on the processes, which provide competitive advantage, will increase.

Tendencies to development global enterprises, creation new cooperative links are visible also in the dynamics of the need to exchange information – cooperative data. Development of cooperation requires data flow according to the elaborated standard of data exchange model of the product for cooperation at the exact time of its coming into being (Botta-Genoulaz, Millet and Grabot 2005, Rose and Girard 2007). Production cooperation process has representation and formal modeling in the literature using:

- graph theory,
- game theory,
- business processes alignment,
- petri nets,
- gaussian networks,
- social network and other.

The multidisciplinary character of cooperation phenomenon is underlined and represented in the literature review including economic theory: international economics (offshoring), theory of the firm - especially information oriented (Nonaka and Takeuchi 1995)

The problem of cooperation in production is connected with innovative activities of an enterprise. The process innovations depend in part on the variety and structure of thier links to the sources of information, knowledge, technologies, practices, human and financial resources. Linkages act as sources of knowledge and technology for an enterprise's innovation activity, ranging from passive sources of information to suppliers of embodied and disembodied knowledge and technology to co-operative partnerships – described in *Oslo Manual* (OECD 2005).

Co-operation of enterprises for innovation allows to access knowledge and technology that they would be unable to utilize on their own. There is also great potential for synergies in co-operation as partners learn from each other. Innovation co-operation can take place along supply chains and involve customers and suppliers in the joint development of new products, processes or other innovations. The level of interaction along supply chains (i.e. whether linkages involve co-operation, or arm's-length exchanges of information or purchases of technology) may depend on the type of knowledge and technology.

BACKGROUND

The Modeling Frameworks and Organizational Structure of Production Processes in Enterprise

Modeling frameworks, methodologies and organizational structure and its rules of processes in enterprise concepts emerged in different application domains such as ARIS, CIMOSA, GRAI/GIM, GERAM, IEM, PERA, Open Group Architecture Framework (TOGAF) or the IDEF family of languages (described in FEA 2007, GERAM 2000, Lankhorst 2005, Williams, Rathwell & Li 2001).

The ARIS-architecture distinguishes Organization, Function, Information and Control views. It uses a graphic modeling system supported by software which models data movement and tasks (GERAM 2000, Lankhorst 2005). ARIS focuses on the analysis and requirements definition phase during the design of managerial information systems, not on the execution of business processes. Federal Enterprise Architecture (FEA) - an architectural description of the enterprise architecture of the U.S. federal government that includes various reference models, processes for creating organizational architectures that fit in with the federal enterprise architecture, and a methodology for measuring the success of an organization in using enterprise architectures (FEA 2007; Williams et al. 2001). The PERA model breaks the enterprise life cycle into "phases". While this is

not the only possible "phase breakdown", it is one which has been proven in a large number of projects in many industries. It also breaks the investment approval process into a number of steps which works well for projects larger than a few million dollars. Smaller projects may combine phases to reduce overhead costs, but the deliverables between phases generally remain the same. GERAM defines a tool-kit of concepts for designing and maintaining enterprises for their entire life-history.

PERA, GERAM and other models are not yet-another-proposal for enterprise reference architecture, but are meant to organize existing enterprise integration knowledge.

CONDITIONING OF PRODUCTION COOPERATION

General Model Cycle of Production and Knowledge

A model of the production system, based on the macro run of the production processes, should take into account mutual interactions of the enterprises with the environment. These problems are related to the effect of world and regional economy on company's functioning. Micro-economic knowledge is also necessary and it makes possible efficient management of the possessed resources as well as allows to design systems, subsystems, and processes of production effectively – Figure 1. Collaborative design process gathers enterprises willing to achieve a common objective based on a new product, information and knowledge sharing, including a high level of activities coordination. Knowledge of the enterprise refers to all their design expertise in one or several given domains (Robin, Rose & Girard 2007) and could be defined as being at the crossroads of in-depth knowledge and collaborative knowledge.

Robin et al. (2007) proposed to structure this knowledge in four different types. So, exist possibility to define cooperation knowledge of enterprise as a set of all this knowledge:

- Popularization knowledge acquired by the enterprise, coming from the other members of the cooperation.
- Popularization knowledge distributed to the other enterprise of the cooperation project. It is a support of problem solving.
- Knowledge-being used by enterprise actor when he has to initiate communication with the other enterprise.
- Synergy knowledge, implemented to carry out and maintain the intra-group knowledge exchanges as a support of communication.

In the literature review (Nonaka and Takeuchi 1995) are proposed two types of knowledge: explicit knowledge and tacit knowledge. Explicit knowledge can be expressed in formal and systematic language and shared in the form of data, scientific formulae, specifications, manuals and the like. It can be processed, transmitted and stored relatively easily. In contrast, tacit knowledge is highly personal and hard to formalize: subjective insights, intuitions and hunches fall into this category of knowledge. Tacit knowledge is deeply rooted in action, procedures, routines, commitment, ideals, values and emotions.

Besides most of computer supported collaborative work the tools focus on communication features (messaging) and co-ordination (approval forms, workflow tools, videoconference tools) but few of them are interested in collaboration among actors. However there are relatively few studies of the role of supported collaborative work in product development and design and its effect on problem-solving activities (Moczala 2006).