters: structural, relational, and cognitive. The structural dimensions of social capital relate to an individual ability to make weak and strong ties to others within a system. This dimension focuses on the advantages derived from the configuration of an actor's, either individual or collective, network. The relational dimension

focuses on the character of the connection between individuals. This is best characterized through trust of others and their cooperation and the identification an individual has within a network. Hazleton and Kennan (2000) added a third angle, that of communication. Communication is needed to access and use social capital through exchanging information, identifying problems and solutions, and managing conflict. The cognitive dimension focuses on the commonly connected and mutually reinforcing, shared meaning and understanding that individuals or groups have with one another.

KC is such a process that knowledge asker searching knowledge provider constantly and integrate their knowledge to create new knowledge. In this process, relations of knowledge worker had been enhanced, new ties increased, more trust, reciprocal and respect gotten. Then their language, standpoint and opinion converged to consensus. All these performed add-value of social capital in total. So, to measure social capital's add-value, all of these three dimensions, social interaction, trust and shared cognitive, should be measured simultaneously (Liu, 2013).

3.2.2. Efficiency Measurement of Knowledge Cooperation

Cao *et al.*, (2010) proposed a structure model of influence factors of tacit knowledge transformation effect in their research. This model concerns 5 aspects, which are technology provider, technology transformation platform, transformation carriers, technology receiver and environment. In the case of regardless knowledge transformation subject capacity and object carriers, the efficiency of tacit knowledge transfer primarily affected by platform, in which mainly include knowledge distance, rule distance, space distance and relationship distance.

In addition, research had shown that key factors affecting knowledge acquisition(KA) are mainly about aspiration of knowledge source, knowledge accessibility and attraction ability. Knowledge accessibility mainly affected by connectivity of knowledge network more than knowledge attribution, and knowledge attraction ability mainly affected by correlation degree (Zhang *et al.*,2012). For the accuracy measurement of KA, richness and correlation degree of knowledge resource, cooperation times of problem resolving should be considered. And for timeliness, there are searching and transfer times, as well as technology reliability should be considered.

In summary, performance evaluation system of KC can be expressed in Table 3.

Table 3. Performance Evaluation System of KC

Construct	Variable	Dimensions and Description	Literature
Effect of collaboration	Add-value of Social capital	Strengthen social interactive: stronger ties, new ties created	Liu Jiajia, 2013
		Enhancement trust: more trust, acceptance, belongingness	
		More sharing recognition: common language, goals and viewpoint	
Add-value of intellectual capital	Increase of Explicit knowledge assets : new patent/technology/process, reused modules/patterns/cases	Increase of tacit knowledge assets: new experience/skill of individual, promotion of group capacity, improvement of organization of process/routine/culture	Hedlund G, Nonaka I.,1993
Efficiency of cooperation	Accuracy	Accessibility, richness and correlation of knowledge resource	Zhang Xiaotng et al,2012; Cao yong et al,2010
		Cooperation times of problem resolving	
	Timeliness	Knowledge searching/transferring times, technology reliability	

3.3 Application of Performance evaluation system of KC

Because of the difficulty of precision measurement of knowledge, most of methods or evaluation systems not only can't count achievement of knowledge activity quantitatively, but also can't make comparison through vertical and horizontal among groups or firms. Our

performance evaluation system of KC is still constrained by this dilemma. But it also has its useful application such as:

(1) For comprehensive understanding of KC, guide practice of enterprise KM

Based on the essential connotation discussion of KC in multi-layer, it is suggested that KC should be considered with two dimensions: effect of collaboration, efficiency of cooperation. It broaden and deepen KC meanings and could be more useful for business managers to configure their knowledge resources optimally through technology and management methods, to promotion the efficiency and level of KM.

(2) Build theoretical basis for more study on KC

From comprehensive understanding of KC, a performance measurement system of KC had been constructed to lead a complete thinking of KC. Thus it can be a basic of embodiment study to search factors, evolvement mechanism and paths, and so on.

Knowledge exists in so much various forms that it is difficult to measure it quantitatively. But in the age of Big Data, Web2.0, especially in Enterprise 2.0 environment, it may be possible to do this. The term Enterprise 2.0 describes the adoption of social software in an enterprise context. Enterprise 2.0 is not just about applying social software, but it describes a wider approach that advocates a new culture of participation, inclusion, and sharing. From a management perspective Enterprise 2.0 therefore is as much about implementing new IT artifacts as it is about managing corporate communication structures. With the support of social software, traces of knowledge activities can be recorded and stored in digital, also for the achievement of knowledge creation. Then variables about knowledge network, such as tie strength, tie amount, efficiency of problem resolving, and document stock and increment, all could be calculated quantitatively. This may be gives us a good chance to put the performance measurement system of KC into practice and get more meaningful research result.

4. Conclusion

This paper discussed innate character of KC in IT service outsourcing, and built a performance measurement system of KC for virtual teams. This may be benefit for the integrated evaluation methods research combined effect of collaboration and efficiency of cooperation into a sole system. On the aspect of collaboration effect, add-value of social&intellectual capital has been considered as a very important role to indicate KC effective. On the other aspect of cooperation efficiency, accuracy and timeliness are two variable to be balanced. In the future, a KC questionnaire based on this model will be developed, and a survey will conduct analyze to prove its scientific and realistic.

Acknowledgments

The authors gratefully acknowledge the Funding project of Beijing Philosophy and Social Science Research Program (11JGB039) , the Funding project of research plan from the Education Committee of Beijing (SQSM201211417002) and the Funding Project for Academic Human Resources Development in Beijing Union University(BPHR2012A02).

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