

Research on Safeguard Mechanism of Industrial Low-carbon Housing Based on Knowledge

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Abstract: With the rapid development of knowledge economy era, knowledge has become one of the most important resources. The characteristics and types of industrial low-carbon housing is introduced; by analyzing the bottleneck of knowledge transformation for engineering construction projects of our country at present, it is pointed out that the safeguard mechanism of industrial low-carbon housing based on knowledge from three dimensions: organization structure optimization, technical tool support, and organizational culture cultivation, which will help to promote knowledge sharing and innovation, and to improve the development of industrial low-carbon housing.

Keywords: Industrial low-carbon housing; Knowledge management; Safeguard mechanism

INTRODUCTION

With the accelerated process of urbanization, the situation of urban and rural housing construction development, displaying a structural contradiction, is serious. There are some carbon emission deficiencies in most of China's new housing construction, for example, high energy consumption and high emissions. Facing slow real estate sales and high inventories, how to "de-stock" and build "humane, personalized" housings has become our primary problem [Zhao, 2015]. The "Thirteen Five" plan has proposed, that green development is one of China's five major concepts in the next stage. Green development is to reduce the consumption of resources from the source of environmental pollution. The concept of low carbon is not only an important means of supporting development, but also a basic requirement to achieve green development, and improve the quality and efficiency by energy saving and emission reduction. However, the social resources are limited, relying on knowledge management for the protection of our country will become a reliable choice for the sustainable development of low-carbon housing industry and low-carbon knowledge management throughout the entire housing industry life cycle of construction [Wang et al., 2014]. It can make various aspects of the project disordered carbon knowledge explicit, systematic and integrated to improve efficiency and ability to create value, achieve effective and efficient use of social resources, and promote the further development of low-carbon housing industry model.

CHARACTERISTICS AND TYPES

Characteristics

The characteristics of industrial low-carbon housing based on knowledge included:

(1)Low carbonization

Low-carbon idea was brought in the construction of industrial low-carbon housing. The aspect of knowledge included energy-reservation, eco-friendly, low-carbon energy technologies and the development and utilization of new type of low carbon building materials.

(2)Standardization

Standardization is the most basic characteristic of production methods in industrial low-carbon housing. The low-carbon knowledge possess the characteristic of standardization because of the standardized design and the standard component ect.

(3)Industrialization

Industrialization is the most important measure that distinguished the industrial production and the traditional construction, and also another characteristic of low carbon knowledge. The integration of product components and the low carbon technology system is included in the industrial production process. Most of the low carbon knowledge is related to the technology and education training of the industrial workers.

Classification

The industrial low-carbon housing knowledge is various inform taking classification by different ways and standardization resulted in different answers. Fully understand the classification of industrial low-carbon housing which helps to understand the characteristics and operation service of the knowledge to provide a more effective protection mechanism. Table 1 provides a classification of the knowledge [Xie et al., 2014].

According to the common classification of knowledge, the knowledge of industrial low-carbon housing can be divided into explicit knowledge and tacit knowledge.

Table 1 Knowledge Classification

| Classification Method | Knowledge Category |
|-----------------------|---|
| Application | OECD: Know-What, Know-Why, Know-How and Know-Who Charles Savage's expansion: Know-Where, Know-When |
| Manifestation | Ikujiro Nonaka: Explicit knowledge, Tacit knowledge Expansion of Feng JiCheng: Analyze knowledge |
| Sharing Extent | Personal knowledge, Organizational sharing knowledge, Organizational Controlled knowledge, Public knowledge |
| Significance | The knowledge in development, Core knowledge, Core knowledge, Overdue knowledge |
| Supply and Demand | Employees Knowledge, Process knowledge, Enterprise memory, Client knowledge, Knowledge of products and services, Relational knowledge, Knowledge assets, External knowledge |
| Organization | Henderson & Clark: Component Knowledge, Constructive knowledge |
| Specificity | Li RenFang: Science and technology, Specific knowledge |
| Level | Quinn, Anderson & Finkelstein: Empirical knowledge, Superior Skill, System cognition, Self-motivated creativity |
| Uncertainty | Puser & Pasmore, Garrity, Anderson & Finkelstein: Fact, Model, Outline, Intuition, Tacit knowledge |
| Structural System | Wang ZhongTuo: Organization system structure, Personnel system structure, Technical system structure, Operating system structure, Culture system structure |

(1) Explicit knowledge

The explicit low-carbon knowledge not only includes the documents of the low-carbon standard system, guidance and normality, low-carbon residential building integration system, components system related to the housing industry, but also the low carbon design, energy, structure, operation, emission, construction, materials, the increase of carbon sequestration in low-carbon housing technology system, the development and utilization of new type of low carbon building materials, the cultural connotation of the participants, rules and regulations, and the knowledge of project management.

(2) Tacit knowledge

The tacit knowledge is mainly refers to informal, low-carbon technology knack which storage in industrial workers mind, the practical experience and creative knowledge, as well as the accumulation of practical knowledge, the demand knowledge of users in all the participants.

The explicit knowledge is normative, which is expressed by system method. However, the tacit knowledge is sharing knowledge, which is highly individual and difficultly formalize. The tacit knowledge is more precious and more productive than explicit knowledge in knowledge management. But up to now, knowledge transformation problem is particularly prominent in the project management knowledge areas.

BOTTLENECKS OF KNOWLEDG TRANSFORMATION

In recent years, the management using knowledge as the kernel has become a new management mode, which is applied to the project management of many enterprises. The analysis shows that there are still some obstacles in the knowledge

conversion of the construction project management of our country [Zhang et al., 2016].

Knowledge Barriers

The engineering characteristics of one-time and temporary project organization cause an atmosphere where members lack communication and sharing between each other. Because of crossing different disciplines, project members do not understand certain aspects of professional knowledge and can't have more exchanges; Lacking trust and ignoring each other's experience and knowledge and so forth, both sides are reluctant to share too much which block the accumulation of project knowledge ultimately.

Consciousness Weak

Most project construction teams have poor information technology and lack awareness of knowledge management, making knowledge less repetitive, specific performances. They don't attach importance to establishing knowledge management system, don't have complete knowledge storage system, don't pay enough attention to finishing data and information of completed projects, which makes it difficult for repetitive use of knowledge; Ignoring the importance of knowledge management talents and lacking knowledge-type talents in team [Guo, 2015].

Mismatching Organizational Structure

The problems in the organization-function of construction project, such as more structural level and unclear responsibilities, hinder the effective transmission of information and the respond for leaders to the problems in the intense competitive environment. Meantime, project organization boundaries are not planned and defined clearly, lacking organizational structure corresponding to the knowledge management and effective mechanism management which cannot make the knowledge integrated effectively and easily lead to the phenomenon of acquiring specific knowledge repeatedly.

CONSTRUCTING SAFEGUARD MECHANISM

Accumulation of Low-carbon Source Knowledge

To enable better conversion of low-carbon knowledge among members of the organization, firstly we have to identify knowledge and access to knowledge. For the protection of low-carbon source knowledge, the construction project can adopt integrated integration mechanism, and potential mining mechanism. Integrated integration mechanism is the accumulation of relatively explicit knowledge, by standardizing and integrating design, construction, operation, dismantling and recovery of the various stages of a low-carbon knowledge-related specification, technologies, and programs and the use

of the coding knowledge for the classification, coding, storage in the knowledge base, to facilitate system integration knowledge. Potential mining mechanism is the accumulation of tacit knowledge of the proposed use of the data warehouse, using OLAP technology[Zhang, 2015] and mining to conduct Web experience, skills, and user demand invisible depth knowledge extraction, sorting and accumulation, while using technology to build knowledge map knowledge base, knowledge maps to facilitate the future conversion of knowledge.

Low-carbon Knowledge Transfer Support

Once the construction project is completed, project members will continue to restructure, disperse and reorganize in the next project, and low-carbon knowledge will gradually be lost in the course of this series. How to achieve effective management and use of low-carbon knowledge, and make better conversion among project members, the key lies in three aspects: organizational structure optimization, technical tools support, and organizational culture cultivation, to build a model of security mechanism of low-carbon knowledge transformation, as shown in Figure 1.

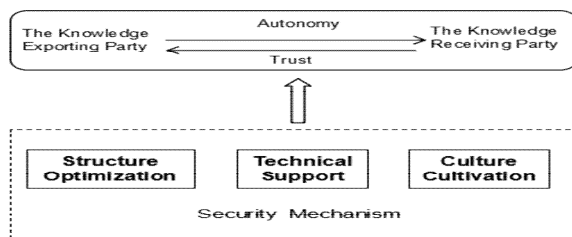


Figure 1 A model of security mechanism of low-carbon knowledge transformation

Optimization of Organizational System

Organizational system, such as Line System, Functional System, Line& function System and Matrix System cannot cater to the demand of the era of knowledge economy. So necessary transformation of organizational system has become an urgent issue. Traditional organizational system should be optimized so that virtual housing enterprises can be well-established as shown in Figure 2. Under the basis of market opportunity and core of business process, traditional organizational system is characterized as multi-layers, large scale, complex structure, multiple factors and overloading information. But this complicated system can still be orderly organized and integrated functioned, which consists of two main levels: organization of hegemony enterprises and organization of partners' enterprises. During its operating process, it is needed to establish a coordination department to facilitate mutual communication and work out possible contradictions, with the use of information network and knowledge base.

To better transform low-carbon knowledge, management departments of low-carbon knowledge as shown in Figure 2, such as knowledge directors and

knowledge project manager [Shen, 2009], are supposed to be established in its organizational system. Specifically, the setting of knowledge director in top management of project, which is responsible for gathering and processing project-related knowledge, supervising and ensuring the consistency of the quantity, quality and organization aim of knowledge base. Knowledge administrators should also be set up to establish and maintain knowledge base of engineering project. Knowledge will be uniformly obtained, classified, stored and be used to establish knowledge index, so as to facilitate the knowledge searching for all members and develop technique and methods related to knowledge service.

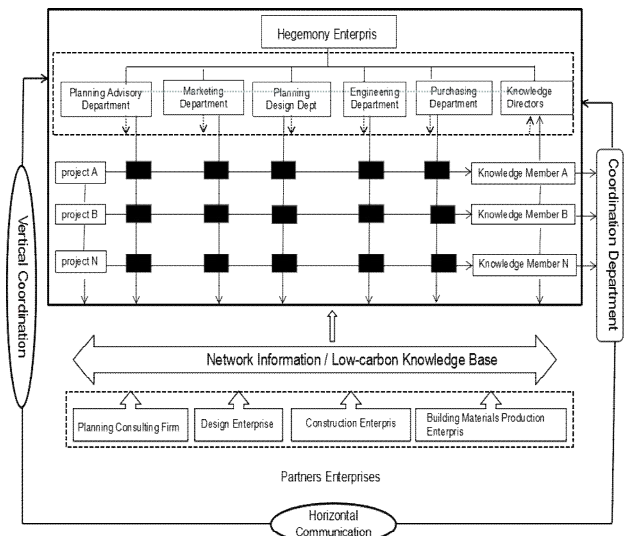


Figure 2 The organizational structure of the virtual enterprise based on the low-carbon knowledge management

Technical Tools Support

Knowledge transmission among all members inside the organization, through using Intranet network technology can transform low-carbon knowledge with the following ways: (1)Set up “network classroom”, in which experts on low-carbon are invited to give online training and instruction, and essays of experience on low carbon written by talents can be uploaded in classroom for the reference of other members; (2)Set up “BBS”, in which discussion on certain theme of low-carbon or consultation to expert can be made; (3)Establish electronic forum, in which personal zone for low-carbon knowledge can be set up, added and improved, and all members can search questions according to one’s own interest, ask for help and promote knowledge interaction. Meanwhile, E-journals can be published in the organization and BBS can be used to announce development trend on low-carbon knowledge regularly.

By adopting Intranet network technology during the knowledge transformation, by setting suitable identification authority and by using databases from different enterprises, projects and users, we (Investor,

Designer, Contractor, Operator and Supplier) ensure the mutual transmission of low-carbon knowledge among different parties, as shown in Figure 3.

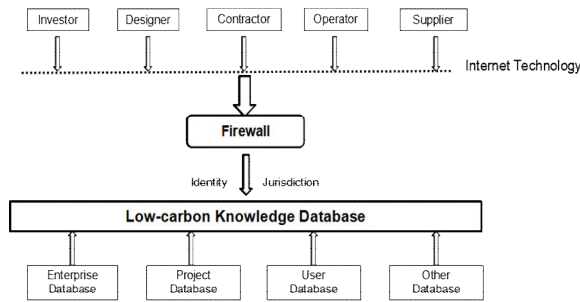


Figure 3 Technical support for the transfer of low carbon knowledge among the participating parties

Organizational Culture Cultivation

In the construction project, the cultivation of organizational culture will provide a good environment for the transformation of knowledge, so that enterprises should create the organizational culture that organization members share their knowledge initiatively and actively participate in the knowledge innovation [Yao, 2015]. Therefore, enterprises should guarantee mechanism of organizational culture to implement low-carbon knowledge transformation from three aspects: communication mechanism, trust mechanism and incentive mechanism.

(1) Communication mechanism

In the process of low-carbon knowledge transfer, it is essential for members to communicate with others. To establish effective communication mechanism, the following ways are involved: the first aspect is the combination of multi channels. Namely official documents, telephone, face-to-face communication and other traditional ways of communication combining with new communication methods, such as electronic bulletin board, e-mail, blog, instant messaging software, etc. Establishing certain rules and regulations, building a unified network communication platform, and achieving the transfer of low-carbon knowledge in a variety of ways; the second aspect is to pay attention to the two-way communication. That is, the two sides should use the feedback function to respond to the content of the communication in time; Moreover, the third aspect is the formation of knowledge team. That is, those members who have certain expertise and knowledge compose an informal organization, forming the common aspirations of sharing experience and feelings through a wide range of communication and mutual help. And thus better achieve knowledge sharing.

(2) Trust mechanism

Trust is the prerequisite for knowledge sharing, and it plays a decisive role in the process of the low-carbon knowledge transformation. If the output and the input side can trust each other, it can enhance the

mutual will of knowledge transfer, promote better communication and enhance the sense of identity of organizational culture. To realize low-carbon knowledge transformation, there is a need to provide the environment for trust. We can adopt the following methods to make trust root in organizations: 1) pay attention to the training of the ability of members of the organization, namely the creation of training courses, so that members can maintain a continuous learning to better finish the work; 2) Fair and open organization system. That is, to seriously understand the needs of members, listen carefully to the member's talk. Meanwhile, to increase the transparency of the system, and to improve the systematicness and continuity of decision making, so as to improve organizational trust; 3) Strengthen the credibility of the leaders. The leaders should keep a fair and trustworthy impression to the member in taking action. Meanwhile, the leaders should also believe the member to stimulate their motivation of knowledge sharing.

(3) Incentive mechanism

The effect of incentive mechanism cannot be ignored in the transfer of low-carbon knowledge. In order to make members consciously share and innovate knowledge in the knowledge transformation, it is necessary to set up a complete set of incentive mechanism for the production of security.

Knowledge performance mechanism. It refers to formulate certain evaluation index and use a variety of assessment methods to check and assess the authenticity and effectiveness of the results of the staff's knowledge. The performance and effectiveness are the basis for the assessment of salary. Appraisal indexes include both the amount of the knowledge the member has and the contribution of sharing and innovating knowledge to enterprises or projects. The mechanism of knowledge performance includes the system of member knowledge achievement audit, the computer joint evaluation system of the value of knowledge result and so on.

Knowledge reward and punishment mechanism. It refers that members' performance are converted to the income that the members are willing to accept. Those who are unable to achieve the objective should be punished. The incentive mechanism includes the knowledge payment system, the knowledge stock and option system, the knowledge promotion system, the knowledge signature system and the knowledge training system, etc [Dang et al., 2015]. The penalty mechanism consists of yellow card, red card warning and dismissal or elimination system.

Knowledge explicit mechanism. It refers that to make knowledge management objectives for the enterprises or projects and members' knowledge productions more clearly. It includes the knowledge signature system and the externalization system of tacit knowledge. The knowledge signature system can be realized through the method of

displaying the name of the provider in the knowledge base, which can balance out members' negative emotions. The externalization system of tacit knowledge means that to transform the tacit knowledge such as the members' experience and ideas, and knowledge resources of the experts into a form which can easily communicate so as to share the knowledge.

CONCLUSION

In the era of knowledge economy, knowledge has become the core factor in the rapid development of enterprises and the competitive advantage. By analyzing the obstacles of knowledge transformation for engineering construction projects of our country at present, it is pointed out that the safeguard mechanism of industrial low-carbon housing based on knowledge from three dimensions: technical tools, and organization culture and organization structure to promote accumulation, transformation, and innovation of low-carbon knowledge and to push forward the "humanized and personalized" construction of low-carbon housing.

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