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PRACTICAL IMPLEMENTATION OF COMPUTERIZED PRODUCTION MANAGEMENT INFORMATION SYSTEM IN A PRODUCTION COMPANY

Abstract

The paper presents the possibility of the realization of the practical implementation of computerized production management information system in a production company.

It also introduces the possibility of practical implementation system program and the actions executed during the implementation.

1. INTRODUCTION

The entry of Poland into the structures of the European Union gave Polish companies the possibility to participate in free trade on the territory of all countries belonging to UE. As a result, they can gain new trading markets.

On the other hand, new firms have to begin to compete with the firms already acting on the market of the “old” UE for which new markets of the newly admitted countries have opened. In order to match the extensive competition, firms have to invest in new technologies and the ways of management which will help them reduce the costs of the production without decreasing the quality of produced goods. One of the ways of modernizing the firm is the use of new program of the ERP type which are used in the modern management of the firm.

The systems of the MRP type evolved at the beginning of the 60s of the previous century, when they were used in large computers in specially air-conditioned halls, serving mainly the needs of the aircraft industry and connected with the defense system of the USA, operating mainly the planning functions of the firm. The next stage took place in the 1980s when the use of MRP was extended beyond only planning functions to MRP II which was used for management productive supplies as well as in accountancy and in auxiliary services. During the most recent stage in the 1990s, MRP was practically used for all basic functions of a firm and the ERP systems were created.

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2. TOOLS USED DURING THE PRE-APPLICATION ANALYSIS OF THE COMPUTER SYSTEM TOGETHER WITH THE DETAILED DESCRIPTION OF THE UNDERTAKEN INVESTIGATIONS OF THE SUBJECT MATTER OF THE PRODUCTION COMPANY.

2.1 DETAILED DESCRIPTION OF THE PROBLEM

Metal Processing Center KOMECH seeks the computer solution which will make possible steering and management of the production. The system has to enable up to date monitoring of the progresses in the realization of production orders.

The implementation of such solutions which will make it possible to introduce into the system such information as

- the degree of the realization of the order,
- possible delays,
- appearing defective products (together with the description of the cause of the problem).

The system also has to make possible deep analysis of individual workers productiveness and the possibility of the evaluation of individual products under concerning the way it influences the profit of the firm.

2.2 THE EXPECTED FORM OF THE SOLUTION

The firm expects pre-application analysis of the computer system enabling the control and management of the production. Within the analysis it expects the information about:

- Detailed requirements of the firm regarding the system of production control and management.
 - Which system to choose .
 - The analyses of chosen systems regarding their usefulness in realization of definite functions in the firm.
- Specifying the functional requirements of the potential system.
- Delimitation of business processes - productive - realized in the firm which should be transferred to the system.
- Defining the roles and duties of the project's team, defining the way of realization and implementation of functional requirements, the division into sub-projects within the whole project.
- Defining the frame schedules of the work with division into stages, preparing of the detailed estimate of the realization of individual functional requirements.
- Defining the possibilities and the ways of managing the innovative project of the implementation of the computer system in the firm.

2.3. THE POSSIBILITY OF THE IMPLEMENTATION OF THE SYSTEM PLANNING OF MATERIAL NEEDS

The system of the planning of material needs (PPM) is the collection of logically related procedures, principles of decision making and documents, aiming at translating the efficient plan of the production into the size of the net needs in the current division and defining of the planned covering of these needs. The system of planning of the material needs verifies the net

needs and their covering when there are changes in the efficient plan of the production, in the condition of the store or in the construction of the article [1].

The system of PPM in the process of the planning assigns the existing supplies of materials according to the gross needs, and verifies the legitimacy of the time course of every unrealized order in order to define the net needs. Such a system assures the covering of the net needs by establishing the schedule of planned orders for every position.

The demand for the given product of the store is defined as independent when it does not make up the function of the demand on some different product. Shaping of the future independent demand requires prognosis. In the majority of firms, materials, dominating supplies consist of raw materials, component elements and components which are the object of dependent needs. The size of such demand can be estimated; however, the formation of dependent needs is not estimated and that is why they can be defined on the basis of the demand for independent needs. The given product of the store can be the object of the exclusively dependent or dependent and independent demand in the production. The dependent and independent demand steps out in the case of parts used both in the current production and in the service simultaneously.

Taking into consideration the directives, the system is designed to control the productive supplies to which belong:

- raw materials in the warehouse,
- unfinished elements in the warehouse,
- semi-finished products in the warehouse,
- semi-finished products in the course of the production.

For this kind of tasks the MRP system was designed. It is the system which belongs to "average" as far as the price is concerned. The costs of implementing the system may seem high, but within five years after implementing it pays for itself. [12]. The newest MRP systems deal not only with controlling the supplies of materials and component parts, but they were extended to the different areas of the productive activity of the firm [4].

At present, the overwhelming majority of medium size and large firms use the computerized management information system.

One of the elements of the realization of the control function and management in the firm is the application of the MPS system (Production Scheduling). In the majority of MPS the management of resources and the planning of the production is done by hand way and on paper. Such management leads to the limited management of the costs for the given product when there are a large number of assortments. Comprehensive systems of aiding the management have been designed for these tasks [12].

The constant growth of the technical progress, together with the mass production, creates favorable conditions for introducing in the production firm new solutions connected with the planning of the production and material needs. One can execute this in the automatic way or by facilitating such actions through the introduction of the data and controlling them by the computer system [8].

System approach presented in many publications in the entire world assumes that the firm is treated as a kind of entity which functions efficiently thanks to technical, economic, social and psychological factors. The firm as the system possesses features determining its contact with the surroundings to which belong:

- openness,
- social-technical shape,
- complexity,
- ability to improve [2].

Recently, a huge growth of the use of computers in the industrial production can be observed. It also contributes to the increase of integration of the processes realized in the firm. This phenomenon relates to planning of the technical preparation and controlling of the production, quality and sale [2].

Among these processes are:

- FMS (Flexible Manufacturing Systems).
- CAM (Computer Aide Manufacturing).
- CIM (Computer Integrated Manufacturing).

The realization of research and development (R&D) connected with the solution of the investigative problem which appeared in Metal Processing Center KOMECH concentrated on the development of the first two stages of the implementation in the firm of the computer system of the ERP class (Fig.1).

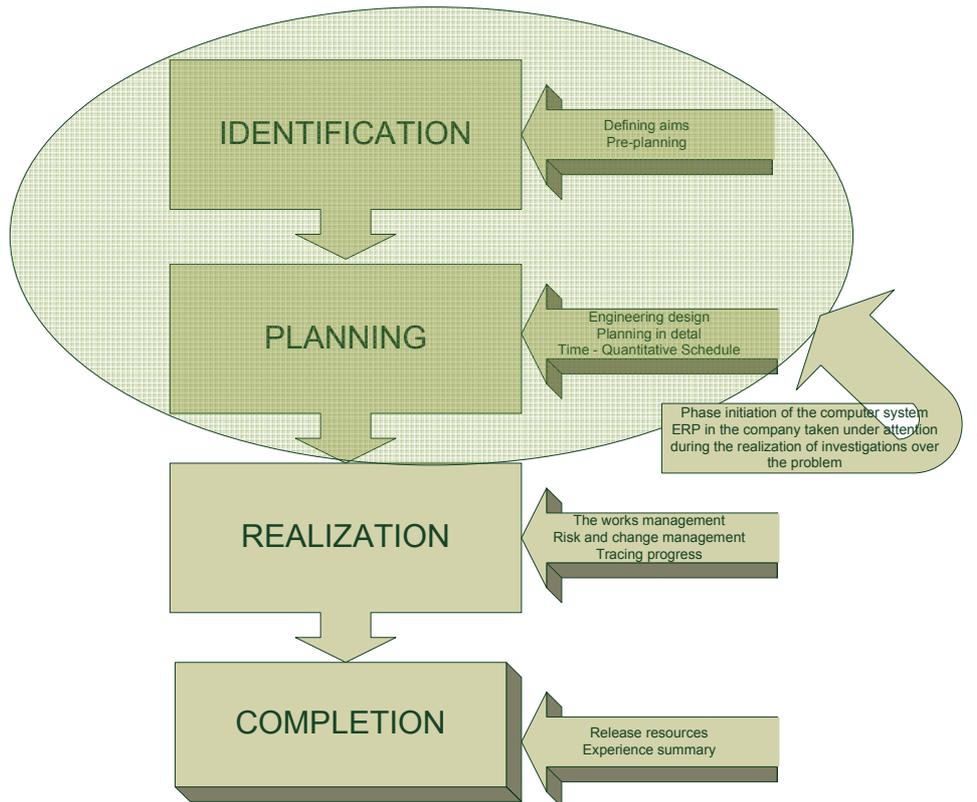


Fig. 1. The structure and the range of the realization of investigative tasks in Metal Processing Center KOMECH

3. DESCRIPTION OF APPLIED TOOLS USED DURING THE ANALYSIS AND THE IMPLEMENTATION OF THE COMPUTER SYSTEM.

There are several various ways of realizing the implementation of the computer system of the ERP class in the firm. Because of the productive character of the economic activity led by Metal Processing Center KOMECH, the PMI methodology was chosen for the realization of implementing the computer system.

The PMI (Project Management Institute) methodology treats the project as the arrangement of stages which have identical processing structure. The PMI methodology recommends that the arrangement of stages - the cycle of the life of the project – be individually selected for the specific project, and here the cycle of the life of the project is compatible with the cycle of the life of implementation. During the realization of the implementation according to the adopted methodology several functional stages must be determined (the groups of processes):

- Initialization.
- Planning.
- Realization.
- Supervision.
- Completion.

The possibility of ordering these groups gives the possibility of creating a network of actions (Fig. 2) which should be conducted in Metal Processing Center KOMECH in order to solve the set investigative problem. PMI defines nine areas of knowledge about the management projects (The Project Management Knowledge Areas):

- Integration management.
- Range Management.
- Time management.
- Costs management.
- Quality management.
- Human Resources management.
- Communication management.
- Risk management.
- Deliveries management.

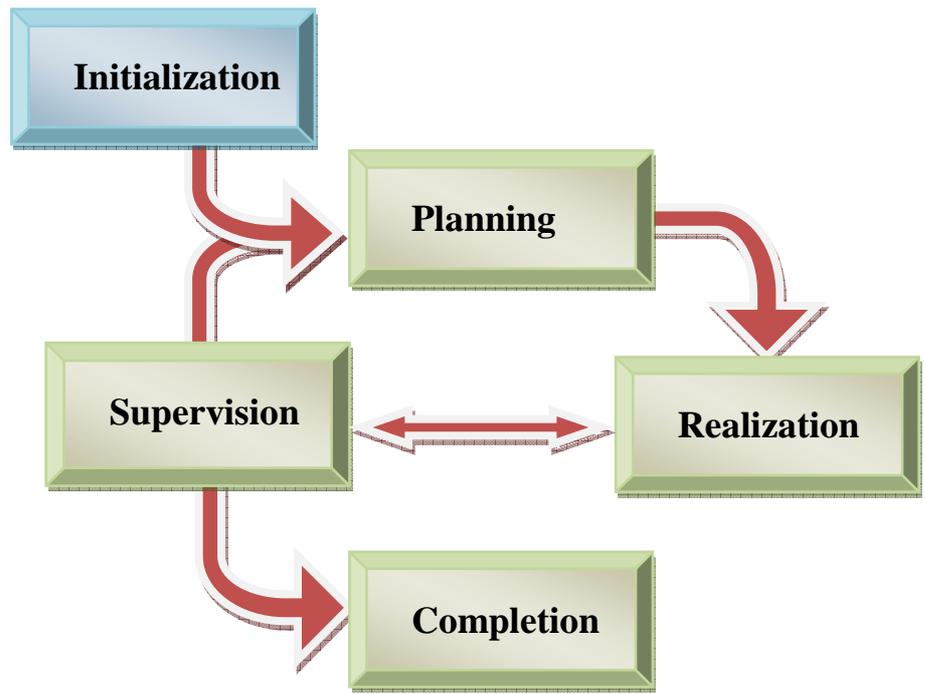


Fig. 2 The arrangement of the groups of processes in the stages of the project according to PMI

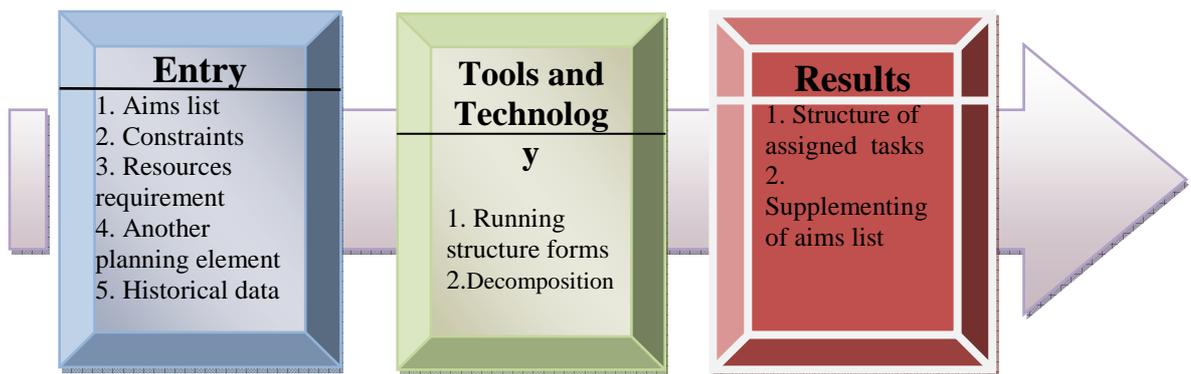


Fig. 3 The model of the process of the management of the project. Defining the range of tasks in Metal Processing Center KOMECH according to the PMI methodology

In each of the areas PMI defines the processes of the management of the projects (PMP - Project Management Processes), which precisely point to the groups of processes realized in the project. With the help of the simple model: Entry, Tools and techniques, Results the elements necessary for every PMP are defined. They also define what techniques are applied in it and what the result of the process is (Fig. 3).

In addition to PMI methodology implemented during the realization of the investigative process and determining the solution of the problem, other tools facilitating the work on the project and enabling the control over the whole the project were used. It was mainly the MS Project program.

Microsoft Office Project Standard 2007 Program makes accessible the tools for the management projects, which combine usefulness, advancement and elasticity and thanks to which one can more efficiently and effectively administer the projects. The user can obtain current information, control the work, schedules and the finances of the projects and coordinate groups of projects. This allows the user to increase the productivity thanks to the integration of the well-known programs of the Microsoft Office System packet, the advanced options of reporting, and controlled planning and the elastic tools.

Office Project Standard 2007 program allows to define realistic expectation with the reference to the teams of projects, board and customers, on the basis of which one can create schedules, assign supplies and administer the budget. The various functions of the program facilitate the understanding of schedules, for example the function Factors controlling the tasks (used to follow the sources of problems), multi-level removal (enabling the testing of the scripts) or the emphasizing the changes (serving to the automatic shading of the tasks which are influenced by the specific change).

4. THE COURSE OF THE REALIZATION OF THE R&D SERVICE IN METAL PROCESSING CENTER KOMECH

4.1. THE PROFILE OF METAL PROCESSING CENTER KOMECH SEEKING THE SOLUTION OF THE INVESTIGATIVE PROBLEM

Metals Processing Center KOMECH was founded in 1980 in Lublin, Poland. We manufacture metal parts for cars, tractors, for the needs of metals and food industries. Our customer base is made up of large conglomerates from Germany, Denmark, Italy and Holland.

Our nearly 30 years of experience has put us in a unique position to fulfill the needs of our diverse customer portfolio.

The high quality of our products is the base on which we build our future. This is the reason why we introduced "Quality Assurance" system [PN-EN ISO 9001:2001](#) in 2001. We continue to improve this system to ensure our products remain of the highest quality.

Our Metal Processing Center is equipped with modern machines CNC (laser cutting machine, plasma cutting machine with HD class plasma source, bending press machine, vertical machine centers, CNC lathes and pipe bending machine). We also prepare surfaces for painting through grinding. The use of modern technologies aids our efforts of manufacturing complex shapes and obtaining a higher precision of manufactured parts.

Metals Processing Center KOMECH is directly connected by capital with the steel warehouse named Building Materials Commercial Enterprise STALMET Co.

The analysis of Metals Processing Center KOMECH has been conducted regarding the possibility of the implementation of the computer system of the ERP class and the main areas of the activity in which the system should be first implemented have been chosen:

- Commodity turnover
- Manufacturing process

4.2. THE REQUIREMENTS OF THE FIRM REGARDING THE SYSTEM OF CONTROL AND MANAGEMENT OF THE PRODUCTION

The success of the undertaking is measured by the gains of the firm resulting from the use of the proposed innovative solution. These gains are first of all:

1. Considerably easier and quicker possibility of studying the productive costs of the so-called technical cost of producing individual products
2. Quick and exact preparation of the calculation of articles
3. The possibility of the quick answer to the bid questions of potential customers
4. The evaluation of the efficiency of the individual work-places
5. Reporting the degree of the burden of the individual work-places
6. Evaluation of individual workers in individual work-places
7. The possibility of the comparison of the productivity of individual workers and teams
8. Quick verification of the theoretically assumed costs of the production with the actual costs
9. The possibility of the evaluation of the profitability of the production of every (isolated) product
10. The possibility the evaluation of every the worker in relation to the quality of the production (the quantity of defects – caused by the worker or resulting from faulty materials or tools)
11. Proper accounting for the quantity of the standard waste of materials and raw materials for one product
12. Overt quality of the work of individual workers - periodical evaluation sheets of the work in particular occupation
13. Identification of products made by individual workers in individual positions.
14. Objectivity and reliability of gathered data about the way of work of individual workers (the elimination of subjectivism in the opinion of the work - the elimination of the human factor), concerning the recorded data and the subjective human opinion
15. Automatic electronic register, electronic clock, the meter of the time of work
16. The speed obtaining and processing the data and information about the production process, which enables the quick possibility of prevention of negative phenomena, financial-economic, organizational, logistic, human factors.
17. The quick possibility of eliminating negative phenomena in the life of the firm

5. RECOMMENDED SOLUTION AND DETAILED DESCRIPTION OF THE USE OF THE RESULTS OF THE REALIZATION OF THE R&D SERVICE IN METALS PROCESSING CENTER KOMECH

The area of production in the firm KOMECH is the typical process of the realization of the repeatable production with the time-defined productive batch. Technological processes are defined in the firm in the precise way; the production orders which are realized according to the bi-weekly plan are also defined. In addition to the bi-weekly production plan, there is the prognosis of the production for the next two weeks which can undergo the change before its starting point. The firm wants to implement the program to realize, among others, the following functions in relation to the process of the management of the production:

- storage of defined technological processes and production orders,
- calculation of standard costs,
- generating production records,
- record and calculation of orders.

The technology is the record of the technology of the realization of the definite product. The given product can have various versions of the technology both for traditional machine tools and for CNC. The technology has the defined size of the production batch (it can equal to one individual production unit).

The record of the technology covers the defined list of the operations including:

- number assigned to the given operation,
- production machine in which it is made (the nest of machines or chosen machine)
- time of the realization – setup time and operation time
- list of the entrance supplies (materials, semi-manufactured products, services),
- list of exit products from the operation – these can be
- kind of supplies – products, durable commodity
- source of origin (entrance supplies) - from the purchase, from the store-house or from the previous operation
- Destination (exit supplies) - to the next operation, the store-house or directly to the customer.
- Technology

In the technology of the production the material supplies of the process are assigned to individual operations – the norms of the waste are shown. The relations following the formula „many to many” are served. It will subordinate oneself to the supplies such as machines, workers and tools and instruments are assigned in appropriate measuring units.

The norms of the waste of supplies in the description of the technology are given for the individual exit products and for the batch of the products.

More than one technology can be defined for the product which allows considering the base technology and variant technologies.

The technology is first of all the model of the process for the production orders created on its basis. The calculation of the standard costs of the process is done on its basis. The implemented system should additionally show as the basis of calculating the costs of the stored supplies the average, maximum or final prices of their purchase. Supplies not stored in the warehouse and services have the definite isolated costs in the firm which are defined for the specific supply on the basis of the historical data.

Production orders

In the firm the service of production orders is based on defined technologies. For the orders the material needs are planned. The service of orders includes the calculation of the costs – standard and real - and the record of the realization of orders.

The task of the computer system is the initiation of orders in an automatic way or defining them manually by the user. The order should be the working document whose elements can be modified. The order released for the production receives the "Active" status and it cannot be changed. The active order has several statuses connected with the record of the realization of the operation, that is begun, begun first operation, finished last operation. The order which has the finished last operation can be closed. The operation of closing of the order also causes the closing of the record of the costs.

Documents connected with the transactions of the collection order and returns of produced semi-manufactured products should be generated automatically.

At any state and status of order the user should have the possibility to prepare the following reports

- the workshop guide (when the order is active it becomes the production document),
- the calculation of the costs according to the supplies defined in the order, in the arrangement of standard and real costs with the enumeration of the degree of advancement of real costs expressed in percentages,
- the accounts of the order, that is the quantitative accounts of supplies and counted exit products and defects.

Reports from production in the future ERP system. In the set of standard reports there should be, among others:

- "TECHNOLOGICAL CARD".
- "CALCULATION CARD OF the COST of the TECHNOLOGICAL PROCESS".
- THE "WORKSHOP GUIDE ORDER".
- "THE CALCULATION CARD of the PRODUCTION ORDER".

The task of the future system will be the possibility of taking receiving all indispensable information about the order and the process of its realization by the production worker directly in the production hall. This should be done by special terminals – at the machine and in the department. The machine terminals will operate the most essential positions from the point of the view of the realization of whole production orders. These are CNC machines and laser and plasma counter band saw.

After implementing the computer system, the production process should allow the effective standardization of the production tasks (the service of the valid technology) and the control the service of orders. The principal task of the system will be the possibility to define the costs of production with relation to the product or the order.

Vendo ERP

Vendo ERP is a modern, integrated system of the ERP class/MRPII improving the efficiency of firms. It is designed for small and medium-size production - service and trade firms, distributing their products through departments, trade representatives and trade partners. Vendo ERP combines:

- **solid storage-accounting system**
- **system supporting the management of the firm**

The task of Vendo ERP is to support the management of the processes of sale, logistics, production and service in the firm. It serves the processes of making offers, accepting offers, issuing orders, planning, realization and the accounts of the order, issuing the invoice and the accounts of the payment, as well as book-keeping.

Vendo ERP Pro is recommended for the firms which need something more than the solid storage-accounting, and for the firms in which the proper management of the processes of sale, production, and the service is of major importance (Fig. 4).



Fig. 4. The functionality of VENDO ERP software

6. CHOSEN THE FUNCTIONALITY FOR THE FIRM INSTITUTION PROCESSING METALS KOMECH

Warehouse and Logistics

Target:

- Efficient functioning of the sections responsible for orders and store-house in the firm
- Decrease of warehouse costs through the optimization of warehouse supplies
- Improvement of distribution and supply

Faktura VAT nr 25/S/07/FV *DOK. WYDRUKOWANY*

Dane podstawowe: Dane kontrahenta Inne parametry Wartości dowolne

Dane podstawowe:
 Numer dokumentu: 25/S/07/FV
 Magazyn: Magazyn Główny
 Data sprzedaży: 15-06-2007 Wystawiono: 15-06-2007
 Nabywca (FZ): EDHAR S.A.
 Odbiorca (F9): EDHAR S.A.
 Forma płatn.: Piszew Data płatności: 22-06-2007

Wartości:
 Wartość netto: 3 195,66 PLN
 VAT (od netto): Zmiana metody: 703,09 PLN
 Kwota do zapłaty: 3 898,95 PLN Zapłacono: 0,00 PLN
 Pozostało do zapłaty: 3 898,95 PLN
 Wpłacone zaliczki: 0,00 PLN Rozliczone: 0,00 PLN
 Grupa I: Zadłużenie: -77 633,99 PLN

	Kod	Nazwa	Ilość	Jm.	Cena jedn.	Wart. netto	V...	Wart. brutto
1	PÓLKA_TEST	półka testowa	20,000	szt	130,00	2600,00	22	3172,00
2	AA2205001-020K	Blочки "YTONS" гладкие 60x20x11	1,000	szt	105,74	105,74	22	129,00
3	AABLACHCYNK	Blacha cynkowa 2mm	5,000	M2	74,58	372,90	22	454,94
4	1701100-034	Cement portlandski "25" z dodatkami	1,000	T	10,66	10,66	22	13,01
5	1320599-033A	Drabiny z rur stalowych, spawane	2,000	kg	53,28	106,56	22	130,00

Składki Towar nie wydany Dok. skrajzone Drukuj Funkcje Dodał Zaskini Do bufora

Fig. 5. The document of the VAT invoice for the printout

Functions:

- multiple storage services,
- outgoings according to LIFO, FIFO, the indication of the batch,
- warehouse documents,
- reservations of products, reservations "in the front", reservation on the batches of products,
- service of back orders - goods waiting for the delivery and deficits (orders not covered by the firm),
- offer question from the suppliers, accepting the orders, making orders,
- generating one kind of documents from another,
- accounting for deposited goods,
- the dates of the validity of the batch, the service of the serial numbers of goods and products,
- weights, volumes, the packaging of goods, the alternative units of the measure,
- the assurance of the unrepeatability of the batch,
- the service of the alternates ,
- issuing of transport orders and transport letters
- co-operation with the barcode readers and etiquettes printers,
- complex warehouse analysis,

Production

Target:

- the increase of the efficiency of production,
- the improvement of the timely realization,
- the increase of the quality of the products.

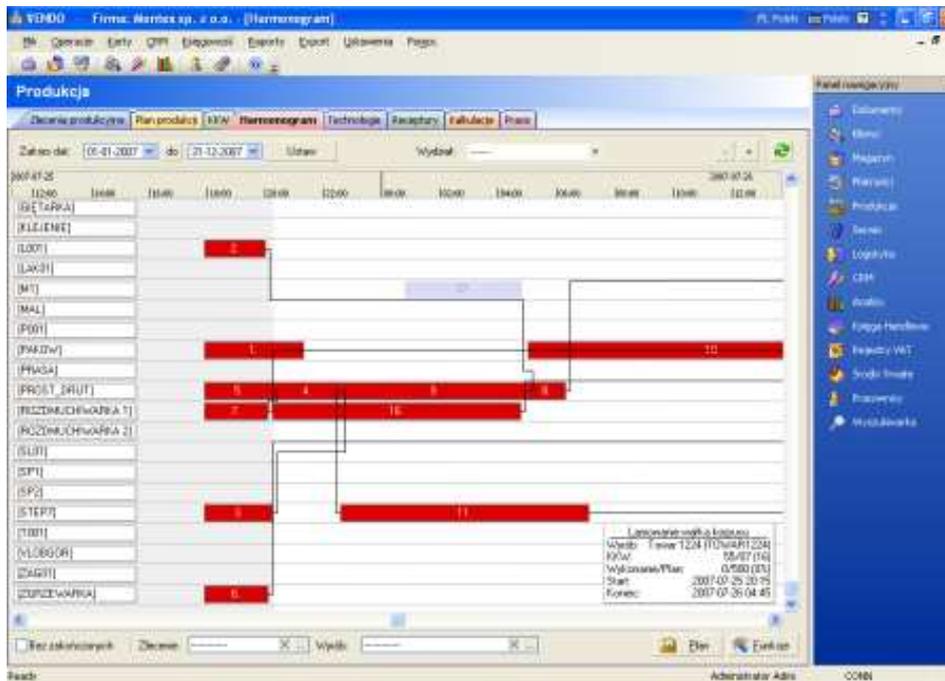


Fig. 6. View of the schedule of the production in the Gantt arrangement

Functions:

- defining the technology of the product:
 - the operations which have to be executed. Vendo makes it possible to create production routes both linear, arborescent and practically any graph of the course,
 - the materials and the semi-manufactured products indispensable to the realization of every the stage,
 - working nests on which we execute individual operations,
 - technological times,
 - cooperation,
 - predicted defects at every stage of the production,
 - any parameters,
 - attaching files,
 - the possibility of defining alternative production routes.
- creating the cost calculations of the products,
- issuing production orders,
- creating sub-orders for lacking semi-manufactured products,

- the scheduling of the production: periodical, for the department, for the on the working position,
- the graphic representation of the production with the help of Gantt graph,
- creating Production Guides enabling the registrations of:
 - the quantity of made products,
 - the time of the production,
 - the worker doing the given work,
 - machines on which the production was executed,
 - defects and productive wastes,
- printing of the barcodes on Guides,
- printing of the etiquettes, the service of barcodes,
- distributing the materials and the semi-manufactured products to the productions and accepting ready goods and semi-manufactured products within the order and productive guide,
- the service of cooperation,
- the accounts of the production,
- orders to the suppliers of raw materials on the basis of the plans of production and technology,
- planning of material needs ,
- the reports of the production, the reports of the workers and machines efficiency, production in progress,
- integration with the systems of the quality management

Planning and the organization of the work

Target:

- Increase of the efficiency and the quality of the work,
- planning of the work, assigning the aims, tasks and responsibility,
- the reports of diligence and the worker efficiency,
- decrease of the labor-consumption of task.

Functions:

- the automation of many tasks and defining the procedures in the areas of the service of sale, supply, production, warehouse economy,
- planning and registration of fulfilled contracts ,
- distributing the tasks for the realization to oneself and different workers,
- document tracking,
- reminding about the deadlines and tasks for the realization,
- determining the aims for tradesmen,
- reports of activity and the workers diligence,
- the facilitating the work,
- aiding the serial correspondence: mailing, the printout of address etiquettes,
- recording operations executed by workers in the system.

7. DEFINING THE ROLES AND THE DUTIES OF THE PROJECT TEAM, THE WAY OF REALIZATION AND THE IMPLEMENTATION OF FUNCTIONAL REQUIREMENTS

The implementation of the computer system in Metals Processing Center KOMECH will be based on the realization of entire work aiming at starting and fully utilizing the system in the firm. The purpose of the implementation is, among others, increasing the level of the organization of work and the growth of the efficiency of the work of the firm. We can distinguish the following stages of implementing of the computer system:

1. technical,
2. configurationally,
3. training.

The technical level consists in the suitable selection of computer equipment, the creation of computer net, the installation of server, the data base and proper software. The aim of the stage of the configuration is the proper parameterization and the adjustment of the system to the model of working desired by the firm and the customer individual needs. The training stage consists of introduction the users with the principles of the service and the correctness of the technical working of the program.

The implementing team

Coordinator

In the firm in which the system is implemented a person coordinating the project is indicated –the so-called Coordinator. The Coordinator has to be very well - informed in the matters relating to the firm and the processes taking place in the firm. The coordinator participates in the configurational part and to a small degree in the technical and training part of implementing the system for example in the installation.

The manager of implementation

The chosen implementation firm appoints the implementation manager. He is responsible for the proper implementation and starting the computer system in the given firm.

8. SUMMARY

The very notion of implementation is connected with the time of a major transformation in functioning of the firm. It requires the commitment, co-operation and good will on the part of not only the management and the board, but also of all the workers of the firm. This is sometimes a demanding and difficult set of changes, but it is inevitable.

Usually we distinguish three phases of the operation: the phase of protest, the phase of mechanical work and the phase of full understanding.

The first phase is the most difficult to overcome.

The time of the mechanical work is the next stage. Workers use the given system only because of the management recommendations, but they are not convinced. The practice follows in certain reflexes and habits regarding the way of the working with the program. Overcoming of those difficulties and going through the cycle of trainings allows making the next step towards the phase of the full understanding. This is the period when the workers get acquainted with the program, gain suitable knowledge of how to use it and how to make use of all available options and functions. They eventually become convinced and well acquainted with the program and use it willingly.

What follows is the considerable growth of speed and quantity of executed operations. The same works and in the same time are able to perform a larger amount of work. They reach the needed information more quickly and considerably shorten the time of serving the customers which translates into the increase of their efficiency and the improvement of hitherto existing results.

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