10th INTERNATIONAL SCIENTIFIC CONFERENCE
Novi Sad, Serbia, October 9-10, 2009

Eric, M., Stefanovic, M., Tadic, B.

ARCHITECTURE OF INFORMATION MODEL FOR REENGINEERING OF TECHNOLOGICAL PROCESSES FOR SMALL ENTERPRISES

Abstract: *Constant enlargement of market demands from aspect of assortment and quality of products, lowering of costs and delivery time are main characteristics of modern business. Answer to the following question: "How the small enterprise to answer to these demands?" has been searched in reengineering and application of information technologies. In this manner, "soft" engineering was originally defined and software solution was applied, such as CASE tool that for designers of technological process enables development and reengineering of technological processes. Architecture of software solution for model of reengineering of technological process for small enterprises is given in this paper.*
Key words: *reengineering , tehnological processes, information model, data bases*

1. INTRODUCTION

Software solution model of technological re-engineering processes, as a CA system meets the following basic principles as follows:
The system should assist - helps the designer, not to replace him. The decision of the designer, his intuitivity and creativity are still weak side of a computer.

The system should allow for appropriate collaboration and distribution. Designing as complex process, today includes many elements that cooperate in different geographic locations and use information resources that are also located differently.

The system should be an open architecture type. Components of the system should be changed over time, through the different modification, replacement, expansion and deletion, depending on the needs and new scientific achievements.

The system must be a tool, not a solution. The system must be developed as a set of tools, not as a facilitator that could prejudice the decision on the problem.

The system must have a high degree of internal presentation. With a high degree of internal presentation of object from the real world that defines the real problem, the system forms the basis for interaction between users and systems and also a certain level of intelligence that can be implemented in its components.

The system should have implemented knowledge. Knowledge can be described as the experience derived from previous events or phenomena. Mentioned experience can be given in the form of rules, detailed analysis, standards and ordinary description of objects and systems that can serve as a prototype.

The system must have the appropriate user interface. A high degree of interaction between the designer and the various components of a CA system is of great importance.

2. ARCHITECTURE OF SOFTWARE SOLUTION'S MODEL IN REENGINEERING TECHNOLOGICAL PROCESSES

The basic architecture of software solution's model in re-engineering technological processes, shown in Figure 1, is defined in relation to the functional requirements of the system, i.e. what the system should provide in terms of services to their customers. From the angle of system observing, software solution of re-engineering technological process should provide:

- the reduction of manual work in the technological design process that is a burden on the designers and engineers-technologists;
- improvement of existing technological processes through the use of available information on machinery, tools, accessories, workability, etc..;
- creation of technological processes of the same validity and quality; systematization and electronic documentation of technological methods, ensuring transfer of knowledge and experience of experienced designers-engineers;
- reduction of time and lower cost design.

System requirements are implemented through functional requirements, which should enable the availability of data / information: technological databases related to cutting and measuring tools, machine tools, accessories, SHP, modes of processing, materials and norms for support, and additional preliminary-final time, the target model of processing object and technological model, creating and defining the technological process and its rational variant, the parameters for the valuable analysis of development time, productivity and cost of processing variations technological process variations, as well as output documents such as operating list / map, the order of operations list, i.e. technological development list, documents that allow Pareto Analysis of time or the technological process costs through operations.
Logical data modeling is an activity that opens the "black box" which was been unknown to future users of engineers, designers-technologists. Based on the

description of technological process as a real system, entities or objects of interest for the observation and their relationships are identified ,and the first next level in information modeling, semantic data model that represents a very important framework for the logical design is defined. ER (Entity Relationship) model is the one that carries the epithet of semantic model. Figure 2 shows the ER diagram of data model in re-engineering technological processes. The diagram entity attributes are omitted, due to visibility, and they are shown in logical database schema.

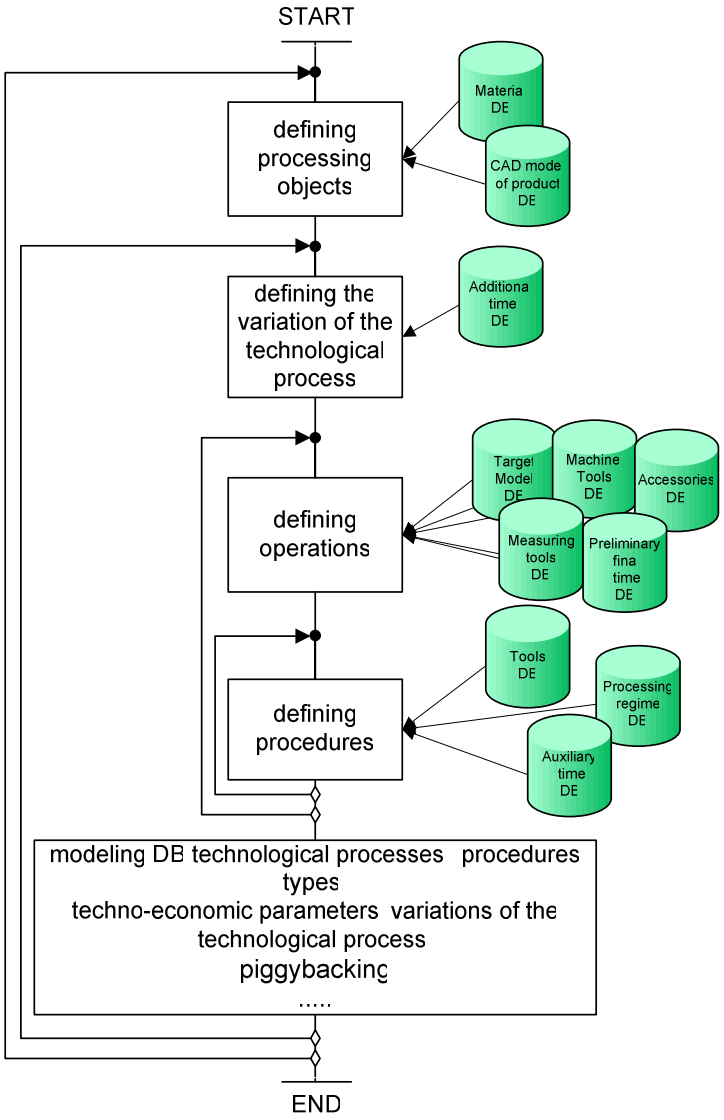

Figure 1. *Basic architecture of software solution's model in re-engineering TP*

The next level in information modeling is the translation of ER diagrams into logical data model. On the basis of ER diagrams, shown in Figure 2, a logical data model of re-engineering technological processes is defined, shown in Figure 3, which represents the conceptual database schema. This model is in the same time an analytic type because it provides information used for analysis. The fact is that using this model, the technological process can be observed from several aspects and dimensions, such as variety, time of production, productivity, costs of processing, make this model a multidimensional and database analytical.

The logical database model considers the following types of databases: **dimensional** (●) such as databases *Technological process and Operation,* and **fact databases** (●●) - remaining databases.

Fact databases, shown in ● color, were created by translating multiple to multiple relations (n: m) from ER diagram. Analytical (dimensional) databases do not meet the requirement of data consistency. They were obtained with denormalization. Also, analytical processes of data observing can be many times faster Specifically in this model, attributes that make it possible are as follows:

Specifically in this model, attributes that make it possible are: a variant of the technological process, the main processing time, support time, extra time, a preliminary final time, total processing time, the cost of tools, machinery costs, costs of SHP, a stationery costs, labor costs, productivity; all that by operation and by technological process.

Based on the conceptual scheme of the

database, physical database modeling follows and its integration into specific database menagment system (DBMS–*DataBase Management System*), which have relevant importance in the development of applications and selection of ways to access data.

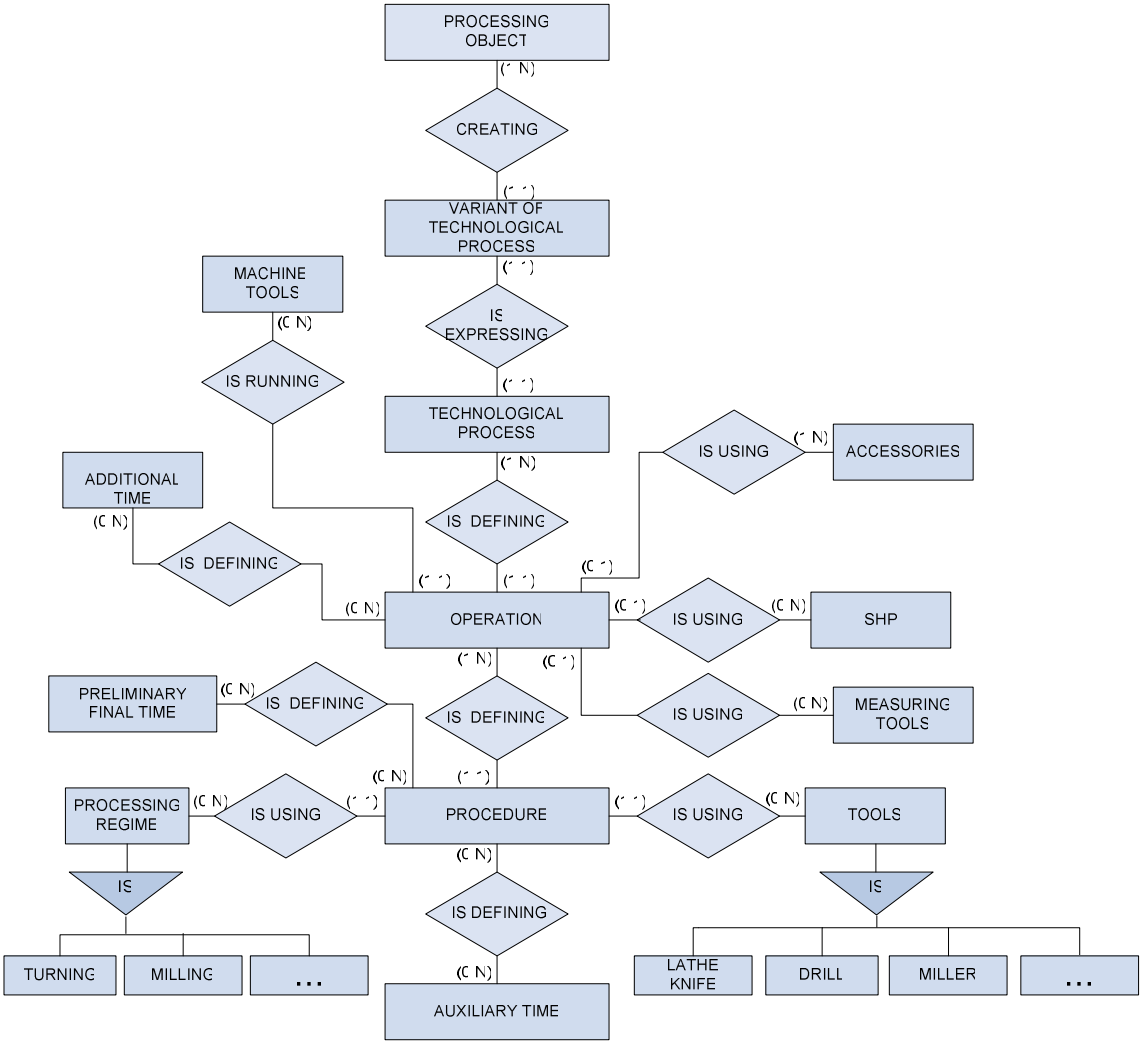

Figure 2 *ER diagram of data model in re-engeneering TP*

There are many CASE (*Computer Aided Software Engineering*) tools to enable this, such as Erwin or DeZign for Databases (Datanamic Solutions Netherlands) in which the logical database model of re-engineering technological processes is made.

Software development environment is Microsoft's Visual Basic 2005 Express Edition. Databases are generated in MS SQL Server 2005, Express Edition. Both environments are Microsoft development tools, and provide a comfortable transition to the commercial versions of the same.

In the case of analytical applications that are not included in the OLAP (On Line Analytical Processing), Microsoft Excel can be used for importing dimensional database and selecting those columns that are needed for the graphical representation and analysis.

By some estimates at least 90 percent of business analysis today is done using Microsoft Excel, although Excel is a mathematical tool, not a tool for working with data.

This environment was selected for several reasons, some more important are: openness to different types of databases (DBMS); highly developed user interface; full compatibility with MS Windows operating system; a relatively easy applicable integration of all modern techniques such as Object Linking and Embedding, Dragging and Dropping; compact object-oriented code, and extremely easy portability of the software.

The integrity of displayed databases should enable the accuracy, correctness and consistency of data, and to identify problems of database protection from wrong changes (wrong input, operator and programmer errors, system failure). Security of data relates to the mechanism of protection against unauthorized use of data that is embedded in the DBMS.

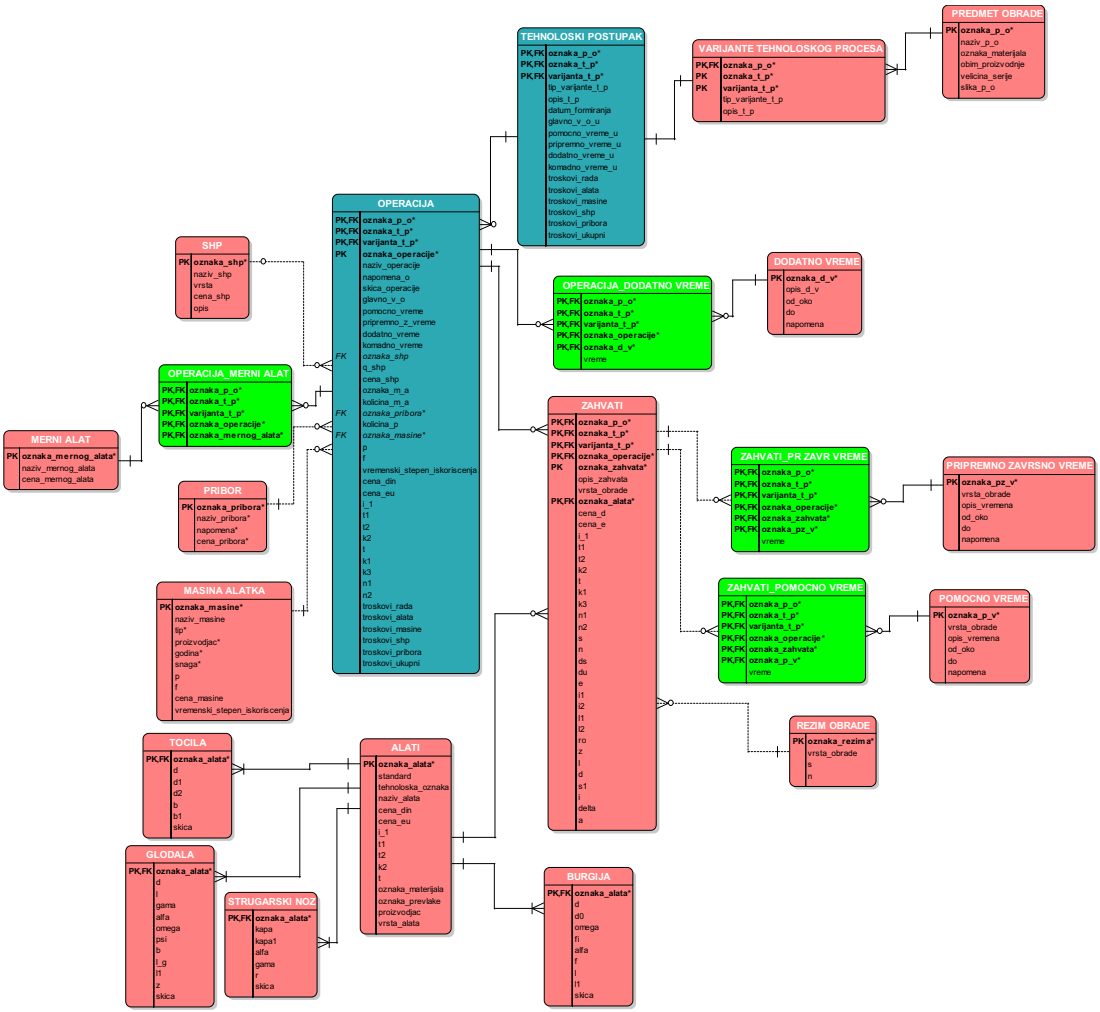

Figure 3 *Logical (conceptual) database model in reengineering TP*

Display of the architecture process focuses on the system implementation structure and takes into account requirements such as: performance, reliability, integrity, synchronization, system management. Display of user functions demonstrates and confirms the logical view, process and implementation reviews. User functions are implemented through the user interface. The user interface aims update and presentation of data from a previously defined databases and their transformation into information necessary to make timely and quality decisions.

3. CONCLUSION

Designed model provides opportunities for development and re-engineering. In order to implement re-engineering of a technological process, of course, it must be developed already. Thus developed technological process, with adding feature, is necessary to register in the database, which essentially is a physical job. However, if the thought process of designing and creating the technological process is joined to the adding function, then we can say that it is a technological process development. Reengineering allows changes to the level of improvement (defined as "soft" re-engineering) to the level of radical changes (defined as "hard" re-engineering).

4. REFERENCES

[1] Erić M., *Model reinženjeringa tehnoloških procesa malih preduzeća*, doktorska disertacija, Mašinski fakultet Kragujevac, 2007.

[2] Lazarević B., i dr., *Baze podataka*, FON, Beograd, 2003.

[3] Mitrović R., *Projektovanje tehnoloških procesa*, Naučna knjiga, Beograd, 1991.

[4] Riordan R., *Designing Effective Database Systems*, Addison-Wesley, 2005.

[5] Todić V., *Projektovanje tehnoloških procesa*, Fakultet tehničkih nauka, Novi Sad, 2004.

Authors: **Dr. Milan Eric, Dr. Miladin Stefanovic, Dr. Branko Tadic,** University of Kragujevac, Faculty of Mechanical Engineering, Sestre Janiic 6, 34000 Kragujevac, Serbia, Phone.: +381 34 335 990, Fax: +381 34 333 192.

E-mail: ericm@kg.ac.rs
miladin@kg.ac.rs
btadic@kg.ac.rs