

Research on Knowledge Management of Agricultural Scientific Research Institution

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Abstract The scientific research institute is an knowledge concentrated organization which works for knowledge innovation. Due to the variety of understandings, people define the knowledge management differently. This thesis analyzes the research background, necessity, contents and range of knowledge management in agricultural scientific research institution. The authors put forward the point that the core values of knowledge management is tacit knowledge transferring into explicit knowledge, which is assumed to throw light on knowledge management in practicing and set up the theoretical system of knowledge management.

Key words Agricultural scientific research institution; Knowledge; Knowledge management; knowledge transfer

1 Introduction

The universal application of information technology has triggered profound changes in the traditional scientific research methods. The extent and speed of possession, distribution, development and utilization of knowledge resources will become key factors to occupy the dominant position of international science and technology, and economy, and also serve as important support and basic security conditions for national technology innovation system. Wide practice has proved that knowledge management and knowledge sharing can increase the company's competitiveness and promote agricultural research institutions in the same way.

2 Enlightenment from Knowledge Management Studies on Foreign Agricultural Research Field

In March 2001, a seminar on strategic plan for global knowledge sharing was held in Washington USA. Participants included information management personnel, information technology experts and research management personnel from the National Agricultural Library, United Nations FAO, and 13 centers of CGIAR organization. They discussed the global knowledge sharing strategy plan [global knowledge sharing strategic planning (GKS)], set off a worldwide wave of knowledge management research. GKS strategy is to address how to spread the knowledge produced by CG organization or knowledge jointly produced by CG organization and its partners, and how to use resources to let CG organizations researchers and its partners access to information and knowledge. The development idea of DKG is to find out the knowledge status owned within CG organization now, to develop and implement common tools that facilitate information and knowledge sharing and let information management professionals combine together with research projects. The specific method is to establish electronic document delivery services for special working group to assess joint procurement and implementation (ARIEL or other methods); set up a union catalog for information that CG organizations library owns. Maintain SRLS database; complete the list of CG electronic resources catalog (IPGRI prototype); prepare and develop a CG organization scientists catalog; establish and develop CG organizations publications database; develop CG Organization Video Library / re-design and modify the library web page^[1].

Economic Research Service (ERS) of U.S. Department of Agriculture has launched a knowledge management project (PMS). Currently, the project goes into service internally. The content recorded within the gateway includes the latest research, ongoing projects, personnel information and so on. It may be updated weekly, and each researcher must, within one week, put the latest research report, published articles, and the work progress on the intranet, so that information and knowledge within the organization can be shared.

U.S. National Agricultural Library has utilized metadata (METADATA) XML extensible markup

language to collect on-line resources to provide customer service. AGNIC of National Agricultural Library access to the Internet as per topics, realizing remote access knowledge inquiry, and now there are more than 50 organizations being involved^[2].

Cornell University Agricultural Library is also actively promoting knowledge management construction on professionals, by advancing personal professional website and personal website, encouraging persons with different professional backgrounds to put their interested knowledge online on a regular basis for the knowledge sharing^[2].

The development and application of the above knowledge management activities abroad will enlighten us well for timely research knowledge management and application. It prompted us to conduct relevant research for involving the world of knowledge management research.

3 Background and Opportunity of Knowledge Management Research on Chinese Agricultural Sector

In the mid to late 1990s, with the gradual penetration of the domestic information construction, the modern information technology represented by computer technology and the Internet are increasingly widespread in agricultural production and research applications. The China Agricultural Science and Technology Information Network were opened in 1997, and in 1998 the research and development projects of Chinese Agricultural Research Information System (ARIS) were launched. In 2001, the basic database and shared services platform construction of China Agricultural Science and Technology are under way, and in the meanwhile, the research and development were performed on agriculture digital library, which has provided technical support and a working basis for management of agricultural science and technology.

The research and development projects of China Agricultural Research Information System (ARIS) put forward a set of "Agricultural Research Information System Management Modes", for providing a theoretical basis to knowledge management and research^[2] through systematic research and analysis.

Both Agricultural technology structural reforms and agricultural technology management put forward new demands. China's agriculture has entered a new period of development, and thus set the new task for innovation and development of agricultural science and technology, requiring the Agricultural Science and Technology Company continues to advance structural reforms of agricultural science and technology, and speed up agricultural technological innovation. It is recognized that the knowledge management can promote the structural reforms of agricultural technology system, technology management and technological innovation.

Information sharing will promote the knowledge sharing. Since 2000, the implementation of major national science and technology elementary projects has promoted the construction and sharing services of China's agricultural science and technology basic database. In recent years, the department of Science and Technology work jointly with other relevant departments to push the construction on scientific data sharing service platform, and promote information sharing so as to offer referential work basis to the sharing of knowledge.

There are some problems existing in agricultural research institutions in new period, but in the meanwhile, new opportunity are presented to the knowledge management research.

4 The Management Core of Agricultural Research Institution Knowledge-explicitize Tacit Knowledge

Knowledge can be divided into explicit knowledge and tacit knowledge. The core of agricultural research institutions knowledge management aims to changing tacit knowledge into explicit knowledge, for applying to knowledge management. Research shows that 90% knowledge of the research institutions is tacit. Therefore, throughout the process of knowledge management, the issue of tacit knowledge transformation has been reflected in all aspects. Whether develop a knowledge management system for knowledge association and knowledge map expression, and the use of information technology networks, or concrete applications under the knowledge management, such as scientific & research management, intelligence management, competitive intelligence, and organizational innovation etc., all they have promoted the agricultural research institutions' tacit knowledge transformation towards explicit knowledge from different perspectives.

Explicit knowledge can be articulated by using of formal language, which is easy for knowledge transmission between each human, including literature and data. With the development of computer and network technology, it is more easy and convenient to access and organize the explicit knowledge that

are processed by digital or database information technology. As the explicit knowledge and tacit knowledge are mutually reciprocal, and can be mutually transformed, it can be either explicit knowledge or tacit knowledge at the same time from different point.

4.1 Concept and characteristics of tacit knowledge

Tacit knowledge is proposed by the British scientist and philosopher Michael Polanyi (Michael Polanyi) in 1958^[3]. Polanyi said: "There are two kinds of human knowledge. The one that is often described as knowledge is only one type of knowledge, which is expressed in written text, diagrams and mathematical formulas, while the one not described is another type of knowledge, like what we owned during doing operating something." Polanyi has a classic analogy on tacit knowledge, that is: "We can recognize one person's face in thousands of faces. However, in general, we can not tell how we recognize this face."

Tacit knowledge has the following characteristics:

(1) Tacitness: Polanyi pointed out that the tacit knowledge is essentially an understanding, a kind of comprehension. It is difficult to explicitly state and logically present the tacit knowledge, which is achievement of non-verbal intellectual activities of humans.

(2) Individuality: tacit knowledge generally exists in the minds of individuals, which is hard to pass through the normal form (for example, school education, mass media and other forms) to, but can transfer in a special way (e.g. "master grant").

(3) Irrationality: the explicit knowledge is available through the logical reasoning process of people, therefore it can be reflected rationally, while tacit knowledge is gained through people's physical senses or intuition and insight, thus the tacit knowledge has irrationality characteristics, one can not rationally criticize it.

(4) Contextuality: the tacit knowledge is always associated with a particular scene, always relying on specific situations, which is integrative viewing on specific task and context.

(5) Culture: the tacit knowledge has stronger cultural characteristic than the explicit knowledge. It is not separated from the concept, symbol, and knowledge system that people analyze in some certain cultural traditions, or, people in different cultural traditions shared different tacit knowledge "system", including hidden natural knowledge "system", as well as hidden social and human knowledge "system".

(6) Occasionality and Randomness: the tacit knowledge is more casual and more occasional, and hard to capture, so it is more difficult to gain tacit knowledge than explicit knowledge.

(7) Relativity: It has two meanings, firstly, under certain conditions, the tacit knowledge can be transformed into explicit knowledge, and secondly, the knowledge belongs to the tacit knowledge referring to one person, but it may become the explicit knowledge by referring to other person, and vice versa.

4.2 Tacit knowledge of scientific research institution

With increasing development and widespread application of knowledge management ideas, the concept of tacit knowledge is also constantly expanded and updated during the practical operation of knowledge management. Companies with different type may have different scope of tacit knowledge. For scientific research institution, Michael Polanyi's tacit knowledge definition showed a little narrow. For this reason, this paper has made the following supplementary to the tacit knowledge concept and scope of research-based company on the basis of Michael Polanyi's theory:

The tacit knowledge of scientific research institution refers to those tacit dynamic knowledge present in the minds of scientific researchers, static tacit knowledge existing in the forms of individual or team project applications, task books, contracts, unpublished research reports and other confidential materials, as well as other "non-logical knowledge" tacit in the research project management process, with no digging and sorting, including:

Strategy and planning knowledge: It mainly covers the company development goals, cultural ideas, operation mode of institutions, planning and strategy that are specified by the leadership of scientific research institution, as well as development strategies made by external advising experts. These tacit knowledge have individual and relatively-hidden features.

Work proposal knowledge: It is mainly consist of management plan of human, financial and material resources, combination, allocation schemes and methods made by middle management department and implemented. It specifically refers to project contracts and tasks book that concentrated reflect the head knowledge of researchers. Although this kind of knowledge has been shown by language, words, diagrams and formulas, but due to personal protection of intellectual property restrictions, the academic thinking condensed in the contract, task books and research reports has been well expressed, it still can not be shared socially. It may be owned in small-scale of researchers personal

or project team. For the research team outside, it is tacit knowledge, also has individual and relatively hidden characteristics.

Individual head knowledge: the scientific and technological personnel of agricultural research institutions has trained and practices the unique research ideas to analyze and solve problems through long period of research practice, including research technical routes, methods, and angles of problem analysis. This kind of tacit knowledge has individualistic and irrational features.

Scenarios inspired knowledge: the scientific research is primarily a thought process of accumulation, but also of thought park by chance. These innovative ideas are not sytematized and modelized. It often crossed one's mind quickly, if you do not capture and fixed in time, that knowledge will soon be forgotten. This kind of tacit knowledge is situational and contingency.

4.3 Knowledge transformation of scientific research institution

4.3.1 Knowledge transformation process

One argument considers that the so-called knowledge management refers to the management on various transformations between tacit knowledge and explicit knowledge. Ikujiro Nonaka, a renowned Japanese experts in knowledge management, proposed four explicit knowledge and tacit knowledge conversion processes of grouping, externalization, integration and internalization (see Figure 1 below)^[4].

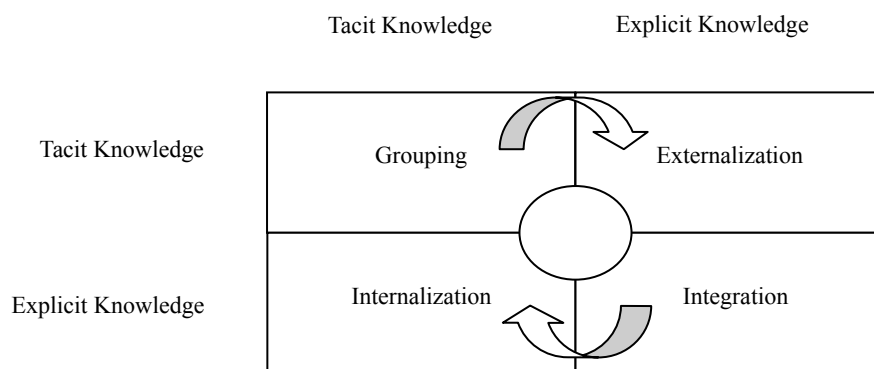


Figure 1 Interconversion Process of Tacit Knowledge and Explicit Knowledge

(Data sources: John van den Hoven, Information Resource Management: Foundation for Knowledge Management.2001)

The grouping transformation process of tacit knowledge to tacit knowledge is a socialization process of tacit knowledge. The information technology may be used to build network virtual knowledge communities (such as BBS, etc) to achieve the “master and apprentice teaching” on tacit socialization knowledge, realize in a wider range of the transformation process from tacit knowledge to tacit knowledge.

The externalization transformation of tacit knowledge to explicit knowledge. Explicitize the tacit knowledge through timely recording and explicit description of tacit knowledge. Such applications as knowledge mining system, intelligent simulation, expert systems and other modern information technology can greatly improve the efficiency of tacit knowledge externalization.

The integration transformation of explicit knowledge to explicit knowledge is a process of knowledge diffusion. The tacit knowledge of scientific research institution is still disadvantaged on fragmentary and unstructured through socialization and externalization transformation, which must be further formatted and structured. These fragmented knowledge shall be integrated through modern information technology, such as the application of the distributed document management, content management, data warehouses, and others, and expressed in professional language, to promote personal knowledge to the organization knowledge, for more people share and create organizational value.

The internalization transformation of explicit knowledge to tacit knowledge is a process, in which systematized explicit knowledge penetrated fully into organization members. After organization members accepted the systematized explicit knowledge, combined with external environmental factors and then applied to work, to create new tacit knowledge. Group work, work training, electronic community, and E-learning systems are effective means to achieve tacit of explicit knowledge.

4.3.2 Knowledge transfer means under the conditions of modern information technology

The development of modern information technology provided a good means of achieving for knowledge transfer. Currently there has been a lot of knowledge management software platform or

products in the market mainstream, such as: Lotus Domino / Notes produced by IBM Company, Exact synergy produced by Netherlands Exact Company, and Oracle eBusiness Suite, ySAP.com and other well-known large-scale e-commerce suite. In accordance with the transformation process of tacit knowledge and explicit knowledge, these knowledge transformation means can be divided into four categories^[5]:

The “grouping” transformation mean of tacit knowledge to tacit knowledge: electronic communities, e-mail, groupware, discussion groups, instant messaging, P2P applications, and expert positioning system.

The externalization transformation means of tacit knowledge to explicit knowledge mainly contains: self-service, document workflow, internal and external web content management, search engine and text retrieval, data storage and online analysis, intelligent modeling, data mining and knowledge mining.

The integration transformation means of explicit knowledge to explicit knowledge mainly contains: knowledge base networking, heterogeneous database searching, data warehouses and data marts, portals, and organization application integration.

The internalization transformation means of explicit knowledge to tacit knowledge mainly contains: electronic communities, e-mail, groupware, discussion groups, instant messaging, P2P applications, traditional teaching, E-learning^[6].

4.3.3 Knowledge transformation of scientific research institution

From the above we can see that the tacit knowledge concept of scientific research institution is different with the general concept of tacit knowledge. Therefore, the tacit knowledge explicitization of scientific research-based institution has a close relationship with general information management tools, such as office automation and document management.

(1) Explicitization of tacit knowledge

Grouping of tacit knowledge. The scientific research institution can train graduate students, combine project team voluntarily, build effective research teams and conduct internal discussions, etc., for individual researchers to exchange academic ideas, to expand the scope of individual tacit knowledge of the radiation, and to realize grouping of tacit knowledge.

Explicitization of dynamic tacit knowledge. The “personal head knowledge” and “accidental scenarios knowledge” existing in the minds of the scientific staffs of scientific research institution can achieve explicitization through discovering, digging, extracting, precipitation and other means. The method of “Discovery” and “Dig” aim to embodying the academic thinking, research experience, research methods, scientific operation and management rules in the minds of research personnel by the report and summarizing; “extracting” is to timely record and sort out the thought sparks of researchers through academic conferences and field reports, for producing readable, visible, and audible explicit knowledge.

Explicitization of static tacit knowledge. For static tacit knowledge existing in the form of research projects applications, contract, task book, concluding report, and acceptance materials, etc., the way of document management and building a knowledge base, etc., can be used to expand the scope to share and achieve dominant transformation.

(2) “Integration” and “solidify” of explicit knowledge

After the explicitization, the tacit knowledge of academic thought, application, contract, task books of scientific research staff still lack of organic links and interact correlation, the integral knowledge of institution is also short of internal logic links, need to be integrated and normalized. The way of extracting knowledge points and knowledge map database retrieval, etc., can be applied to achieve consolidation and normalization and the overall integration of explicit knowledge;

The development strategy knowledge, explicitized personal mind knowledge and the institution development law of scientific research institutions can achieve solidify transformation from dynamic explicit knowledge to static explicit knowledge through the trial, amendments, judgments and solidifying methods. The scientific research institutions can design work systems or measures accompanying based on the planning and formulation of the institution development strategy, and then give a trial at work or implement temporarily; at the same time, take the form of surveys and meetings, listen to opinions of the masses, screen and assess correctness and rationality of a variety of systems, procedures and proposals, make adaptation amendments on a regular to Interim Measures, system and knowledge on the trial, and solidify the dynamic explicit knowledge.

(3) Internalization of explicit knowledge

Once the tacit knowledge of innovative ideas of academic researchers is explicitized, they should

be together with the institution's development strategies, research programs, scientific research and management system for a hidden "internalizing" static explicit knowledge. Scientific research institutions may upgrade the individual or local knowledge into institution knowledge through a wide range of literacy lectures, relying on online inquiry and learning of the knowledge management system, etc. Preach researchers with the institution's development strategy, key concept and planning programs through advocacy and training, etc., and give various incentives systems to make the explicit knowledge exerted a subtle in the minds of all scientists under the institution's mainstream culture framework, forming at a higher level of behavior and thinking patterns, for laying foundation for knowledge innovation and new knowledge transformation at the next step.

5 Conclusions

As the national investment on agriculture research basis is relatively weak, it is difficult to share the agricultural science and technology research results or knowledge assets formed; by the constraints of traditional agricultural concept, physical material resources are highly valued, while invisible intellectual resources are belittled; due to the long-term impact of the planned economy, the ways of agricultural research management and organization innovation are out-of-date and thus do not meet the requirements of knowledge management; the loss of strategic knowledge resources (caused by retirement of researchers or staff mobility) still exists; since China's accession to WTO, in the market economy, agriculture will gradually go abroad, and all aspects related to agricultural production need various types of knowledge to support; under the influence of knowledge management, the agricultural information management organization began pay attention paid to explicit knowledge management, such as database construction of literature books, but great importance are not attached to tacit knowledge, that is, no ordering, non-structural knowledge, such as the important thinking of people, innovative programs or proposals management. As the above problems existing in research institutions, the knowledge of these institutions are scattering and such information with each other are closed; causing the phenomenon of repeat research , leading to waste of capital and talents; knowledge assets of these institutions can not be integrated in a comprehensive development and utilization; the overall layout of knowledge can not meet the scientific and technological development requirements; the human resources of long development and management have little knowledge of the explicit and tacit knowledge, who can not achieve knowledge sharing and innovation through knowledge management. All of these problems and results existing showed strong demands for the implementation and application of knowledge management and research.

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