

**KNOWLEDGE NETWORK
SYSTEM APPROACH TO THE
KNOWLEDGE MANAGEMENT**

ZHONGTUO WANG

**RESEARCH CENTER OF KNOWLEDGE SCIENCE AND
TECHNOLOGY**

DALIAN UNIVERSITY OF TECHNOLOGY

DALIAN CHINA

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1.KNOWLEDGE SYSTEMS ENGINEERING

In the recent years, the term **knowledge management** had immediate and vast appeal and, at the same time, spawned strongly felt criticism. The major criticisms are:

- It implies that knowledge can be managed, in real life, the tacit knowledge can't.
- It describes knowledge management as a set of processes as “creating-capturing-storing-sharing-applying-reusing”, which is too mechanistic and ignore the complex cognitive process of human being.
- Knowledge management implies control and restriction of knowledge, and people prefer **knowledge enabling and facilitating**.

- We can think of knowledge management as building and enhancing **knowledge systems** and embedding work systems within these knowledge systems.
- Since Systems Engineering is the technology of organization and management of systems, we have suggested establish a new discipline:

KNOWLEDGE SYSTEMS ENGINEERING

and define it as **the technology of organization and management of knowledge systems.**

- The advantages of knowledge systems engineering approach are we can integrate:
 - knowledge as object and as process(knowing)
 - technique-orientation and behavior orientation

- **Knowledge Systems Engineering** as an applied science can be accepted both by the people with background of natural science and engineering, and people with background of humanity and social sciences.
- **Knowledge Systems Engineering** as an interdisciplinary technology, can absorb more methods and tools from systems sciences.

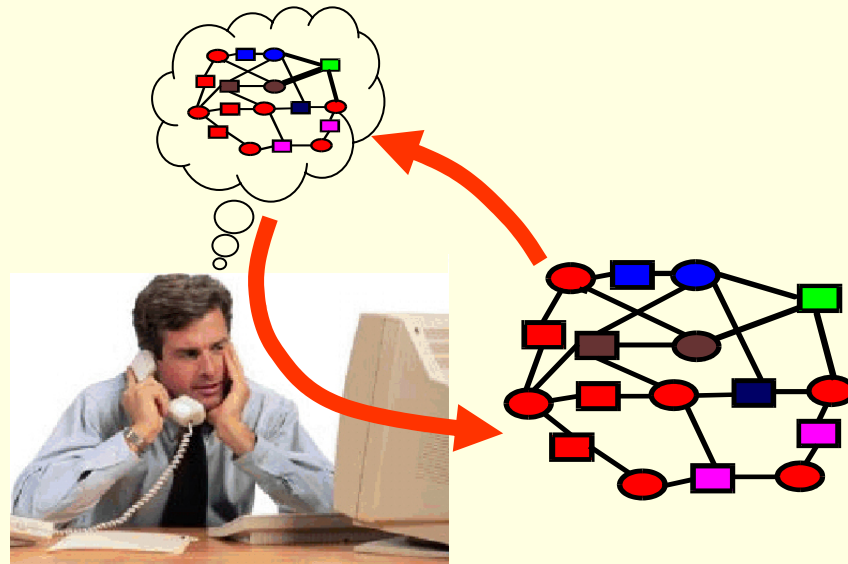
2. KNOWLEDGE NETWORK SYSTEM

- We can imagine **the structure of knowledge system as a network.**
- The notion of network implies nodes and links. **Nodes** can be individuals, teams even organizations. Nodes are the focal points for activity or organizational processes.

Links are various connecting and coordinating mechanisms, such as workflow procedures or meeting.

As knowledge flows across the links, new **knowledge is created both at the nodes and on the links**, which can then be applied to meet the needs of the organization.

The Network as a Thinking Tool

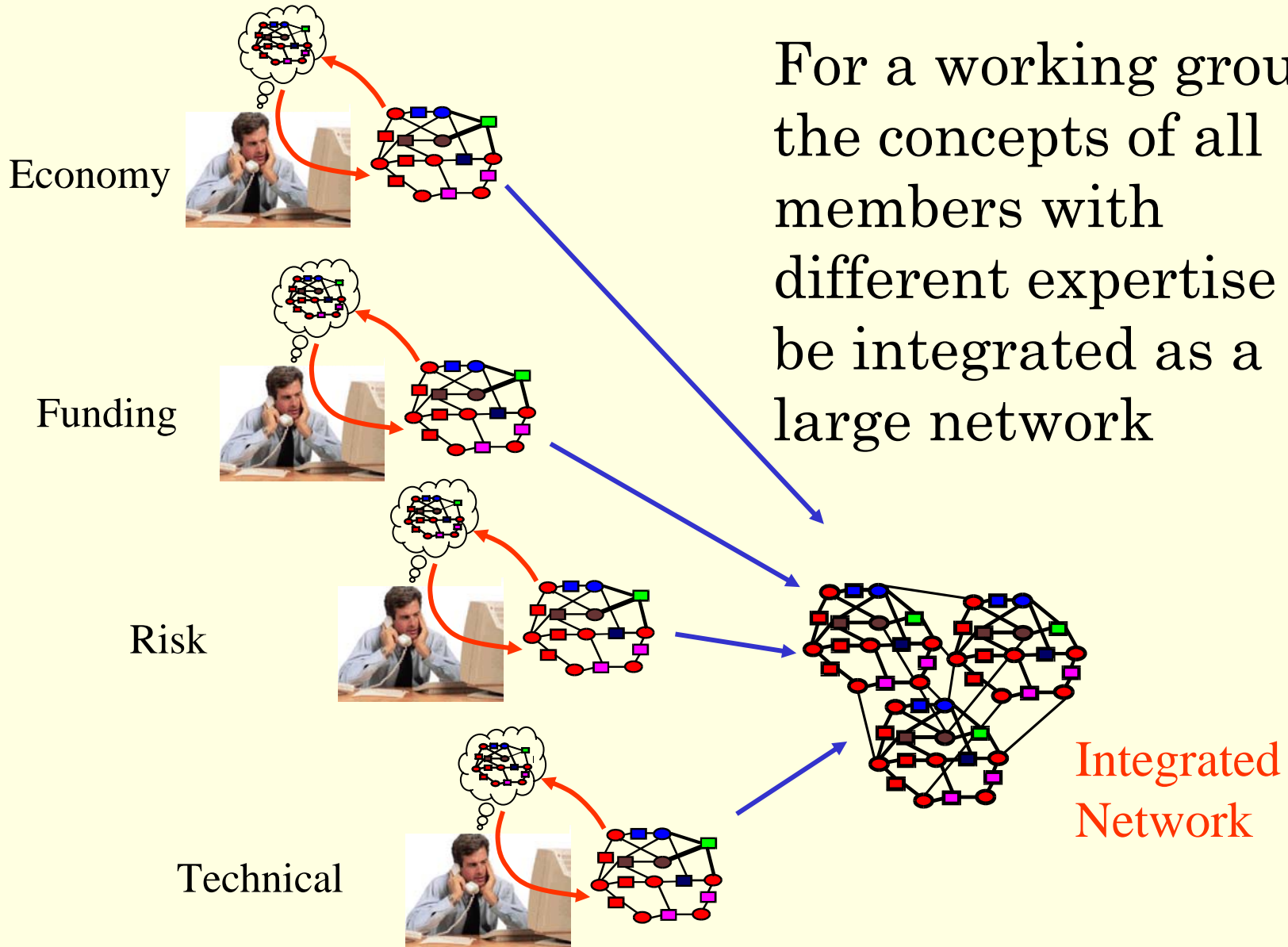


When people think about some things or events, all the concepts (nodes) are connected by some relations or laws (links) to formulate a network.

The network can be used as a **thinking and knowledge presentation tool**.

Integration of Knowledge Networks

For a working group, the concepts of all members with different expertise will be integrated as a large network



- In the last decade, the National Science Foundation of U.S. set up an initiative of **knowledge networking.**
- The aim of Knowledge Networking is to facilitate the evolution from distributed information access to new technical and human capabilities for interactive knowledge creation and use.
- Through this evolution, interdisciplinary communities can be joined in sharing data and building knowledge to address complex problems traditionally treated within disciplinary boundaries.

- Two main streamlines of knowledge management focus on different approaches:

Information Management

Knowledge Network

Knowledge as object

IT Network

Use and reuse of existing
knowledge

Personnel Management

Knowledge Networking

Knowledge as process

Social Network

Creation of Knowledge

- These two approaches should be integrated.
- This lies to a new paradigm:

Knowledge Network System

to bridge knowledge-network and knowledge-networking

- There are three kinds of linking in the knowledge network system:
- **1. Linking knowledge to knowledge.** The different units of knowledge can be linked. It is the necessary condition for the knowledge integration.
- **2. Linking people to knowledge.** This is the important way for people to get the knowledge. And in reverse direction users can find the related people from the knowledge.
- **3. Linking people to people.** This forms a social network.

3. ARCHITECTURE AND COMPONENTS OF KNOWLEDGE NETWORK SYSTEM

- The knowledge network system is composed of four **layers**:
 1. **Interface** layer
 2. **Application** layer
 3. **Function** layer
 4. **Repository** layer.
- The system includes four basic types of **elements**:
 - 1.**People**: knowledge management is human-centered task .
 - 2.**Hardware**: computer and communication network

3. Software: Effective database management,
powerful algorithms

4. Procedures:

-access

-navigation

-observation

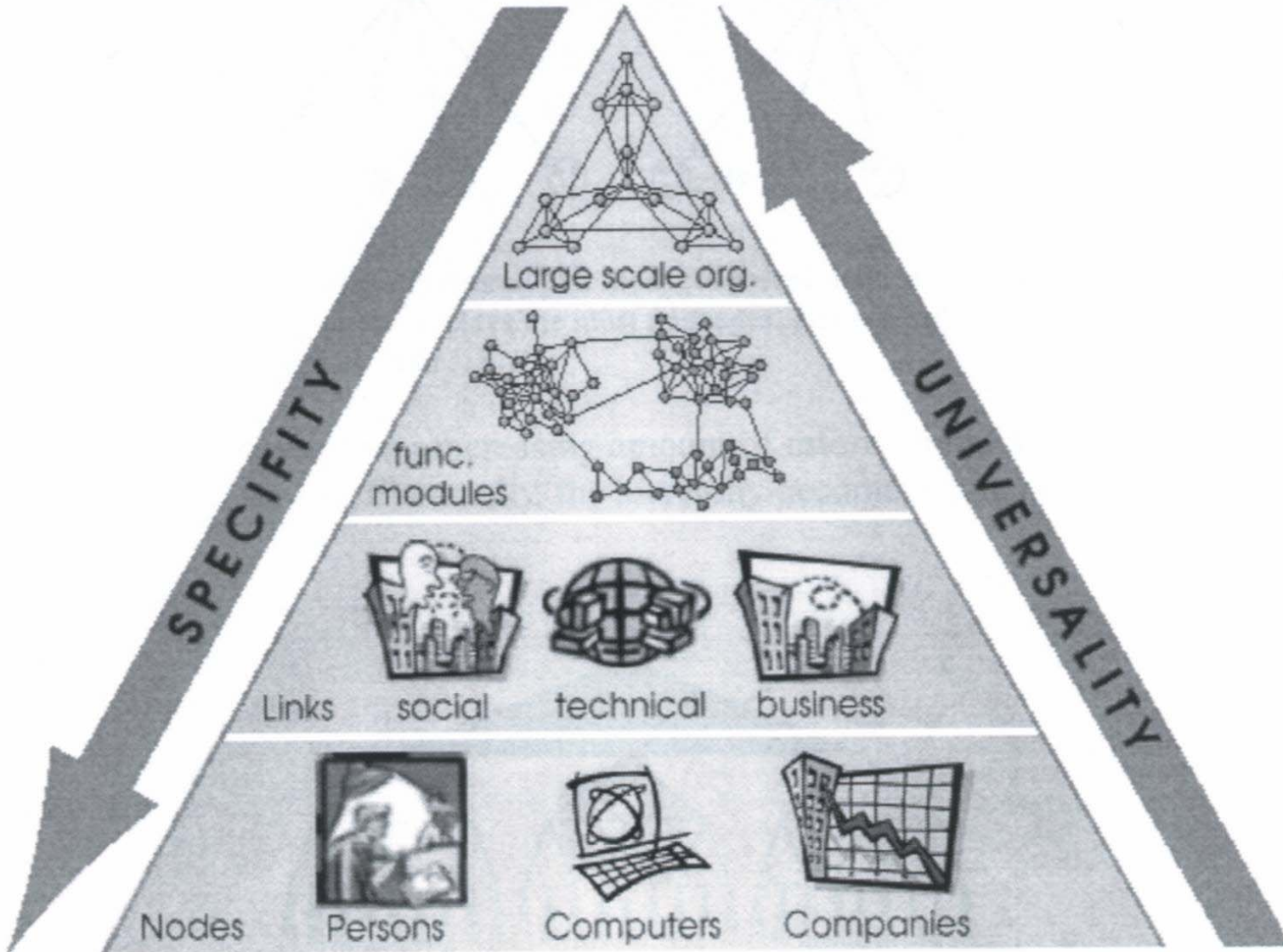
-repository

-analysis

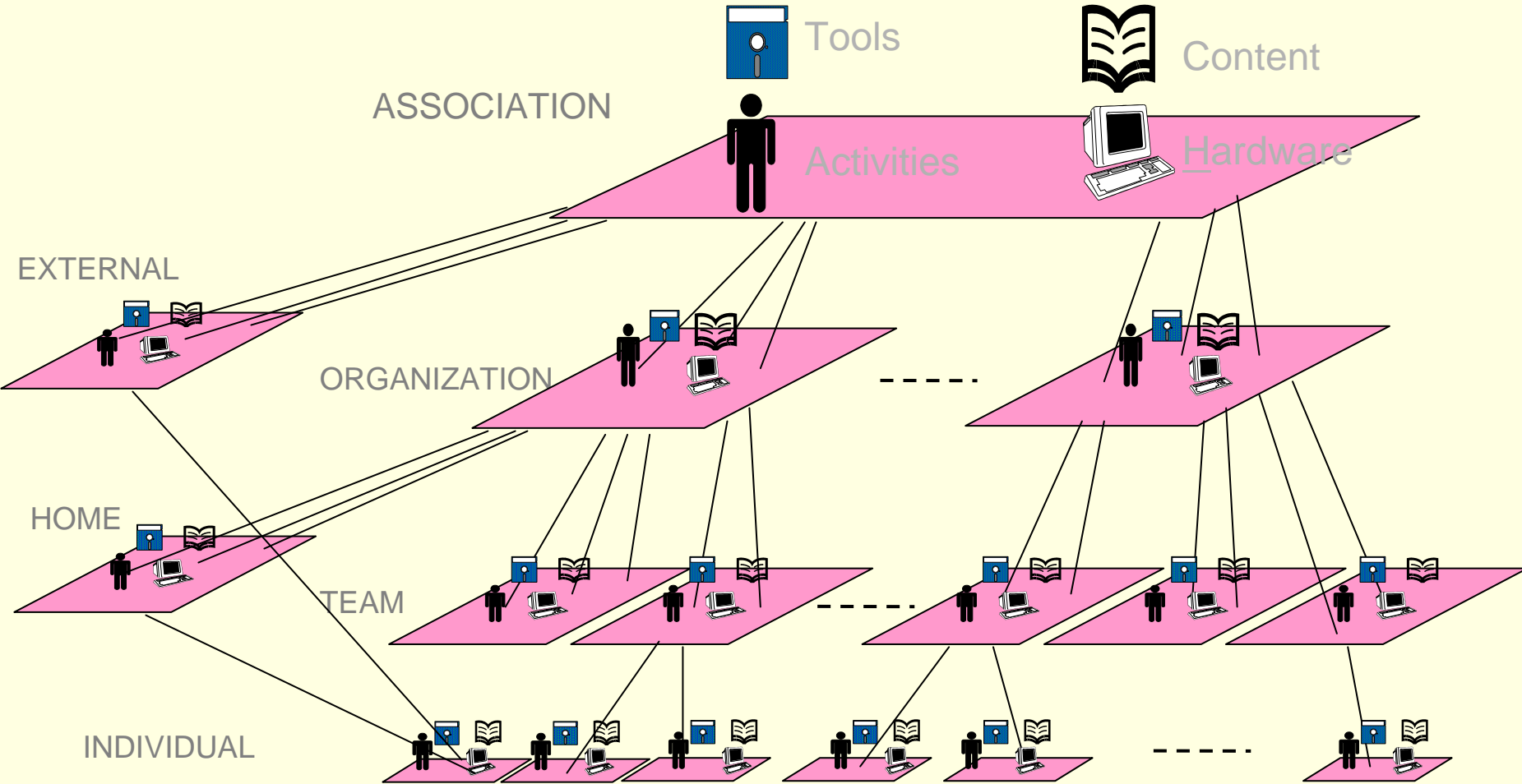
-collaboration

-learning

KNOWLEDGE NETWORK PYRAMID



NETWORK ON DIFFERENT LAYERS



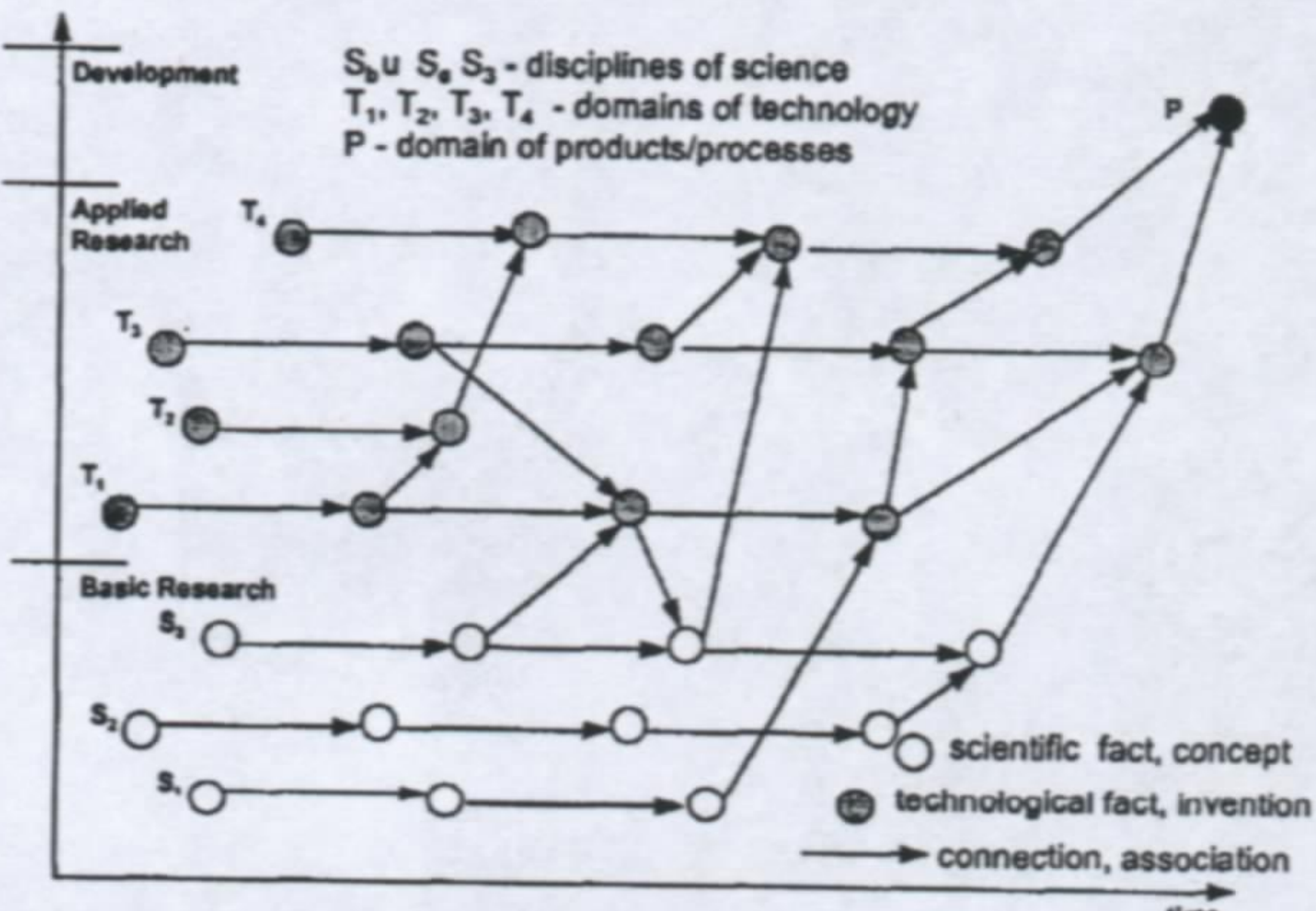
4. PROCESS IN KNOWLEDGE NETWORK SYSTEM

- The knowledge network system aims at the integration all the knowledge resources at all the levels (as well as the whole Internet) and provides easy and flexible means for the knowledge capturing , processing, and creation.
- In the daily work, people get their knowledge through the following ways :
 1. Searching and finding knowledge on paper (explicit knowledge).
 2. Meeting persons in real life to get explicit and tacit knowledge

3. Using multimedia communication tool like telephone, TV to get some knowledge
4. From personal computer, in which there exist some knowledge captured and stored
5. From the distributed knowledge network (DKN) at different level.
6. Creating new knowledge after capturing, integrating existing knowledge and creative mental process
- For the effective processing the knowledge, the concept of **knowledge node** is introduced

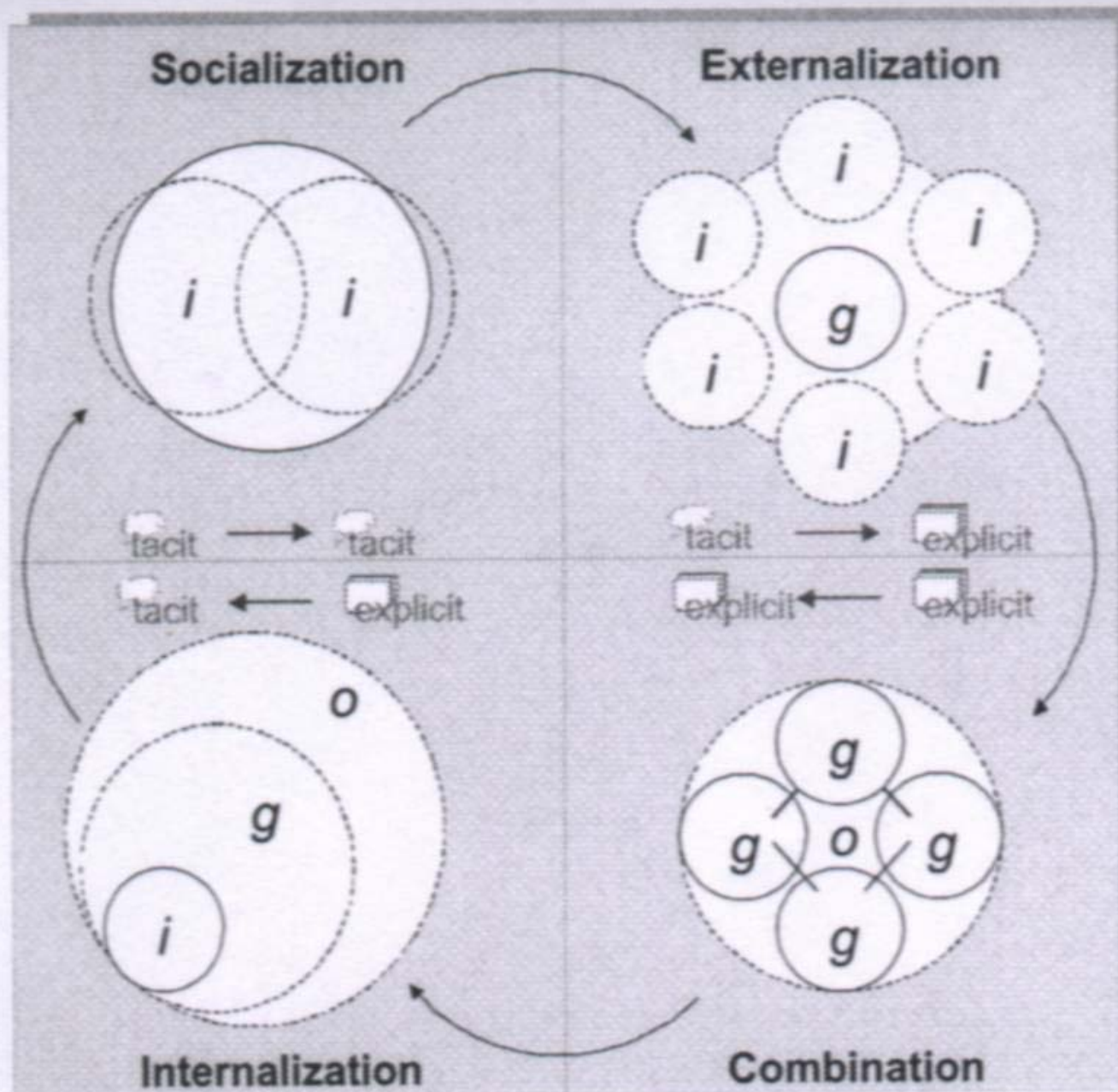
- A knowledge node is a kind of high level processing unit. It has three main functions:
 1. Dissemination of information on request or automatically channeled.
 2. Two way communication and feedback capacities through multimedia interfaces.
 3. Access to a local knowledge bank and possibly meta knowledge about other knowledge nodes.

- At the lowest level, a technological innovation is preceded by a number of interconnected scientific and technological facts (concepts). In the basic research work, those facts may present new scientific ideas, theories, empirical achievements, discoveries, etc in different scientific disciplines. In applied research work, they are advances in different technologies, e.g. new technical solutions, inventions, new principles and methods of design and manufacturing, etc. A network can be constructed by connections between these facts or concepts.



- Each node can be interlinked to another nodes at different levels
- The more important point is each new concept may play a catalytic role in triggering out new ideas and their applications to extending knowledge.
- If we can mine the existing networks and explore some pieces of network and integrate them, some prototypes of knowledge generating network may be expected, though it can not guarantee to perfect success.

- The most crucial task for the knowledge management is knowledge conversion and creation.
- A typical approach is put forward by Nonaka and Takeuchi. They assumes that knowledge is created through the interaction between tacit and explicit, individual and organizational knowledge, and proposes four modes of knowledge conversion.
- Corresponding to the above four modes, Nonaka proposes four types of *ba* (means a place or a sphere).



I = Individual g = Group o = Organization

- There are other scholars they do not agree with the knowledge conversion explained by Nonaka and Takeuchi. In reference [13], Cook and Brown point out the difference between knowledge that is possessed by its owner and knowing that is demonstrated and enacted as part of action. They distinguish the epistemology of practice (knowledge) and the epistemology of practice (knowing).
- According to their interpretation, knowing is considered inseparable from practice and interaction with the world. Each form of knowledge does its own work that the others can not do.

- Knowledge is seen as a tool at the service of knowing., something brought into action to be used during practice. Since knowing is an aspect of our interaction with the world, its relationship with knowledge is dynamic. Each of the forms of knowledge (individual and group, explicit and tacit) is brought into play by knowing when knowledge is used as a tool in interaction with the world. within this interaction, lies what they have called the **generative dance**. Through these actions, organizations create both products (or/and service) and knowledge.
- In this approach, the knowledge network system serves simultaneously for the knowledge and knowing .

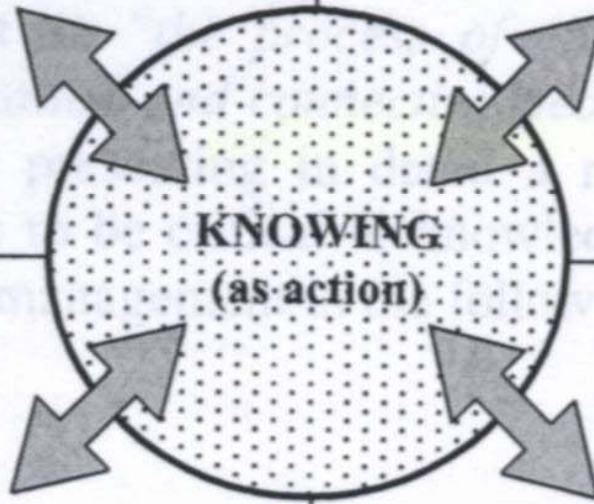
Individual

Group

Explicit

Knowledge

Knowledge

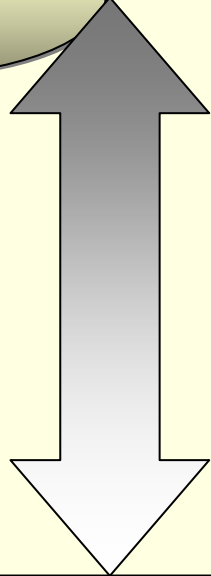
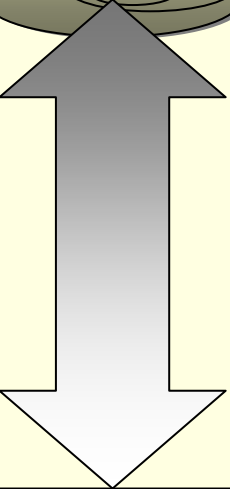
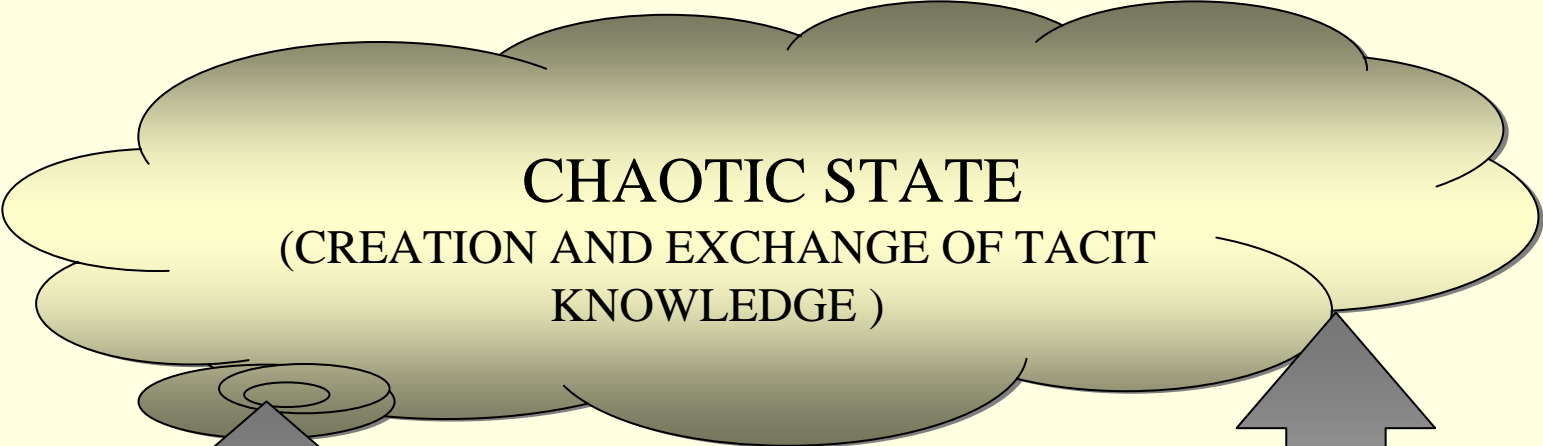


Tacit

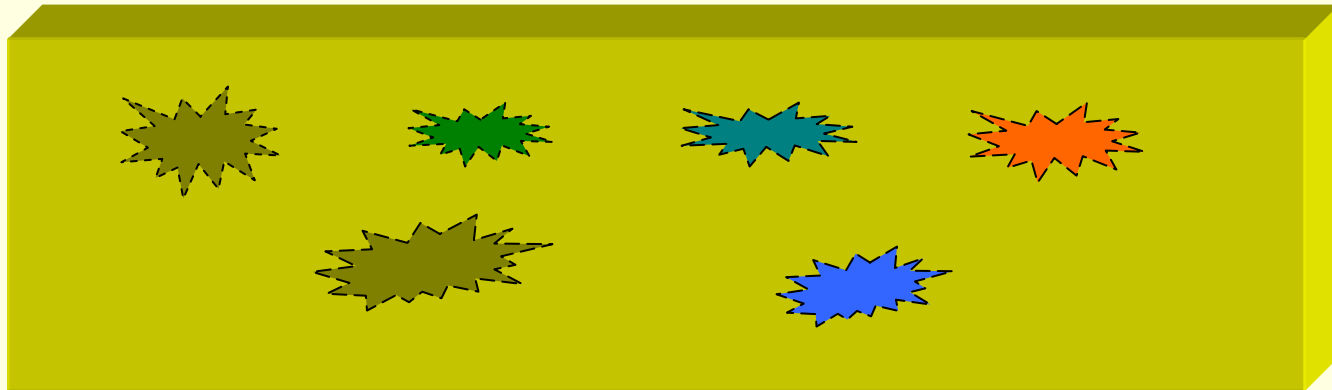
Knowledge

Knowledge

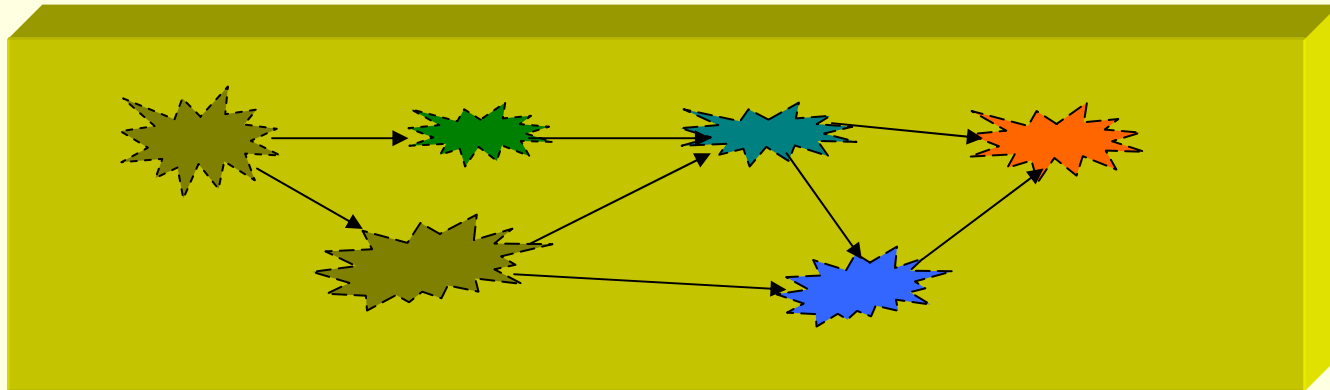
- The author of this paper has pointed out, the knowledge systems in the organization is an **intelligent complex adaptive system**. In the system they are two types of states : **ordered** and **chaotic**. The ordered state exists in the routine work or structure procedures. The chaotic state exists in the process of tacit knowledge exchange and creation. In the knowledge creation and innovation processes, the individual mental process and brainstorming cannot in ordered state. It is in the boundary between two states, some new ideas will be emerging. **The knowledge network system will bridge the two states.**



FUSION OF TACIT AND EXPLICIT KNOWLEDGE



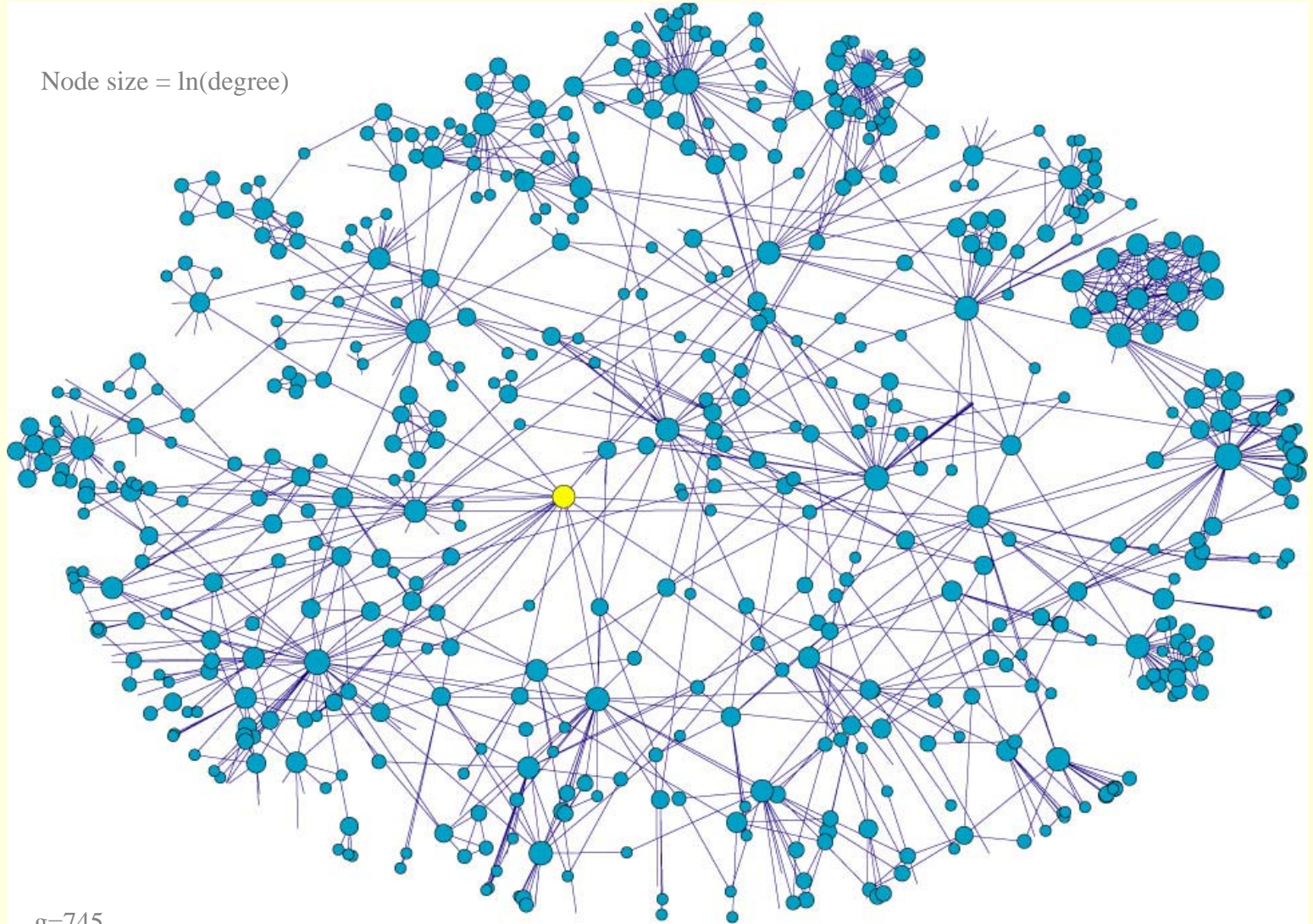
FUSION OF TACIT AND EXPLICIT KNOWLEDGE



5. COMPLEX NETWORK ANALYSIS

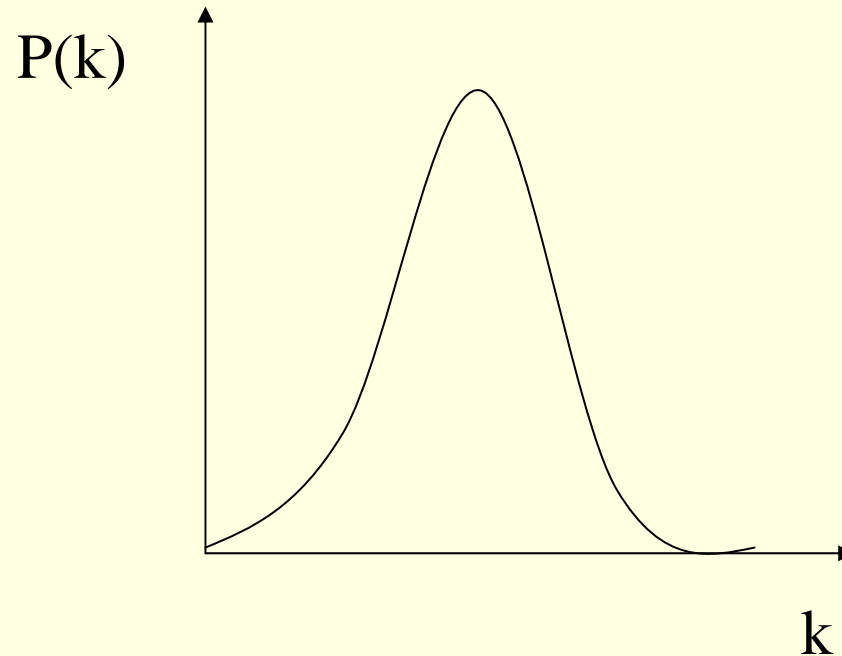
- Knowledge network system is a kind of complex network. As the system growing up, and the numbers of nodes and links increasing to a large figure, there are some issues in network itself.
- The issue of arrangement of element to form the network, e.g. the topology of the network is also a new focus.
- For the investigation of complex network, three spectacular quantities play key roles in the modeling :
 - the average path length
 - the clustering coefficient
 - the degree distribution

Node size = $\ln(\text{degree})$

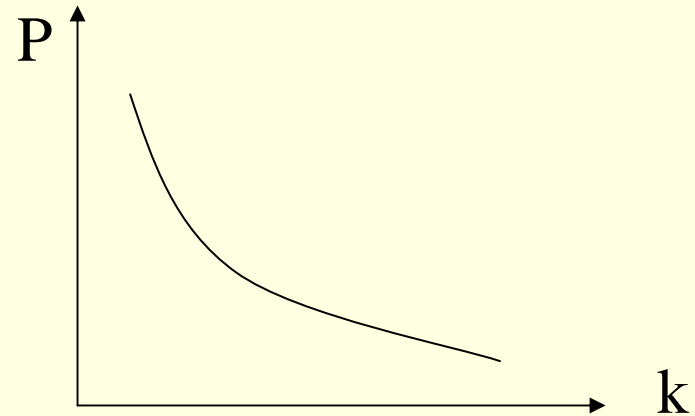


g=745

- There are some interesting characteristics in the complex network like Internet & World Wide Web. Internet is in uncontrolled and decentralized growth. New lines and routers are added continually. People thought it may be a random network with $P(k)$ as shown as

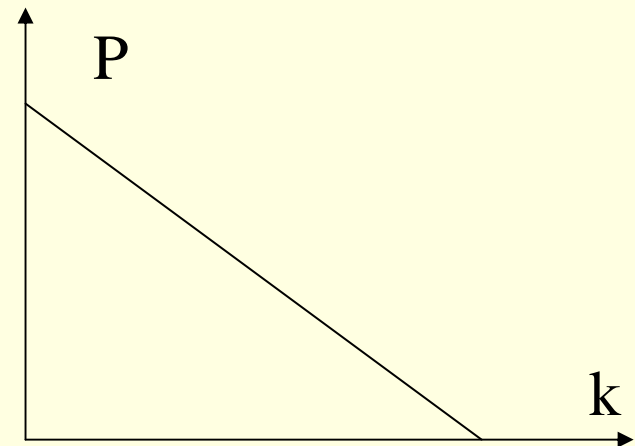


- But experience on Internet and WWW shows that the $P(k)$ is like this:



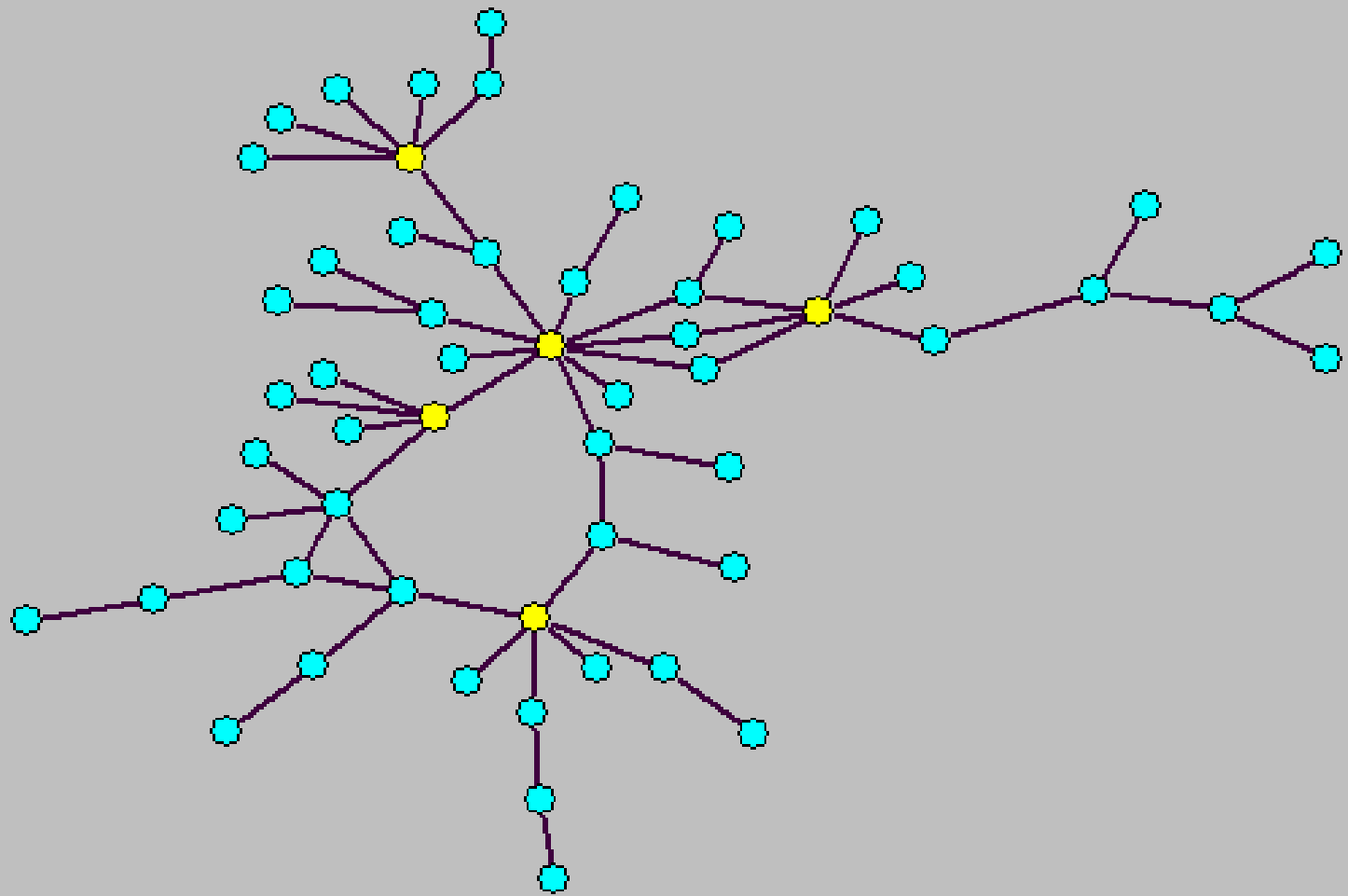
It significantly deviates from above. It can be described by a power law and in logarithmic scale, it is a straight line like this:

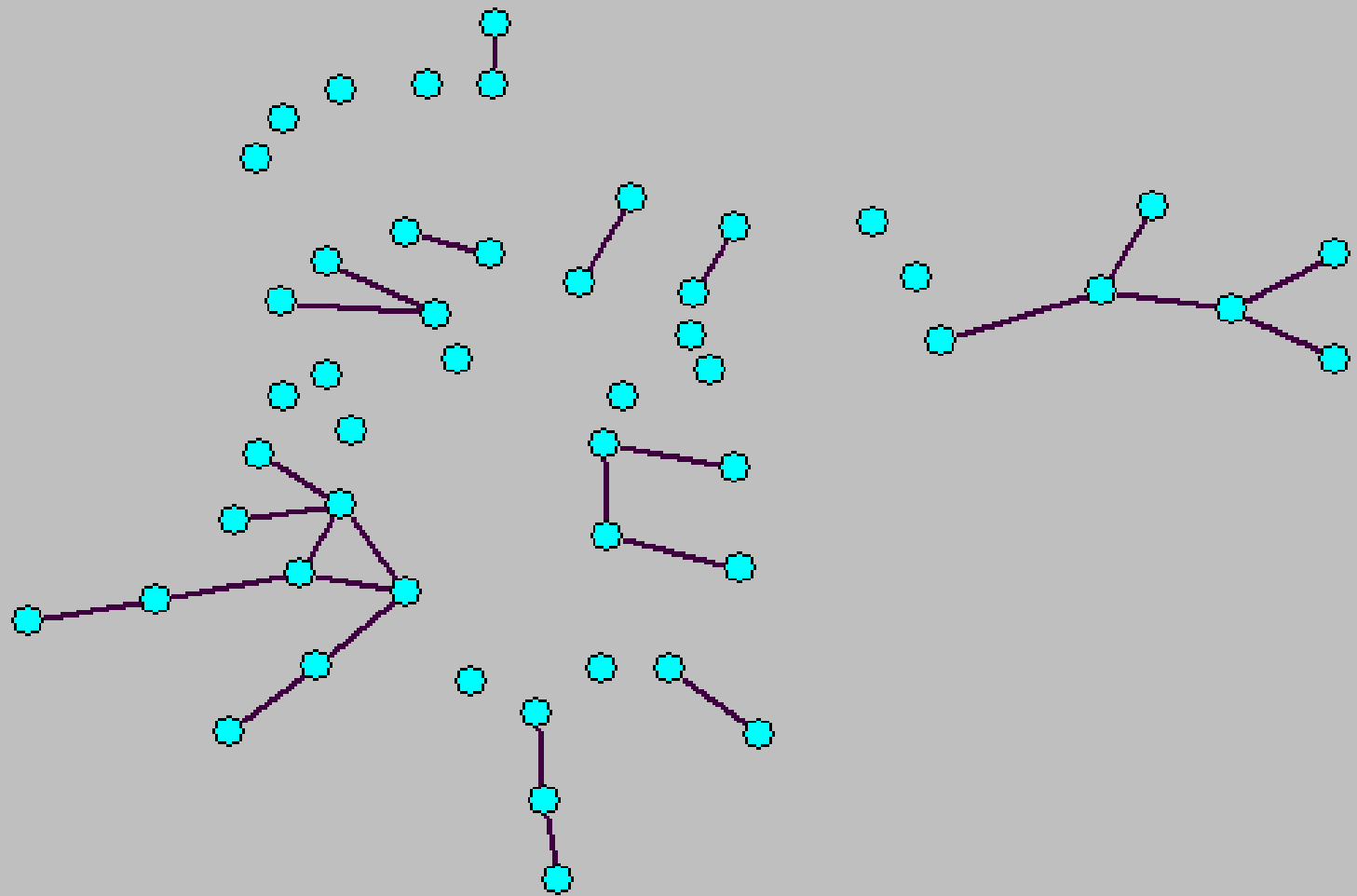
- Since power law is free of a characteristic scale, so this type of network is called **scale free network**.

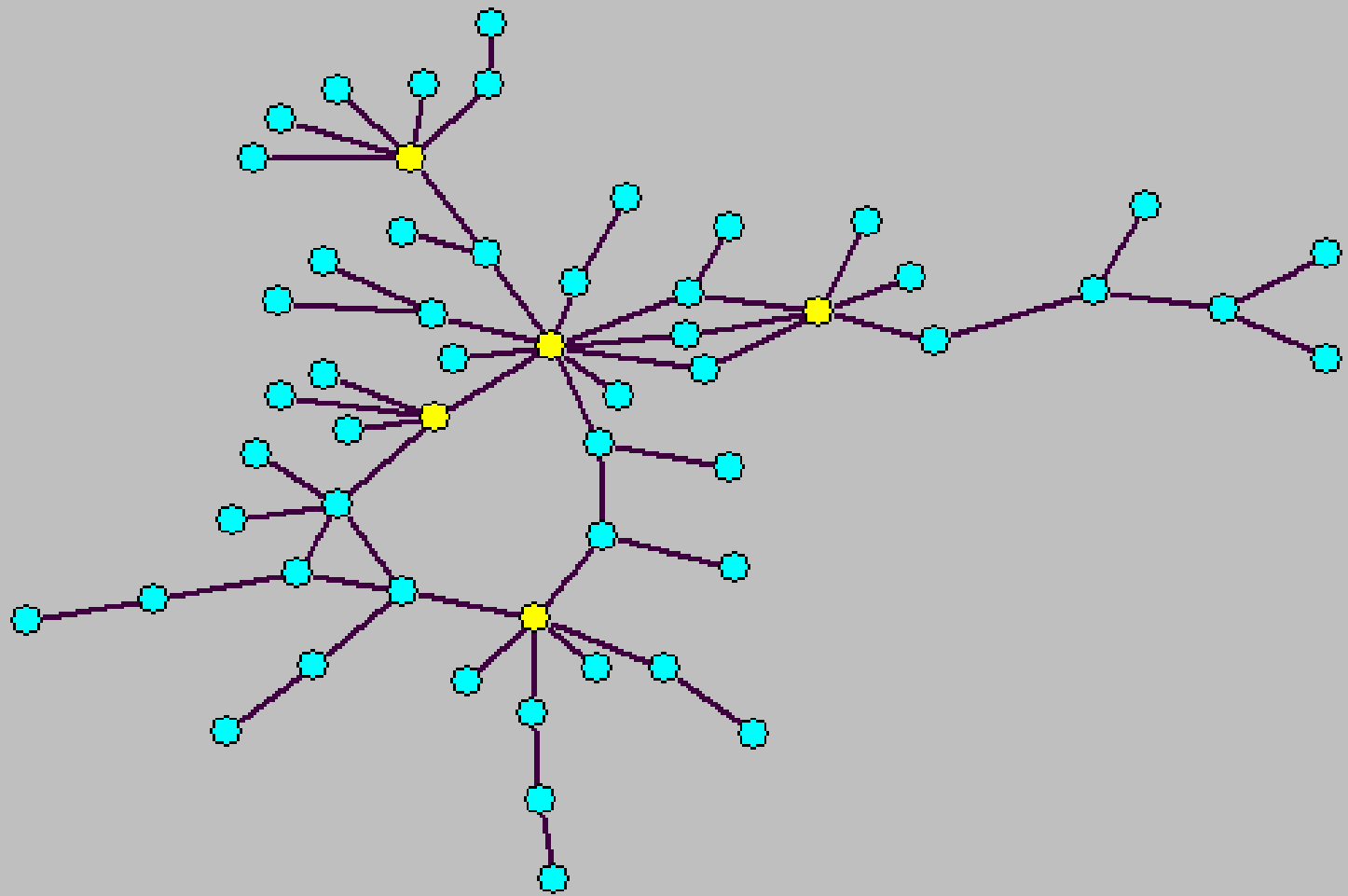


- This type of network has two generic features:
- 1. It is **dynamic, open** system that grows by the addition of vertices.

2. **Preferential attachment**, which favors attachment to vertices with high degree, rich gets richer.. The vertices with high degree are called **hubs**.
- Other two features are :the connectivity of scale free network is **robust**, it contains a giant cluster compromised of most of the nodes even after a removal of a fraction of its nodes. At the same time it is **fragile**, if the hubs are removed.







6. CONCLUSION

- In this paper, is put forward to model the knowledge system. It's not only a tool, but a paradigm to integrate the knowledge as objects and knowing as processes, and integrate the technical and social networks.
- Knowledge network system as knowledge creation environment, the application potentials are discussed with different approaches of knowledge conversion and innovation.
- Finally, the some issues of complex network analysis are described.

THANK YOU!