COMPETENCE–BASED SUPPORT OF INTERACTION BETWEEN BUSINESS NETWORK MEMBERS

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Abstract: In a complicated business network finding a supplier can be a very time consuming task. The technology of competence management is aimed to support such kind of tasks. The paper presents an approach to support interaction between business network members based on such technologies as competence management and knowledge management. The conceptual models of the context-driven competence management system and production network member competence profile are described. The usage of the competence management system is illustrated via an example from automotive industry.

Keywords: competence management, competence profile, knowledge management, business network.

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Introduction: Horizontal (Cluster-Based) Approach to Innovation Development

There are a number of reasons leading to innovation development. First of all, the business environment has changed and become network-centric. In the political environment the role of the structuring leader is moving from independent states to network communities. In the economic environment it moves from industries to network clusters based on distributed cooperation of representatives from different industries. Such clusters are not headed by leading companies, but managed through virtual spaces where knowledge exchange and innovation generation take place. The further uniting of the clusters in the network leads to development of global networks crossing state borders. This is accompanied by the de-sovereignization of the world economy and at the same time its regionalization based on new principles (the regions are not considered as administrative units, but as networked trans-border institutes). In addition, due to the Internet the world economy becomes absolutely transparent and as a result hypercompetitive.

The way production has also changed: the industrial development paradigm has yield to the postindustrial paradigm that has different driving forces and “game rules”. Knowledge has become the major production factor; continuous innovation (instead of scale economy) has become the major competitiveness factor; anticipatory growth of investments into human capital (instead of investments into fixed capital) has become the basis of the steady growth; and the innovation speed (i.e. time management instead of territory management) has become a priority in the area of safety.

Hypercompetitiveness has not left any chances to the pursuing industrial development. Three centers of the economical power (USA, EU, Eastern Asia) are still preserving their influence, however the world is quickly dividing into “developed” and “lost”: those who has managed to move to the innovation growth and, those who has not.

Another reason is drastically changing growth landmarks. Technologies are changing so fast and the structure of globalized markets is getting so complicated that the government cannot longer identify the optimal investment projects for business (as it used to do during the industrial age in the pursuing countries of Asia and Latin America). Contrary to the widespread idea, the direct encouragement of particular industries and “braking-through” technologies by the government today becomes secondary. The job of the production structure optimization is done by the market itself via competitive interactions and economy clustering. This means that the institutional structure of the economy (and not the structural reforms, targeted production diversification or high-tech volumes as it was considered) plays the major role in the growth of the competitive advantage.

As a result it can be concluded that classic (vertical) industrial policy with its bet on leading industries, production scales and industrial base completion goes to the past. A new industrial policy is needed to shift to the innovation-

based social and economic structure. This policy has to be horizontal, with the government having completely different tasks – stimulation of cooperation and cluster initiatives, assistance in finding partners by companies (especially SMEs), creation of competitive stimulus for network organization. The success of Scandinavian countries shows that competition leadership is achieved by those who use the Triple Helix Model – partnership between government (state), business and science (academia) [Etzkowitz and Leydesdorff, 2000].

Background

Business network is an aggregate of resources of independent companies united on the principle of cooperation within the same information environment and capable to coordinate their activities for production of the final product/service. However, to organize companies into a network the coordination of their activities and "understanding" of one another are required. For this purpose it is necessary to use information technologies that would allow to automate these processes. Knowledge management, context management and competence management are proposed to be applied to solve this task.

Knowledge management is a discipline that provides for an integrated approach to creation, accumulation, organization and usage of information sources and access to them. These resources include structured databases, textual information (e.g., electronic documents) and the most important tacit knowledge and employees' expertise. Currently, ontological models are widely used for knowledge representation. The ontological model is a formalized description of the problem domain.

For intelligent processes supported by information technologies, the context is defined as information that can be used for description of the situation concerning a certain object at the given time. Application of the context management technology to knowledge management systems is necessary since during the interaction between network members the current situation can put some constraints at the interaction (e.g., unavailability of a member, impossibility to perform a task by one of the members at the given time, etc.). In the presented approach the context is described in the form of the ontological model.

Competence is a possibility to perform business processes that are supported by necessary resources, practice and actions, the let the company to offer its products or services. Competence profile management lets the knowledge management system to use the corresponding network members as knowledge sources.

Conceptual Model of the Competence Management System

Depending on the way of the competence management system usage two types of users can be identified: network members and users, who are representatives of the network members (Fig. 1). Within the network the company employees may have different roles. When the user (company representative) is registered in the system he/she is assigned a use profile containing personal, registration, and system information about the user, his/her preferences revealed by the system, feedback of other users, as well as history of the user actions in the system. The user profiles make it possible to specify and complement user requests with necessary information and personalize the knowledge and information flow from the system to the user.

When the network member is registered in the system its competence profile is created. It contains information about the member, the history of its activities in the competence management system, production preferences, feedback concerning the quality of order performance. The competence profile makes it possible to faster and more precisely choose a network member to perform a required operation or to produce/supply required components.

Fig. 1 represents interactions between users and supply chain members. The user representing network member *i* can make a request to a particular user representing network member *j* or get information directly from the competence profile of network member *j*. For example, the user representing member *i* can find capabilities of member *j*, as well as feedback concerning meeting quality and time requirements by this member for other users. After that he/she can directly discuss cooperation details with a representative of member *j*. The direct interaction can be useful for security reasons: a network member may have some confidential information that should not be stored in the shared competence management system, but it can be directly handled to another member.

It is also possible for network member *i* to send a direct request to network member *j* (without user intervention). For example, an automated warehouse management system of network member *i* can request the appropriate

network member (e.g., network member *j*) to supply required components if the stock at the warehouse is insufficient.

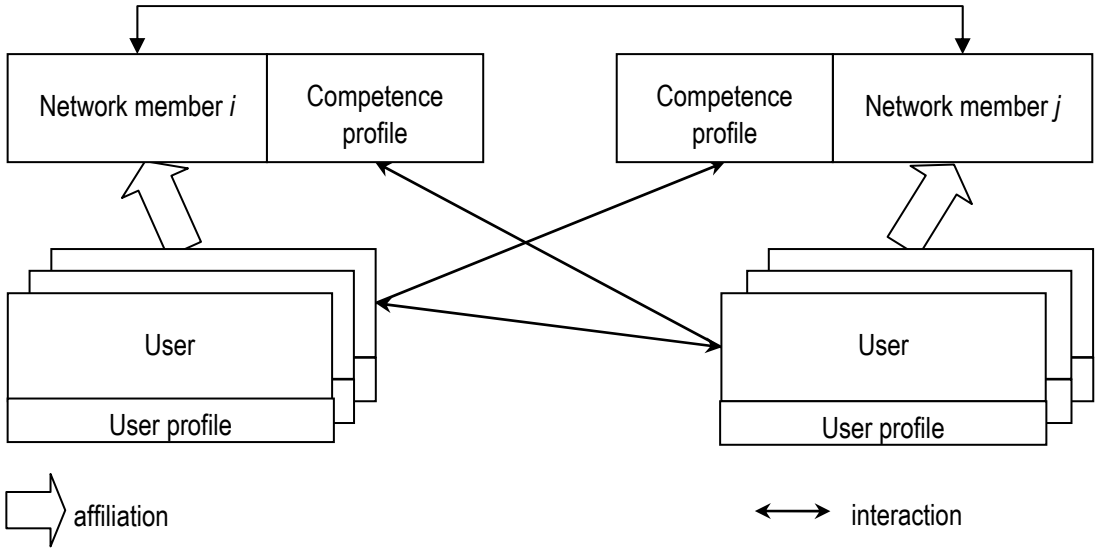


Fig. 1 Interaction between users and network members

The conceptual model of the context-driven competence management system in flexible supply network (Fig. 2) is based on the earlier developed idea of ontology-driven interoperability support [Smirnov et al., 2007]. In accordance with the conceptual model the context-driven competence management system implements the following scenario for coordination support between members of a flexible supply network.

A user (a representative of a supply network member) submits a request to the system (1). Based on this request, available ontological model of the problem domain and the current situation the context is built (2), which is a description of the user request and current situation in terms of the ontological model. The ontological model in the competence management system describes the main terms used for supply network description and relationships between them. Since the terminology used by users may differ from that used in the ontological model it is necessary to map these terminologies to each other. Synonyms can be used for this purpose. The request terms are searched for in the ontological model and found fragments are combined to form the context [Chaudhri et al., 2000].

The knowledge map defines references between the ontological model (3) and knowledge sources (4). This makes it possible to use uncoordinated sources as a single distributed knowledge base. Based on the knowledge map and the formalized user request, the knowledge and information required for answering the user request are acquired from appropriate sources (5). Databases, electronic documents, information systems as well as supply network members can serve as knowledge sources.

If a supply network member serves as knowledge source it provides services for the system to access the owned knowledge. Information about the member is obtained from its competence profile. Based on this information a decision can be made whether this member is suitable for a particular supply network configuration.

The following information from the competence profile is taken into account during the supply network configuration:

- capabilities describe products and services the supply network member can provide;
- capacity and lead time are used by the system to decide if the supply network member can supply required products/services in the given time and quantity;
- price-list is used by the system to reduce costs of the entire supply network;

Besides, the preferences of supply network members are also taken into account. For example:

- order time (a supply network member might prefer long-term or short-term orders);
- order volume (a supply network member might prefer low volume or mass production);
- technology (if a supply network member produces good A it might prefer to produce good B at the same time).

Location of a supply network member is used to define product delivery time, and depending on the current situation (season, precipitations, snow, storms, local holidays, etc.) the supply network member can be inaccessible.

The information from knowledge sources is transferred to the user, with the user profile being used for ranking of the presented results based on their relevance to the user request and preferences.

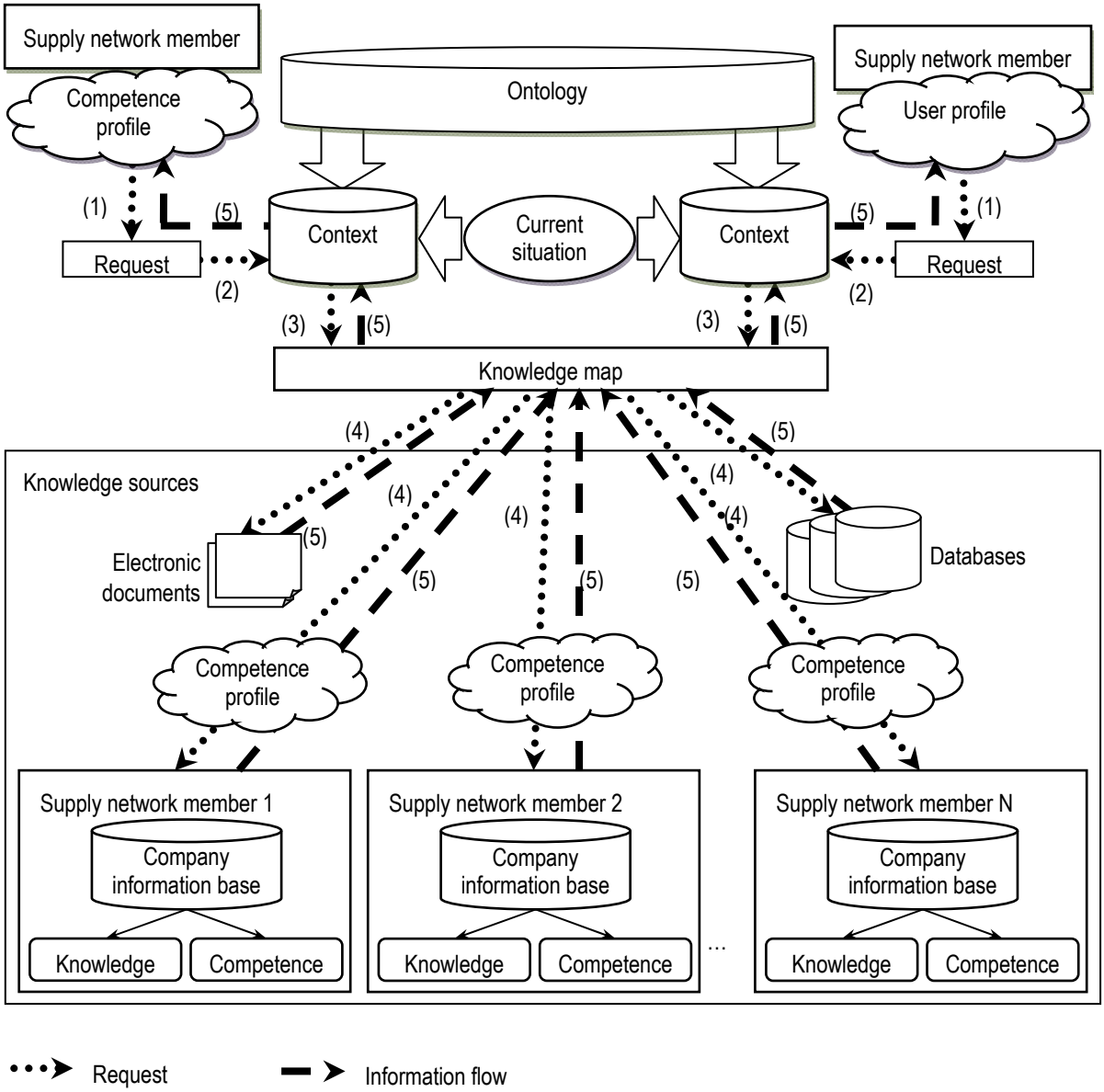
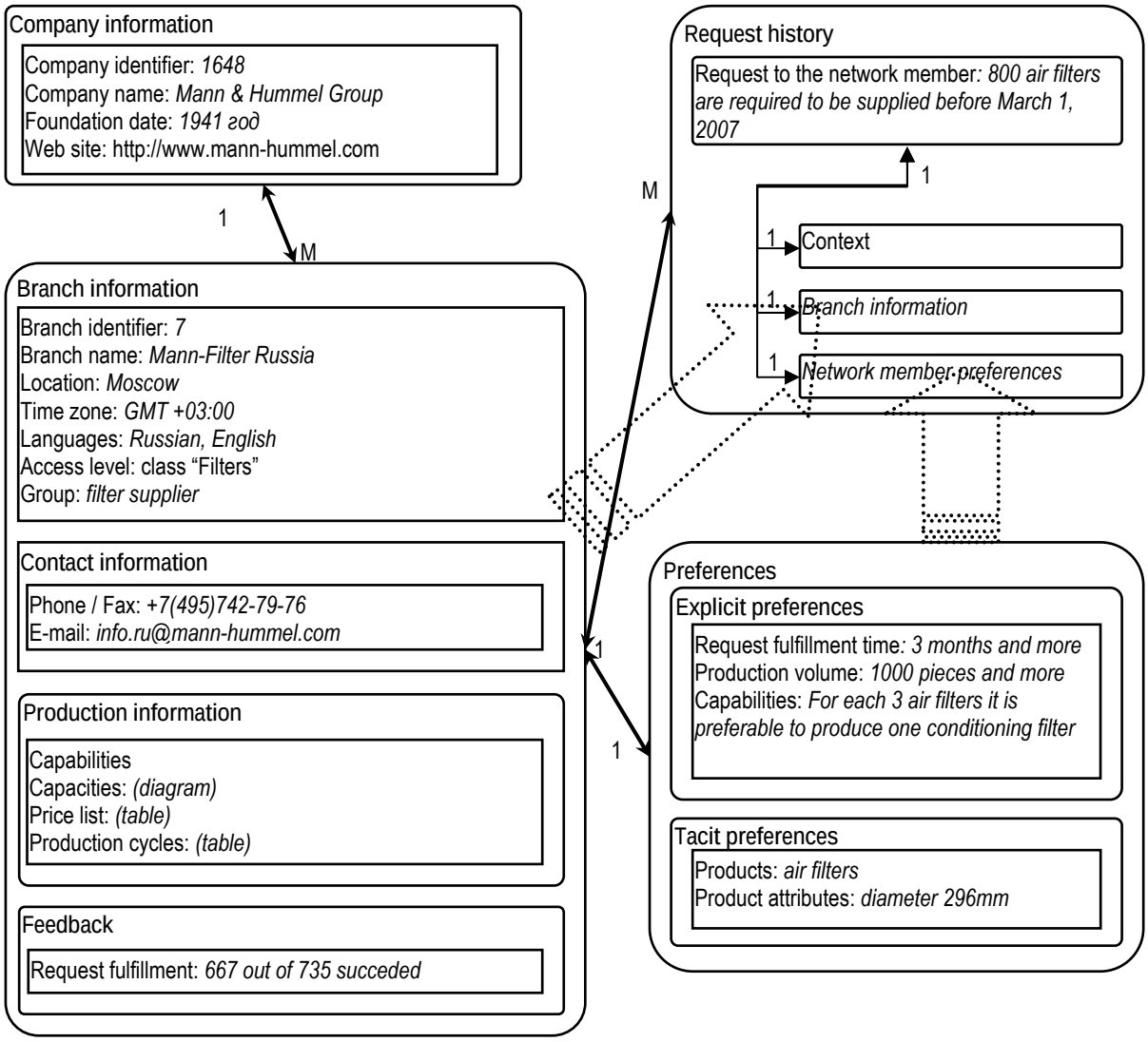


Fig. 2 Conceptual model of the context-driven competence management system in a supply network

Network Member Competence Profile

The competence profile of the network member is presented in Fig. 3. It contains the following categories::

- "Company information" contains general information about the company;
- ""Branch information" contains information about a particular branch of the company;
- "Request history" contains the entire history of the branch in the system;
- "Preferences" contains preferences of the network member related to its products/services.



* Attributes "Branch information" and *"Preferences"* are snapshots of the categories "Branch information" and "Preferences" at the moment of request initialization

Fig. 3 Conceptual model of production network member competence profile

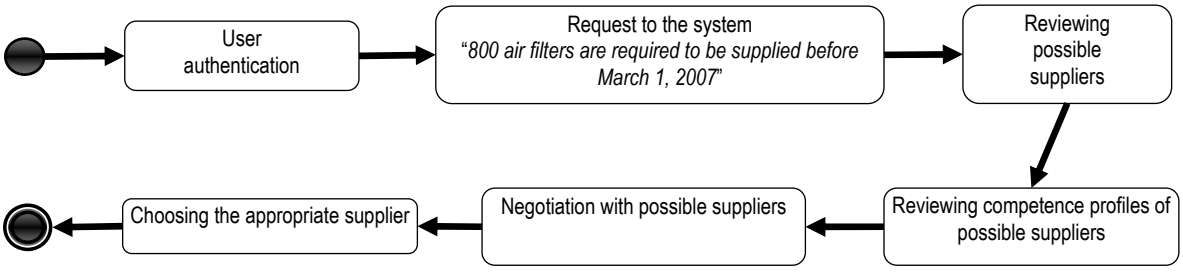


Fig. 4 Competence management system usage example

The FP6 project "Intelligent Logistics for Innovative Product Technologies" (ILIPT) is aimed at developing new methods and technologies to facilitate the implementation of a new manufacturing paradigm for the European automotive industry [Stone et al., 2005]. This new paradigm, "the 5-day car" approaches the building of 'cars to order' in a reduced time scale. ILIPT project addresses the conceptual and practical aspects of delivering cars to

customers just in a few days after placing the order, the automotive industry's exciting and radical new business model [ILIPT].

One of the ILIPT project tasks is to develop a competence management system to support interoperability within the "5-day car" production network. Fig. 4 demonstrates an example of the usage of the competence management system for automotive production network developed at SPIIRAS. The user passes the authentication procedure and formulates a request to the system ("*800 air filters are required to be supplied before March 1, 2007*"). The system finds appropriate suppliers and suggests them to the user. The user can review the competence profiles of the suppliers and initiate the negotiation process with their representatives. After that the user can decide which supplier is the most appropriate.

Conclusion

The developed model of context-driven competence management system increases the level of coordination between its members due to usage of the ontological model of the network and competence profiles of its members. The competence profile of the network member includes information supplied by the member itself as well as information, revealed by the competence management system based on the behavior of the member. This information from the competence profile can be of high interest for other network members planning cooperation with this member and allows automating some of the processes taking place in the business network.

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