DEVELOPMENT OF A COMPUTERIZED SYSTEM MEANT TO IMPROVE CASTING PARTS PRODUCTION UNIT MANAGEMENT

Ruxandra IONICĂ[1]

Preluând ca principiu un soft de contabilitate – Saga S disponibil, autorul a realizat o soluţie computerizată originală pentru gestionarea depozitelor de material şi substanţe din cadrul uzinelor metalurgice.

Originalitatea elementelor şi posibilităţilor create de acest soft dedicat agenţilor de producţie din domeniul căldurii şi construcţiei de maşini permit o gestionare modernă bazată pe un sistem SSD de luare a deciziilor în timp real, efficient şi în avans.

Taking as a principle an open source bookkeeping soft – Saga S, the author worked out an original computerized solution to manage substances and material stocks within foundries.

The originality of elements and opportunities of this soft dedicated to productive agents in the heat sectors and the car building field allow modern management based on a SSD decision taking support system in real, efficient and advanced time.

Keywords: foundries management, stock management, open source computerized system

1. Foreword

The present work develops the premises to achieve modern foundries development, within the achievement of a dedicated computerized system.

We shall detail the bookkeeping, management and standardizing manners of substances and materials stocks within foundries.

2. Foundries activity computerization

The activity of an economic agent such as a foundry is registered in a series of specific documents, generally speaking, on yearly time periods, that require a great amount of technical, technological and financial-bookkeeping data,

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[1] PhD. student, Department of Material Processing And Ecometallurgy, University POLITEHNICA of Bucharest, science activity leader Prof. Ion CHIRA, Romania, e-mail: ruxandraionica@yahoo.com

reports and synthesis; inherently, using the classic bookkeeping method on paper support, there occur insurmountable difficulties connected to their synthesis and the taking of some right decisions on the basis of their analysis [1, 2, 4].

The modern management of such a productive unit can only be applied when computerizing its activity at the respective organization chart level, on the vertical line of compartments and the horizontal line of the technological tide from specific productive sectors (steel, cast iron, non-ferrous materials) and departments (stores, preparation of forming and hot-box mixes, modeling, formation hot-box, alloy elaboration, moulding, debate and cleaning) (fig. 1)
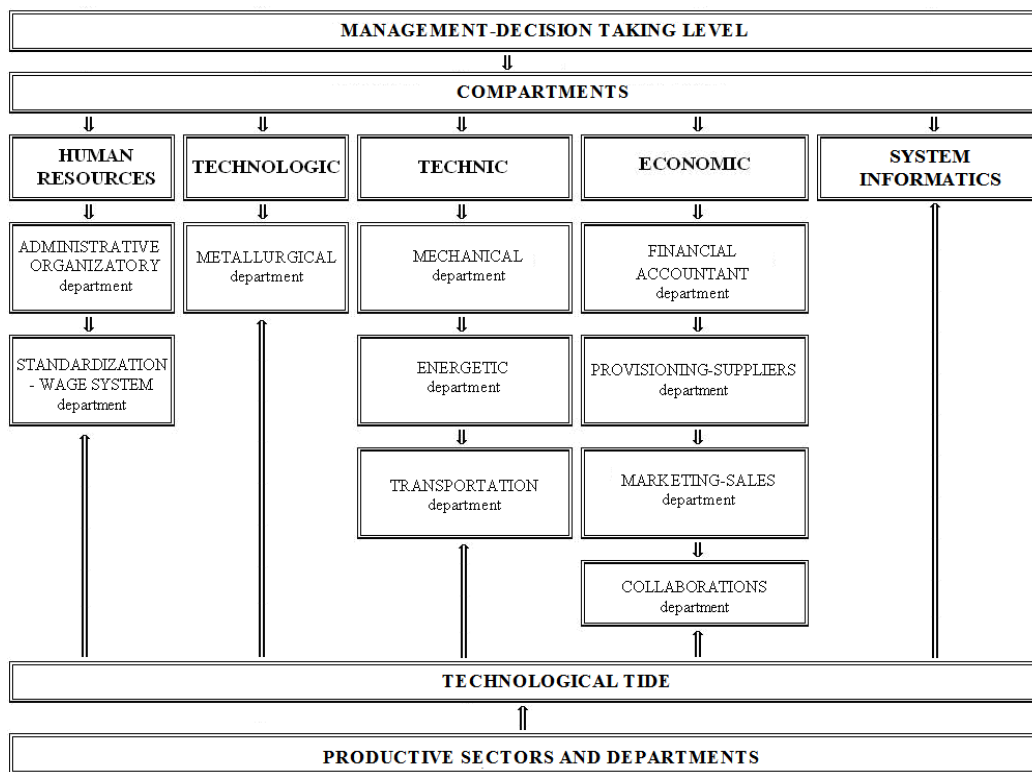

Fig. 1 Main computer lines of a foundry.

In figure 2 we specified the main stages when elaborating and implementing foundries computerized programmes [8].
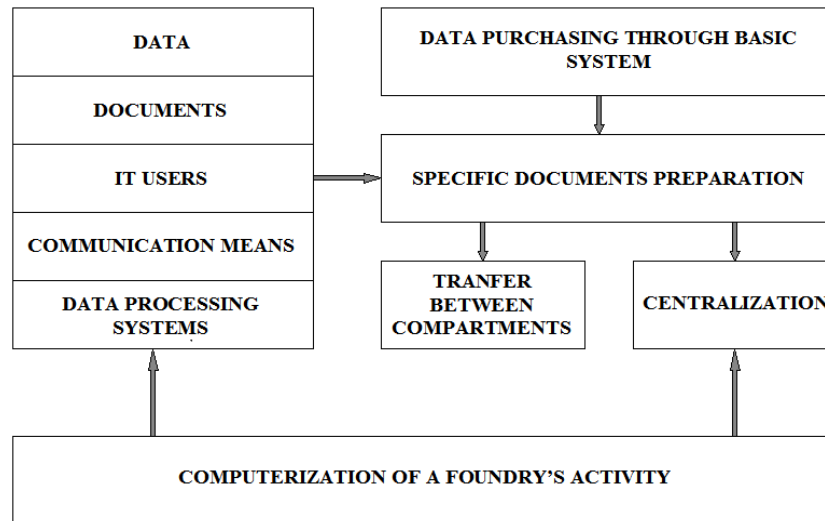
Fig. 2. Main stages necessary when computerizing a foundry's activity

Though each sector or compartment of a foundry can be more or less computerized, it would be ideal that all these should be embedded into an overall computerized system at the whole unit level, which should correspond both to the IT performance general criteria and to the peculiarities of the economic agents from heat sectors and car building field (table 1) [3, 5, 9].

Table 1

Criteria and computerized system types

CRITERIUM	SYSTEM TYPE	DETAILS
According to specialization	▪ specialized systems	They are designed to solve a certain type of problems from a certain field.
	▪ general usage systems	With their help, one can solve a large scale of problems from several fields.
	▪ local systems	They stand for data processing programmes and data lie on one calculation system only.
	▪ systems on network	The system within a computer network, case in which, data and programmes can be assigned to several working stations that are part of that network.
According to data localization and the place where processings are being performed	▪ with centralized data	Data lie on one calculation system only.
	▪ with distributed data	Data are being distributed to several network computers.
	▪ with centralized processings	Data processing is made on one working station only, no matter the number of stations on which lie the data to be processed.

CRITERIUM	SYSTEM TYPE	DETAILS
	▪ with distributed processings	More computers process data coming from one or more network computers.
According to the field in which they activate	▪ data basis	They are specialized to manage large amounts of data.
	▪ for science processings	They are specialized in certain science fields.
	▪ for technologic processes leading	Used to drive computerized engines, instruments, tools.
According to the hierarchic level occupied by computerized systems within society organizational structure	▪ Computerized systems meant to lead activities at economic units level; ▪ Systems at group structure organizations level; ▪ Territorial computerized systems; ▪ Computerized systems at branch, sub branch and national economic level; ▪ General usage systems.	
According to the activity they automate	▪ to lead production; ▪ for commercial activity; ▪ for bookkeeping situation; ▪ for materials and goods administration; ▪ for staff and wage system administration; ▪ for fix means administration.	

3. Foundries management based on a computerized system

Individual computerization and industrial unit activity monitoring integrate into a territorial structure, which, in its turn, lies at the basis of the information source for the department administrative decision, at ministerial and republican level.

The leading and decision taking management within a foundry's sectors and workshops, in terms of activity computerization, is achieved on the basis of a decision taking support system – SSD (fig. 3).
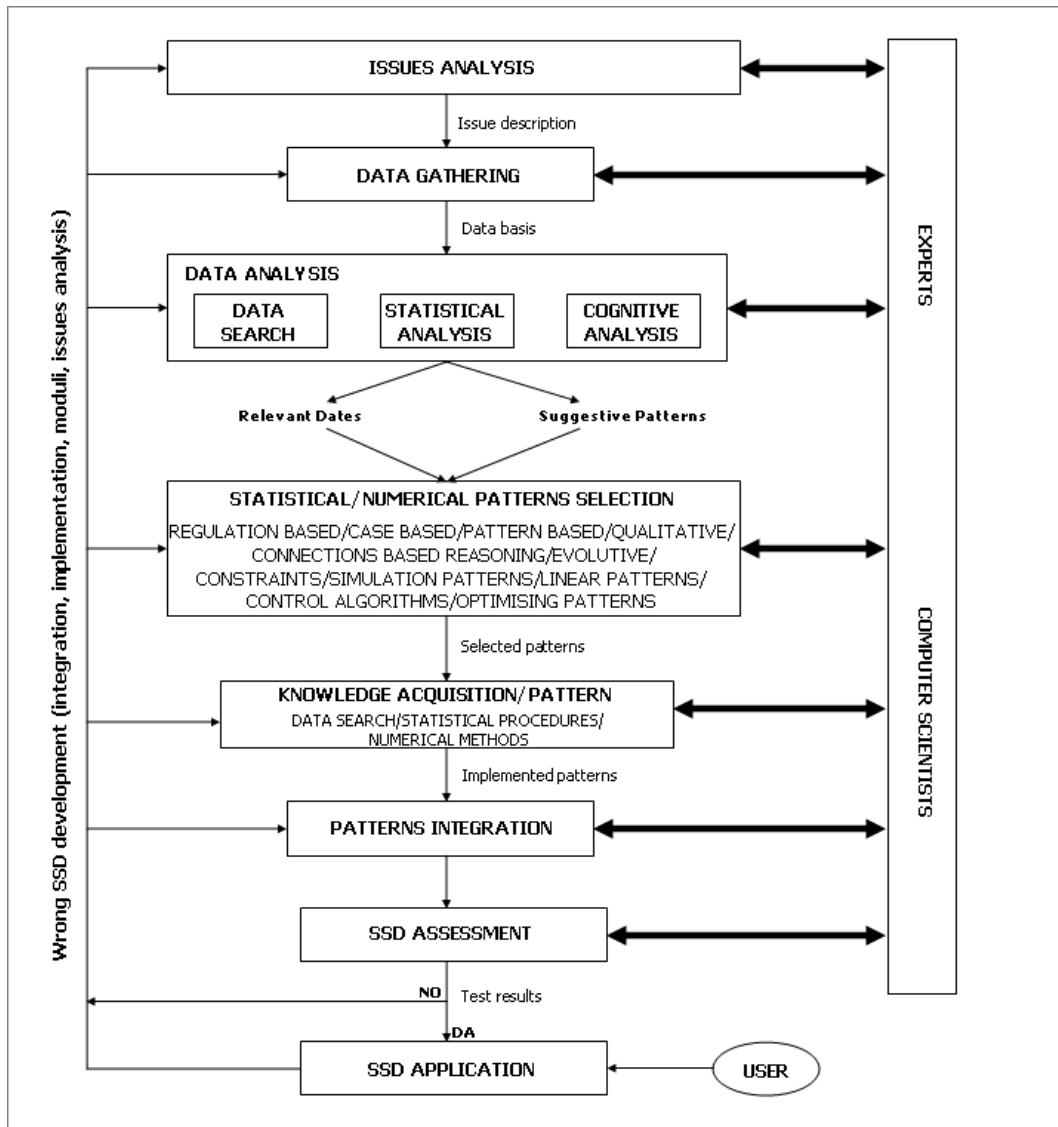
Fig. 3 Principle architecture and a *SSD decision taking support achieving stages*

4. Stocks management peculiarities within foundries

Within the provisioning – suppliers department, a series of synthesis documents, that need, rule and contain a great amount of data and information are being periodically elaborated.

It results that this compartment decissively determines the activity of the entire foundry; according to the material and financial-bookkeeping administration specific features, stocks management involves a high amount of data that require processing and synthesis. Access to these syntheses, reports, situations must be done instantaneously both by the leading team and management department, and by the departments and sectors standardizers; moreover, the respective activity and data are in close connection both to suppliers and beneficiaries, and to hierarchic forums and technic and financial-economic departments, being in pronounced dynamics that should correspond to efficiency requirements against competition and maintenance on the market. All these elements lead to the compulsoriness of computerization the substances and materials stocks management subsystem, that is integrated, too, into the overall computer system of the foundry.

In table 2, we detailed the documents that lie at the basis of stock management operations.

Tablel 2

Documents that are necessary for stock bookkeeping

DOCUMENT	ACTIVITY
▪ warehouse card	Operative bookkeeping document of storehouse or warehouse.
▪ consumption ticket	Necesary to release storehouse materials for consumption.
▪ delivery – transfer – restoring ticket	Worked out to deliver to the storehouse the products got from self production and to transit materials from one warehouse to another.
▪ delivery stipulation	A document the foundry issued for its clients, through which the products that shall be sold (casting parts) them are specified.
▪ goods and/or fiscal invoice accompaning notice	Goods and products delivery is being done on the basis of delivery stipulation.

The stocks and production (that is in process of execution) bookkeeping goals are mainly connected to the enterprise's commercial functions achievement (table 3).

Table 3

Stocks bookkeeping goals

GOAL	GOAL ACHIEVING WAYS
▪ Pursuit and control of suppling programme achievement	Organization of administration bookkeeping by groups and types of stocks.
▪ Ensurance of stocks patrimonial integrity at storage places and permanent pursuit of their movements	Organization of material circulating bookkeeping means by types of administrations.
▪ Pursuit of rational usage of supplied material means	Organization that allows specific consumption rules when releasing them from the storehouse.
▪ Ensuring delimitation of transport-supply expenses from supplied materials value	By organizing bookkeeping in such a way that these should be separately pointed. By supplying data in connection to the level and structure of transport-supply expenses.
▪ Stocks revaluation control	By registrating and controlling the revaluation of goods stocks and other categories meant to be delivered to third parts.
▪ Pursuit of product stocks	By bookkeeping and pursuit of stocks in the process of acquirement and delivery at competitive prices.
▪ Realistic stocks assessment and determination of influences on patrimony and results.	By correct application of assessment rules.
▪ Promotion of prudence and continuity principle	By registration of stocks in bookkeeping.

5. Bookkeeping settling and working methods in stocks administration and management

Within foundries, we organize stocks analytic bookkeeping using the permanentt inventory method for stock synthetic bookkeeping. Stocks analytic bookkeeping must be organized in such a way that it should allow to acknowledge them from quantity and value perspective, according to each section storing place, partly, and according to material types, products, goods etc.

Analytic bookkeeping can be managed according to the activity specific features and the foundry's own needs, using one of the following methods: quantitative-value; operative-quantitative; overall value.

Within a foundry, the material circulating assets occasion numerous operations, that can be grouped according to their content:

1. *The provisioning and conservation operations* are emphasized in the following documents: orders are issued by suppliers patrimonial units; economic contracts are being closed with suppliers according to orders; order register is

used to pursuit the way in which one closes the supply contracts; goods accompanying notice is a document that accompanies stocks during transport, a document on the basis of which one can issue the fiscal invoice or the receiving document in the buyer's bookkeeping; the fiscal invoice executes both the accompanying notice and the transport functions for preventive financial control visa, and simultaneously, stands for a justificatory document to discount countervalue; entrance-taking delivery notice is drawn up at the supplier stocks arrival and their entrance into the unit storehouse; the storehouse card is a storehouse operative bookkeeping document and it is being separately drawn up for each material stocks type, quality or range;

2. *Storehouse releasing operations* are pointed out by the following documents: *consumption ticket*, which is used to release stocks from a storehouse; *limit consumption card*;

3. *Inventory operations* are pointed out in bookkeeping through *inventory lists*.

6. Contributions to improve foundries stocks management; proposed software

A software solution, placed at those interested disposal, is the open source variant, a set of principles and practices that promote acccess to goods and knowledge designing and production or a creative practice of sharing the created and discovered containt.

The *open source* software refers to computer applications whose source code is available under a certain licence, that allows users to use, change, improve the soft and redistribute it under a modified or non modified shape [6, 7].

The advantages of using an *open source integrated system* are described in table 4.

Table 4

Advantages of open source solutions

ADVANTGE	DESCRIPTION
▪ Independency of the supplier	Sources are available, there is no dependency on supplier, and the investment in an *open source* will lasts as long as desired.
▪ Stable, well tested	When the source code is public, it is tested by a multitude of users, problems are rapidly detected and solved just as quickly, without being hidden in the product.
▪ There are no hidden data in the software	All data are available, anyone can test and use all the functions.
▪ There are no licence costs application	Licence costs are zero, which means an acquisition and holding cost highly reduced compared to commercial systems (whose licences must be bought).

The software solution proposed for stocks management within paperworks and research due to the present work is based on *SAGA S* open-source general application, a programme that allows stocks operations control within the quantity-value system with quantity-value bookkeeping stocks assessment, goods administration assessment, finished products, materials, inventory objects and society services. The application takes active part in both the provisioning and sales specific activities, and in the pursuit of financial relations to clients and suppliers. It disposes of powerful systems to consolidate collected data.

According to the usage licence, the *SAGA S* soft stands for a freely served out programme. The upgarding and usage assistance are not free, being the object of a semestrial subscription.

One takes into account the primary data bases that should take part in the basic architecture of stocks management computerized solution, designed within the present paperwork:

1. *Hierarchical models and network*. For *Hierarchical models and network*, data are represented at article level by hierarchical (*tree*) or graph connections. Data manipulation language imposes the programmer to specify the access ways to data. *The network model* is an advanced but complex one. A network type data base stands for a collection of nodes and connections that allow the achievement of the following types of structures: linear, hierarchical, network;

2. *Relation type models*. *The relation type model* treats entities as relations. The present data base market is mostly covered with relation type systems. The relation type models offer the user a certain easiness concerning data manipulation, beside other advantages like: inexistance of visible pointers for users; great variety of relation applies to operators that allow data definiton, search and upgrading; data independency and logical psysical description; existence of some utilitarians that enable working with menus, applications, forms and labels; appearance of data definiton and manipulation special languages;

3. *ADVANCED SYSTEMS*: *object oriented SGBD, deductive SGBD, distributed SGBD*.

When practicing the usage of a certain stock management computerized application, there occur cases when one desires to search data about a certain *ARTICLE*, according to certain searching criteria. Thus, the aplication data base needs structuring in between *relationing tabels,* that contain data about *articles, their quality standards, administration substances and materials suppliers*.

There has been designed and elaborated a series of classified lists adequate to the foundries' stocks types, as well as a series of specific applications, for which we present the source code in the present paperwork, so that any beneficiary should be able to shape his bookkeeping computerized system according to necessities (table 5).

Table 5

**Specific classified lists and software applications whose source code has been
elaborated through the present work's research and papers**

Designed classified lists and software applications	Peculiarities and fields
▪ ARTICLES ▪ Classified list	1. - article (alphabetical index); 2 – article code; 3 – Q code (quality); 4 – supplier code; 5 - U.M., RO lei/U.M.; 6 – quantity and value stock at a certain time date (RO lei); Each article gets a *code* and is characterized by its *quality code* – taken from *"quality srandards classified list"* table, the respective article supllier's code is taken from *"suppliers classified list"* table, measuring unit, unitary price, stock value from value and quantity perspective.
▪ QUALITY STANDARDS Classified list	▪ 1. – quality standard; 2. – Q code (quality); 3. - article code; 4. – article title and equivalent quality standards; The *article code* is taken from *"aritcle classified list'"* table.
▪ SUPPLIERS Classified list	1. - supplier (alphabetical index); 2. - supplier code; 3. – supplied article code; 4. – social residence adress, contact details; The *supplied article code* is taken from *"article classified list"* table".
▪ GUIDE MARK Classified list	1. – product; 2. – guide mark code; 3. - guide mark sizes; 4. – processed article unitary weight, raw article unitary weight; 5. – quantitatively achieved; 6. – moulded total weight.

Since the classified lists are connected in between by *connection keys*, they allow to furnish all memorized data refering to a searched registering.

The application interface containts a *searching module* after certain criteria previously introduced; there have designed three types of *searchings,* as it follows:

1. By introducing an *article denomination* and pushing the *search button*, the desktop will display data about it, refering to the *article's* code, *quality, supplier, measuring unit, unitary price, quantity and stocked value*.

2. By introducing an *article's quality code* and pushing the *search button*, the desktop will display data about the article that holds that *quality code* and data refering to the *article's code and quality standard*.

3. By introducing a *supplier's code* and an *article's code*, after pushing the *search button,* the desktop will display the *supplier's identification* and *contact data* for the searched article.

The modules developed in the application refer to provisioning (including imported articles), production (including recipe based articles), internal operation with stocks (consumption tickets, giving/receiving tickets, transfers, inventories

etc.), sales, complex situations for clients / suppliers, cash register (RO lei, currency), bank (RO lei, currency), discounts, generation of bookkeeping articles dued to the worked documents.

7. Conclusions

The industrial software applications are interdisciplinary, involving partnership and collaboration between theory and application science experts, between IT designers and different industries technologists.

A first step that is necessary in the metallurgy computerization process consists of implementing dedicated programmes that are already existent and successfully used in other fields, with financial-bookkeeping character, graphic representations, physical processes simulations and shapings.

Within an efficient collaboration between IT programmers and foundry technologists there can be achieved software applications in certain application fields, that, after industrial implementation and testing, can become complex and complete computer programmes, which should be the basis of improving the entire activity of such an economic agent as a foundry.

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