Enterprise Resource Planning as Part of an Efficient System in Mining Data Base

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Abstract: *Mining GIS is one of the newest applications of the Geographical Information System. Application of GIS in mining was delayed because of the success that software coordinating the mining activity, such as Vulcan and Surpac, has had in the management of this type of activity, but also because of successful implementation of Enterprise Resource Planning (ERP) systems. In seeking to create a new concept of mining database, called MDB GIS, we started from MGIS by adding software, databases, actors, links, components, of which a very important role is taken by ERP, and the most recent applications from the SAP class (Systems, Applications, and Products in Data Processing) or the latest generation Romanian version Senior ERP. The paper addresses this issue, stressing the importance of including ERP, and its latest versions, in the new MDB GIS mining database.*

Keywords: MGIS Mining Data Base Geographical Information System, MDB GIS Mining Data Bank Geographical Information System, ERP.

1. Introduction

MGIS history, or its roots, can be assimilated with GGIS history (14) and its achievements, GIS geo-sciences through the contributions of Burroughs 1987, Aranof 1989, Tolin 1990, Maguire 1991, Carter 1994, or with the first ESRI application in geo-sciences in 1993(8). As a general theme, name and specific concerns, the field is very new, probably somewhere between 2004 and 2006(8).

Compared to the previous analysis of data banks it can be said that GIS is the most modern territorial database being the current management concept in running any organization(2). That is why the author believes that research should focus on defining a new concept for creating mining databases on the analysis, configuration, definition and customization of GIS databases, for mining, given that information comes from an organization, and the systematization of data as a database is aimed at a better view of all relevant information on the organization's activities(3). This makes the establishment of the current relation between information in the field of mining and the Geographical Information System-GIS, and the ways of integrating data from the mining field into the GIS, crucial.

The new concept of MDB GIS(Mining Data Bank GIS) is a summary of the author's view on data making up the 'life" of a mining company, the way it collects, selects, handles, manages, updates in order to computerize its activity as much as possible, in a permanent action and desire for efficient management. Enterprise resource planning (ERP) systems integrate internal and external management information across an entire organization, embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc. ERP systems automate this activity with an integrated software application.

2. MGIS, Mining Geographical Information System - author's analysis

The application of Geographical Information Systems (GIS) in mining still remains low, and although the mining industry's share in the global economy is significant, reaching up to 70% in some countries, the sale of GIS licenses is less than 1% of all licenses sold by the largest manufacturers, ESRI and Intergraph(8). Mining GIS is a new field of GIS applications was reinforced, there being few works viewing and analyzing this field, most form Australia and Canada. We have thought, ever since the beginning of the research, that the computer means used, today and in the future, in the mining industry, will play a crucial role in developing all projects and specific operations worldwide. Based on this quote and studying a vast bibliography we have identified the main problems of implementing GIS technologies in the mining industry (becoming MGIS)(8):

1. MGIS can help solve a major current information issue in mining, although most data being used can have a spatial representation; focus is now on the descriptive aspect of the data.
2. MGIS, as an argument, having the opportunity to present data in the form of layers and maps, can provide better aid in decision making for the people responsible in mining, than tabular information or, as stated previously, descriptive information.
3. MGIS has had a very slow evolution in comparison to the explosive development of GIS, because software exists and is applied, basically computer packages for the mining industry, which have sufficient modelling resources for the demand of spatial information in this industry. Such software as Vulcan, Surpac, Datamine, Flac, Gemcom Minex, Plaxis, Vertical Mapper, etc. (around 30 software programs) solve spatial modelling issues very well and effective, but interfaced with GIS, they can have a greater contribution in managing mining data.
4. MGIS has had a more difficult entry into the mining industry also because of the CAD technology which was very cheap (some of it), so it expanded, and then operators were familiar with these operating modes which could be interfaced to the aforementioned mining software relatively easily.

Conclusion: MGIS is currently underused!(8). One way to increase the involvement of GIS in mining will be the integration into a database of which the main competitors are a part of: mining software and ERP-SAP management systems.

3. Mining Data Bank Geographical Information System (MDB GIS) mining database concept

The new concept MDB GIS(figure 1), according to the author, is modulated starting from a trunk which defines the initiated information system in minimalist terms. The system is designed on a GIS platform, in fact MGIS, on which we build by adding modules, components, adapted and adaptable, from software, actors and links to general management systems, as is the case with ERP, tailored for the field (Figure 2). The system will allow the addition of an infinite number of modules at the "data" level, relational" level, "programs-software applications", "processing equipment", but also at the level of the components in the "database management system" and last but not least at the "users" level. In the MDB GIS design the author has included:

1.Databases,

2. The general operating platform which is GIS

3. The general rectangular coordinate system in which it operates, GSRC (Generalized System of Rectangular Coordinates)
4. The GSRC integration and georeferencing system in 4D + DS (3D + Time +Dynamic Simulation) of all data entered into MDB GIS
5. The general operating and computing system
6. The general link system of all networks
7. Processing equipment
8. Database management system
9. Software applications
10. System users.

The geospatial solution, basic idea of the MDB GIS concept of georeferencing all information entered into the system, is the skeleton upon which specialized interfaces shall be developed for data loading / consultation and loading / association from existing applications. This solution is the first step in a process in which all administrative sectors of the unit will contribute with local information to the central database, creating all the prerequisites for an objective justification of decisions regarding short-term, medium-term and long-term strategies for spatial development of the mining institution.

4. The place of Enterprise Resource Planning (ERP) in MDB GIS

ERP is a software applications system which is known by companies and used to manage and coordinate all resources, information and business functions (8). ERP systems, at present, are attempting to cover all basic functions of an enterprise, regardless of organization or status (1). An ERP system has a service-oriented architecture with modular hardware and software components or "services", which communicate over a local area network, in this case MDB GIS. Modular design allows the company to add or reconfigure modules (perhaps from different suppliers) and to maintain data integrity during this period in a shared database that can be centralized or distributed. It should be noted that for integration into the new mining database, modularity is a key component, allowing the recipient to build the information system in stages, depending on structural or financial criteria. In terms of functionality, an ERP software covers the following areas of a business (mining included) (8): production planning, procurement management, inventory management, interaction with suppliers, customer relationship management, tracking orders, financial management , human resources management. The traditional mining industry is divided into a number of sections like Surveying, Production Planning, Production, Material requirement, Sales and Distribution, Finance ,Humane Resource Development, Machinery Maintenance etc which has very limited interaction with each other and in many cases isolated with each other. So very limited data are available about a particular department to other departments and top management. As a result, Instead of taking organization towards a common goal, the various departments end up pulling it in different directions. Sometimes objectives of different departments are conflicting(4). **ERP systems** were created as a solution to these challenges, being able to process large volumes of data and information aggregated in order to optimize and streamline processes (Figure 3). **The advantages of an integrated ERP system are:**

- Tightening relations with customers and suppliers, by creating an effective chain,
- Reduction of **production costs** and **inventory**,
- Complete planning of company resources,
- Improving overall productivity.

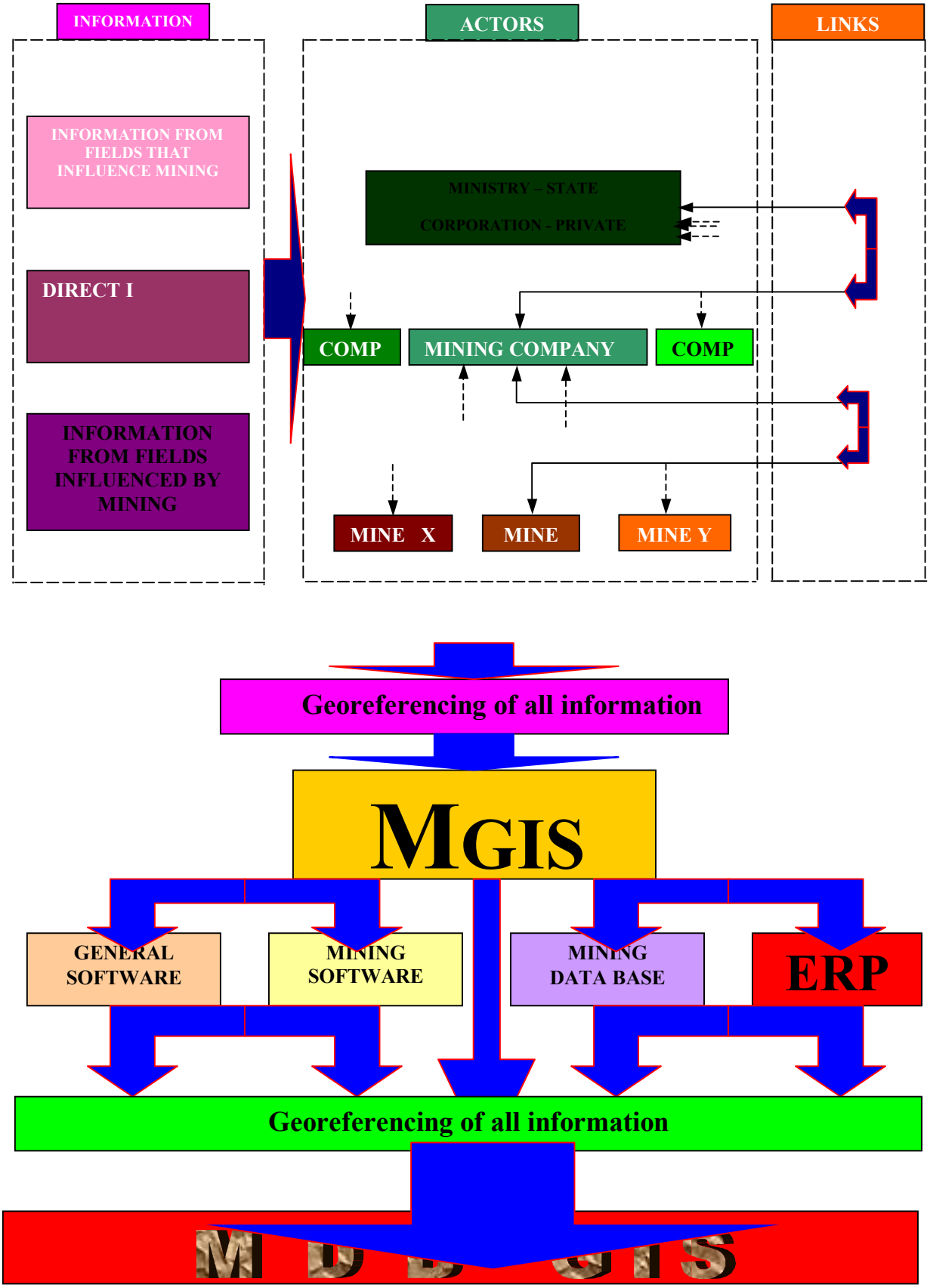

Fig. 1. Sources of information, actors involved and the meaning of links created in the MDB GIS

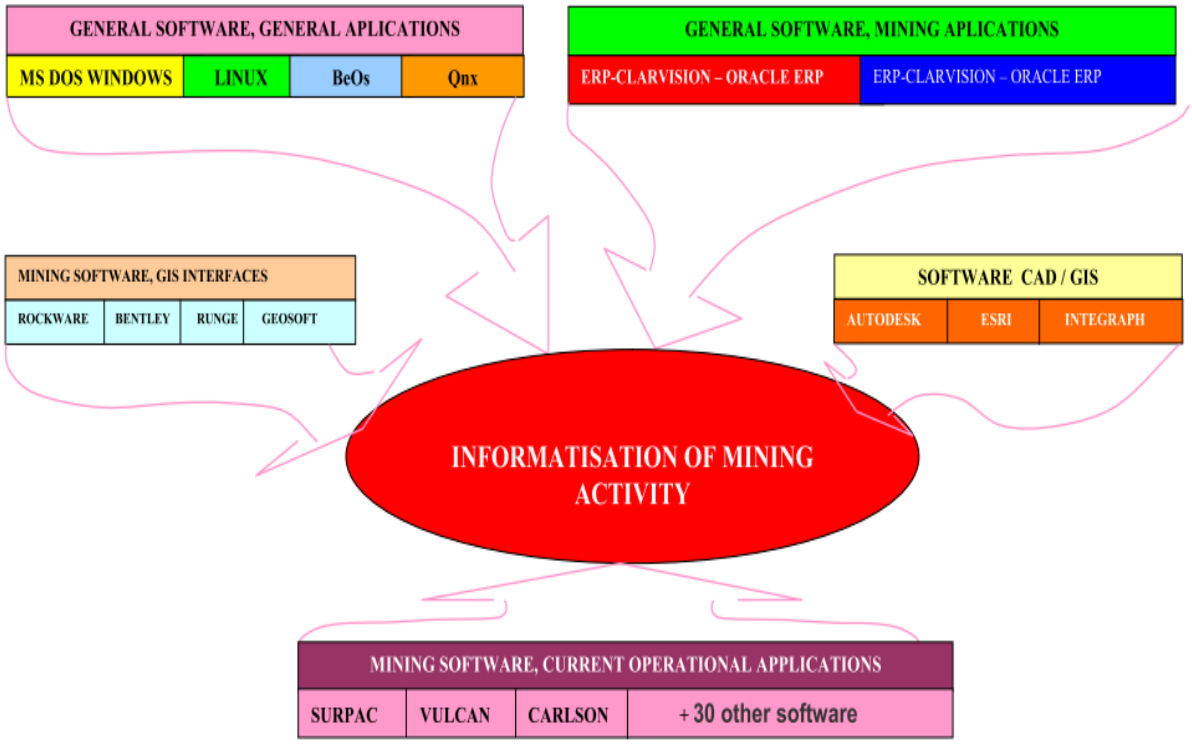

Fig. 2. The position of ERP in creating the new concept of MDB GIS mining database

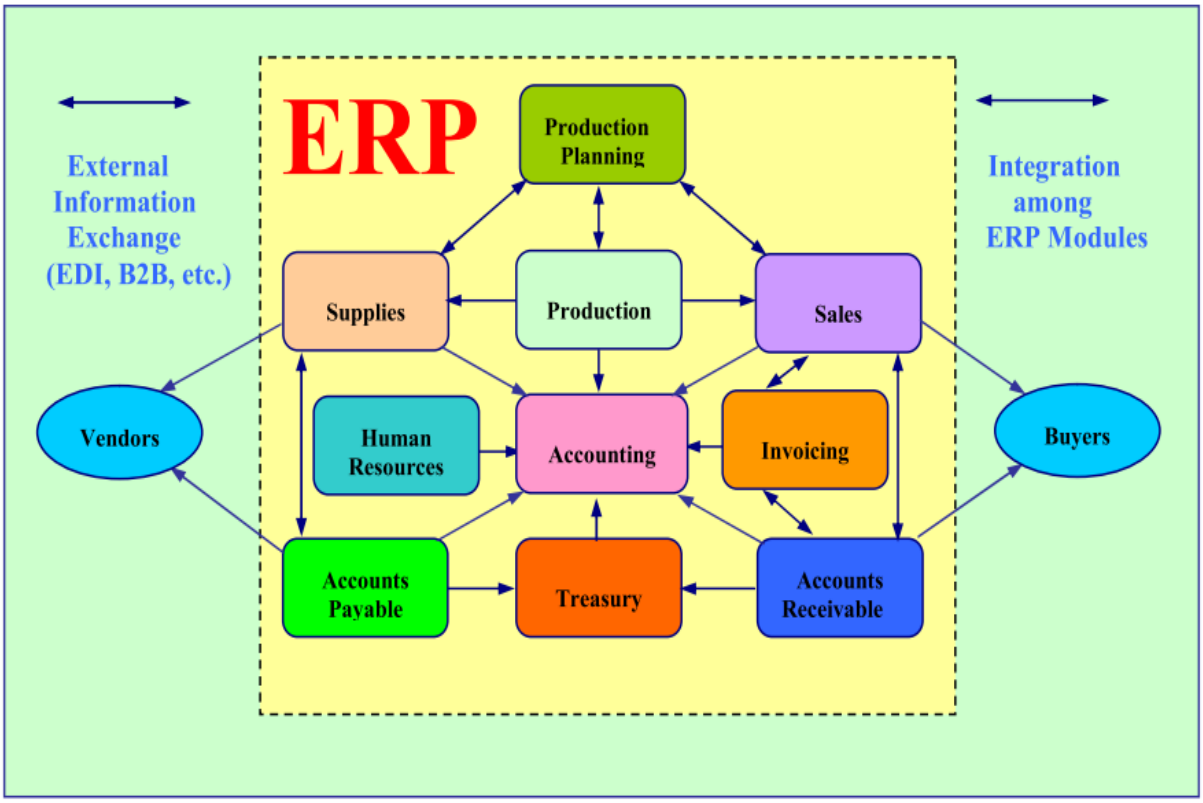

Fig. 3. Modules considered to be primary in ERP (source: author, adapted after Zwicker 2003)

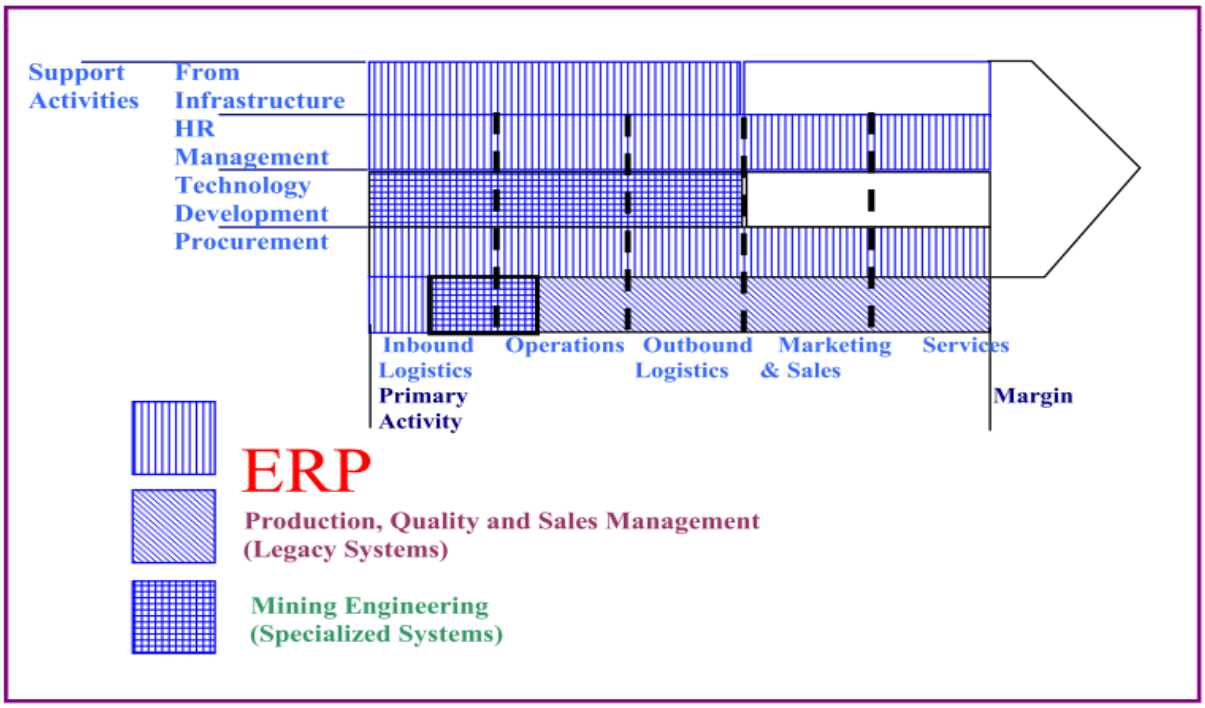

Fig. 4. ERP coverage area from M. Porter's value chain in the mining industry (source: author, adapted after Zwicker 2003)

Production is the most important process in the value chain in a manufacturing company, and the quality and competitiveness, on the market, of products resulted from the production process, is essential. ERP systems are modular programs, each area of activity within the company being covered by a specific application. The modules of an ERP system work in an integrated way, using a common database, or can operate independently. Ideally, ERP delivers a single database containing all data for software modules, including that for a mining company:

- **Production**, bills of materials, scheduling, capacity, workflow management, quality control, manufacturing, project management, production flow.
- **Supply chain management**, order entries, procurement, product configuration, supply chain planning, supplier scheduling, inspection of goods, processing of complaints, commission calculation.
- **Finance**, general register, cash management, debt payment, receipts, fixed assets.
- **Project management**, costs, invoices, time and expenses, performance units, business management
- **Human resources**, payroll, training, duration and presence, records, benefits
- **Customer relationship management**, sales and market studies, commissions, services, customer contact and telephone support center, data warehouse and various self-service interfaces for customers, suppliers and employees.

Figure 3 presents the variety of functional departments of a mining unit and the information that forms and travels between them, solved by ERP modules. It is noted that, starting from production planning, monitoring of actual production, to accounting and human resources, and sales, a very wide range of information can be managed by means of ERP. This fact also results from Figure 4, in which one can analyze the very large share of ERP in mining computerization. The main benefits of using ERP are:

- Reduced operational costs,

- Facilitating operations management,
- Inventory optimization,
- Improving cash flow,
- Integration of financial information
- Standardization of business processes.

The ERP system is a combination of business management practices with information technology, through which a company's business processes are integrated into the computer system in order to achieve specific business objectives.

SeniorERP is the latest version of ERP, that has specific modules for Distribution, Production and Services and, in addition, is already interconnected with premium add-ons, such as: Warehouse Management, B2B and B2C eCommerce, Payroll, Sales Force Automation or Customer Relationship Management. **SeniorERP** is an integrated business management software developed by the Romanian company Senior Software.

Thus, the main components of the system are (15):

- Controlling - the module enables the planning of the company's financial parameters;
- Administration – the module allows users to define different levels of access to information in the application, by defining specific groups of users;
- Auto fleet - it is an indispensable product for the fleet manager in order to increase business efficiency;
- Logistics - this module of the SeniorERP application plans existing infrastructure resources in order to achieve optimum use of resources;
- Fixed assets - the operations applied to fixed assets are tracked in detail throughout their period of use, as well as those liable and their place in the company;
- Accounting - the module is designed in order to automate general accounting operations, offering flexibility and utility both to small and medium companies but also to large enterprises with complex activity (with many branches and outlets, different currencies);
- Treasury - the module integrates company financial flows, following in detail each type of operation;
- Production - the role of this module within the SeniorERP system is to complete inventory management by implementing the specific operations of a simplified production process.

Other components / modules are: Inventory, Prices, Sales, Purchasing, Nomenclature, Workspace. **SeniorERP** allows internal flow adjustment according to the analysis, for implementation. Certain configurations have a general nature in the system and are configured in this sub module.

5. Conclusions

In the configuration of mining databases, the implementation of ERP management systems is extremely desirable because it is already successfully applied in the mining industry and it solves several problems in current activities within the organization. The stage of integration in the MDB GIS system comes after the MGIS configuration, with the inclusion of mining-purpose software. ERP implementation in mining industry has both direct and indirect benefits(4). Direct benefits are reduction in lead time ,greater transparency and fast data transfer,on time shipment, reduction in cycle time, increased worker efficiency etc to name a few. While some indirect benefits in terms of better customer goodwill, helps in increasing customer base.

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