

Application possibilities of fuzzy networks concept in metallurgical industry

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Abstract. Our article presents possibilities of applying the concept Fuzzy Networks for an efficient metallurgical industry in Romania. We also present and analyze Fuzzy Networks complementary concepts, such as Expert Systems (ES), Enterprise Resource Planning (ERP), Analytics and Intelligent Strategies (SAI). The main results of our article are based on a case study of the possibilities of applying these concepts in metallurgy through Fuzzy Networks. There are presented the domains afferent to KIBS are defined complying with the standardized classification of industrial sectors according to European Monitoring Centre on Change (EMCC). It is also analyze important approaches in the specific scientific literature, the research methodology a study case. KIBS concept implementation to the Romanian metallurgical industry aims also to include performance of activities concerning the formulation and development of new specific concepts.

1 Introduction

The concept of Knowledge Intensive Business Services (KIBS) is basically defined as providing efficient services performed by specialized companies to other businesses interested in intensively using advanced knowledge [3-5].

KIBS has diverse areas of concern as specific activities. These include:

- Conception;
- Designing;
- Research-development;
- Training (learning – training);
- Implementing new technologies;
- Consulting in: management, marketing, advertising;
- Quality Assurance and Certification.

Figure 1 presents the algorithmic scheme of KIBS's design and specific correlations.

The beneficial aspects of KIBS concept application like: quality increase, economical efficient making, sales optimization are pointed out in many works of scientific literature.

The Romanian metallurgical industry suffered unfortunately an important and severe regression during last period. So, many production works of this industry branch have been

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closed or severely diminished production. Most relevant examples in this regard are the Steel works of Călan, Oțelul Roșu, Reșița, Târgoviște [2, 6].

Further on, are presented several possibilities to apply the KIBS concept to the Romanian metallurgical industry. It is also analyze important approaches in the specific scientific literature, the research methodology a study case.

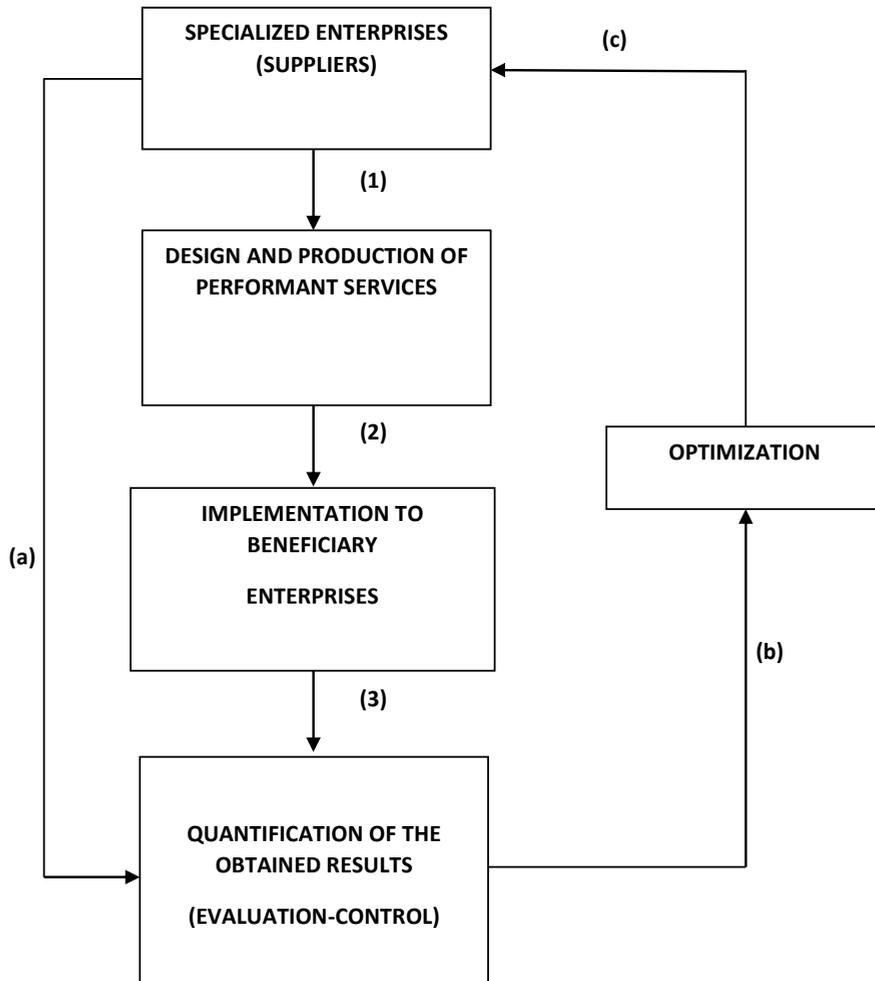


Fig. 1. Algorithmic scheme of KIBS's design and specific correlations. a – Suppliers evaluate the KIBS concept implementation on beneficiary's side. (b) + (c) – Supplier optimizes KIBS concept based on evaluation outputs. (1) - (3) – Time phasing of KIBS concept realization.

2 Possibilities and prerequisites to apply the KIBS concept to the Romanian metallurgical industry

According to European Monitoring Centre on Change (EMCC), the domains afferent to KIBS are defined complying with the standardized classification of industrial sectors [1, 7]. NACE Division 72: Computer activities and related:

- 72.1: Hardware consultancy
- 72.2: Software consultancy and supply

- 72.3: Data processing
- 72.4: Database activities
- 72.5: Maintenance and repair of office, accounting and computing machinery
- 72.6: Other computer related activities
- NACE Division 73: Research and experimental development:
 - 73.1: Research and experimental development on natural sciences and engineering
 - 73.2: Research and experimental development on social sciences and humanities
- NACE Division 74: Other business activities:
 - 74.3: Technical testing and analysis
 - 74.4: Advertising
 - 74.5: Labor recruitment and provision of personnel
 - 74.8: Miscellaneous business activities n.e.c.
 - 74.11: Legal activities
 - 74.12: Accounting, book-keeping and auditing activities; tax consultancy
 - 74.13: Market research and public opinion polling
 - 74.14: Business and management consultancy activities
 - 74.15: Management activities of holding companies
 - 74.20: Architectural and engineering activities and related technical consultancy
 - 74.81: Photographic activities
 - 74.84: Other business activities n.e.c.

KIBS concept implementation to the Romanian metallurgical industry aims also to include performance of activities concerning the formulation and development of new specific concepts as is (Dumitrana et. al, 2015, Ioana and Marinica, 2014, Ioana et. al. 2013, Ioana, Mirea and Bălescu, 2010): Expert system (ES), Enterprise Resource Planning (ERP), Fuzzy Network, Analytics Strategy and Business Intelligence (ASBI).

Unlike the majority computing programs, that require complete pieces of information to issue a decision, expert systems are designed to find the optimal solution based on available data the same way a human expert would act (Kallweit, Spreer and Toporowski, 2014, Semenescu, Ioana and Marcu, 2014).

An expert system (ES) is a computer program made of two components:

- A database (as big as possible) and
- A set of rules (program, algorithm) to search the given database aiming to find the optimal solution of the given problem

The database (DB) and the set of rules (SR) are set up by questioning the domain experts (Abrudan, Plăiaș and Dabija, 2015, Ioana and Semenescu, 2013, Ioana, Semenescu and Preda, 2012, Ioana, Mirea and Bălescu, 2009, 2010).

Figure 2 presents an expert system (ES).

The cost of producing similar products vary between different countries because certain resources, such a labor, raw materials and energy will be cheaper in some countries than others.

Multinational enterprise are able to take advantage of these cost differences by buying components or products from countries that have these advantage. For example, a motor-vehicle manufacturer in an economy with high labor costs may purchase certain components from another country with significantly lower costs.

An expert system is made of five components, rendered in Figure 3.

Knowledge Base (KB) serves to stock all pieces of knowledge (facts, rules, solving methods, heuristics etc.) specific to the domain of application retrieved from human experts or other sources.

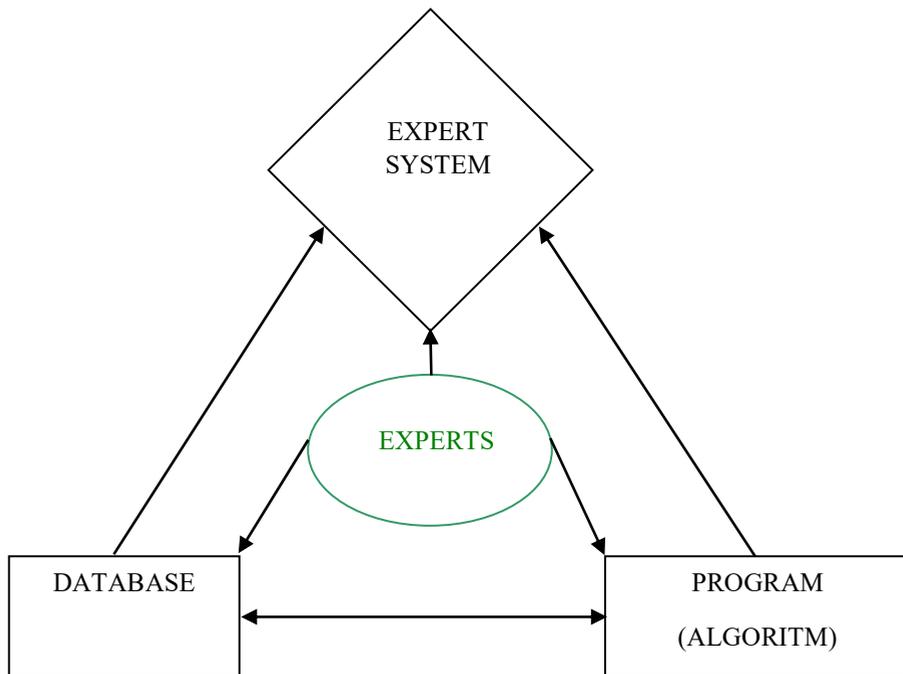


Fig. 2. Expert System Scheme.

Inference Engine (IE) is a program that contains checking, procedural and operational reasoning by means of which the database is explored applying reasoning in order to assert solutions, recommendations and conclusions.

Dialogue Interface (DI) permits communication with user during consulting sessions as well as access for users to facts and knowledge in the database for adding or updating thereof Oh, Teo and Sambamurthy, 2012).

Knowledge Acquiring Module (KAM) assists the expert user to introduce knowledge in a form recognized by the system and to update the knowledge base.

Explicative module (EM) is aimed to explain to users the knowledge level available in the system as well as the reasoning process that is performed or the solutions asserted during consulting sessions (Renko and Druzijanic, 2014, Sirbu, Săseanu and Ghiță, 2015).

The explanations in such a system, if designed accordingly, improve the way the users perceive and accept the system.

¹⁾ Inference: a logical operation to pass from one statement to another while the following statement is derived from the previous.

An ES is based on two distinct and complementary components:

- a. **Programming technologies** which allow a large volume of knowledge as well as the way to interfere therewith.
- b. **Developed constructions** and methodologies that enable effective use of these technologies.

Reasoning and knowledge should not be treated separately in an ES since such a system requires harmonizing thereof.

The expert who understands the need for an expert system in its field can obtain help from the knowledge engineer (computer specialist), so following discussions with this one, certain knowledge can be reformulated to enable the use thereof in a computer.

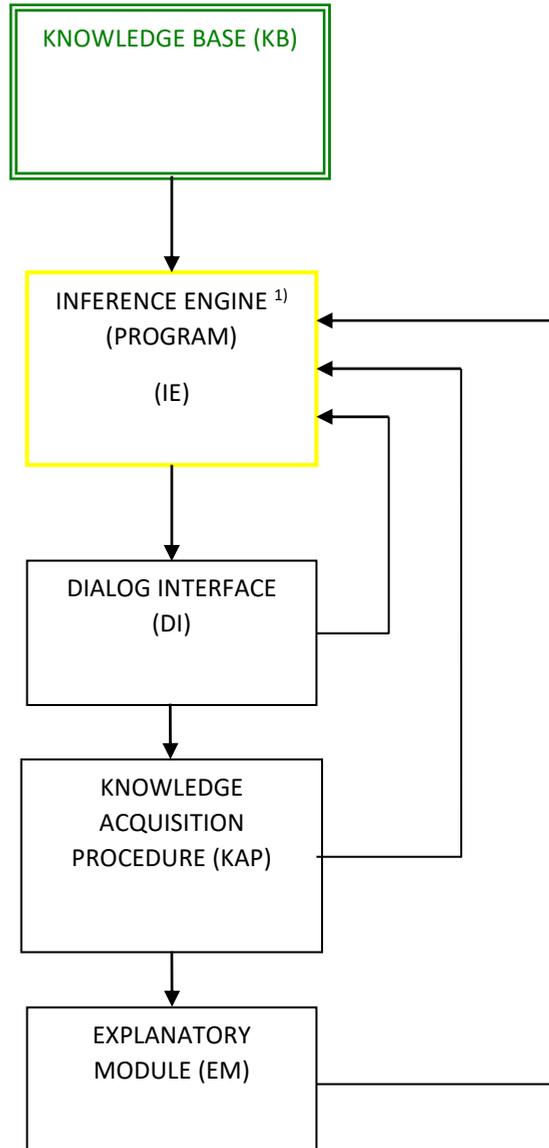


Fig. 3. Architecture of an ES.

An **Enterprise Resource Planning (ERP)** is a combination of business management practices with information technology, whereby company's business processes are integrated into the information system with the goal to achieve business specific objectives.

Equity finance represent finance raised from shareholders in the form of ordinary shares and reserves, as opposed to non-equity shares and to borrowing.

3 Conclusions

The Romanian metallurgical industry has unfortunately suffered major setbacks in recent years. Privatization strategies related to metallurgical production units were deficient,

euphemistically said. In this negative context, the application of the KIBS concept to the metallurgical industry still left in Romania can represent a revival.

The following concepts complementary with KIBS concept are of particular importance: Expert System (ES) Enterprise Resource Planning (ERP), Fuzzy Networks, Strategy Analytics and Business Intelligence (SAI).

Absolute performance standard is a standard set at the theoretical limit of performance. For example, in manufacturing, the theoretical quality standard of “zero defects”, which it is impossible to improve on, might be set as the absolute performance standard. Such standards may be achievable in practice or may form an ideal against which an organization may judge its progress.

An accounting process used in absorption costing in which the overhead of an organization is borne by the production of that organization by the use of absorption rates.

The cost accounting system in which the overhead of an organization are charged to the production by means of the process of absorption.

Cost are first apportioned to cost centers, where they are absorbed using absorption rates.

Equity capital is the part of the share capital of a company owned by ordinary shareholders, although for certain purposes, such as pre-emption rights, others classes of shareholders may be demand to share in the equity capital and therefore be entitled to share in the profits of the company or any surplus assets on winding up.

Equity dividend cover is a ratio that show many times the dividend to ordinary shareholders can be paid out, of the profits of a company available for distribution.

The higher the cover, the greater the certainty that dividends will be paid in the future.

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