AUTOMATION OF PRODUCTION CONTROL MANAGEMENT BY MEANS OF GROUPWARE TOOLS

Blazevic, D.; Mikac, T.

Assist. Dalibor BLAZEVIC, M.Sc., Technical faculty University of Rijeka,
Department of Industrial Engineering and Management,
HR-5100 Rijeka, Croatia, Phone: +385 51 651 553
E-mail: dalibor.blazevic@riteh.hr

Abstract: *An office without papers is still unimaginable, particularly in the field of operations and production control management due to continuous information interchange with production shop floor. Yet the reduction of paperwork is possible thanks to various open source groupware tools. They provide automated data interchange avoiding thus paper duplication redundancy. The application of open source groupware tools and wireless network in automating the operations management process is presented.*
Key words: *production control, groupware, wireless network, personal digital assistant*

1. INTRODUCTION

Today much work in the field of production optimization is focussed on the optimization of the material flow through the production shop floor and on reaching the maximum tool efficiency simultaneously [1]. This, however, requires considerable effort by the production planning and control department before the production actually starts. It includes the preparation of various production control and operations management documents (work instructions, material tracking documents, material issuing documents, finished parts delivery note, final product delivery documents, etc.) and checking whether the necessary raw material, tools and production equipment is available and ready for the production process start-up. In other words, regular checking of the raw material inventory levels and the status of the issued supply orders is indispensable, as well as that of the necessary tools [2]. As much as for the equipment, the maintenance plan has to be consulted to see whether the equipment is available or scheduled for maintenance in the period planned for production. Moreover, the service and maintenance department should be consulted regularly for availability of production equipment. Likewise, much co-ordination work has to be done within the production planning and control department itself. If overall efficiency and optimization of production is to be achieved, the majority of these duties should be automated somehow. Various open source groupware tools, personal digital assistants (PDA) and wireless network can handle much of the above mentioned automation tasks.

2. DOCUMENTATION WORKFLOW

After the production planning and control department issues the master production schedule, there are many documents to be prepared, completed with data and distributed to various parties. The simplest form of a workflow diagram with basic ways of distribution of documents among various parties is shown on fig. 1.. Instead of using the manual distribution of operations documents and notifications, the web based update and distribution of documents is performed [3].

First the production planning and control department retrieves the sales and distribution plan from the sales and distribution department. After reviewing and adjusting the planned terms according to the availability of production resources (e.g. equipment, work force and material), the master production schedule (MPS) data must be entered into the database through the MRP enabled software for further processing.
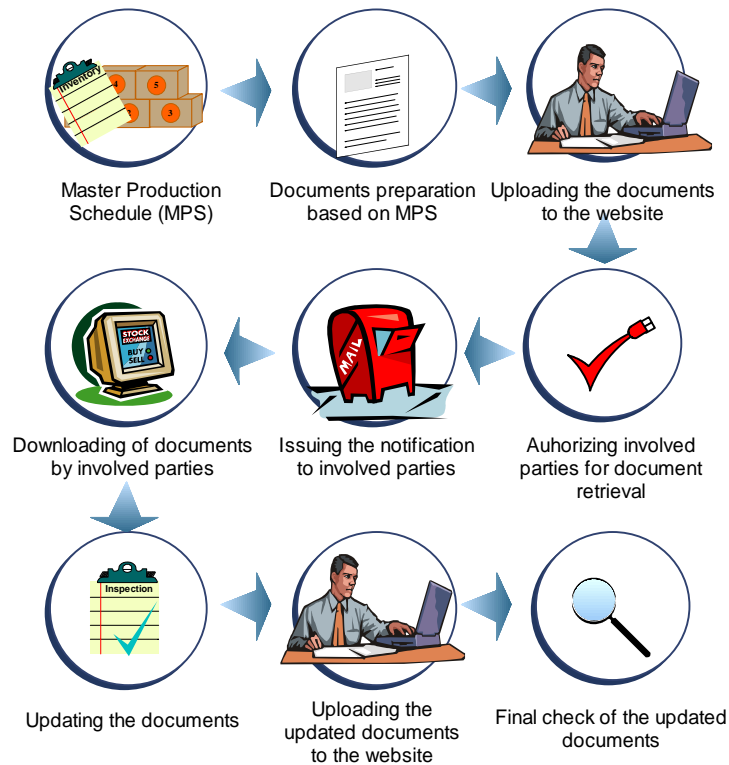
Fig. 1. Basic flow of production control documents

The outcome of the processing provides MRP planned data. These data contain production start and end terms, as well as information about quantity for every part in the final product bill of materials..

2.1 Important control documents and information

MRP plan is the basic source for issuing the work order. The work order consists of three main parts or documents: "work control list" i.e. the material tracking document, "takeover note" i.e. the material issuing document (fig. 2.), and "delivery note" i.e. the finished parts commitment document.

Important data for material tracking, that are to be filled in the "work control list" document, contain information about resources (e.g. area where the actual work is to be performed, equipment on which the work is to be executed, work labour responsible for the execution of production) and the name and the code of the processed part. Data are to be entered into the document only once, meaning that they are never to be updated during the whole execution cycle of the production process. Other information on "work control list" (such as planned and actually produced quantities, planned and actual production start and finish dates, and number of good and scrap products in particular) are updated regularly. These updates are either performed on fixed interval basis, or are based on the production project milestone terms and, of course, are made at the end of the production cycle.

TECHNICAL FACULTY RIJEKA		**TAKEOVER NOTE**		**WORK ORDER**		
				Code: 070-50-250		
				Date: 19.04.2007		
Part	Name: Crank Code: 500-20-070	Ordered quantity	160 pieces (2 plates)		Cost per piece	Total cost
Material	Name: Plate Code: 500-20-069	Planned quantity	154 pieces		2	84
Warehouse	Name: Raw Mat Inv Code: 4000-20	Produced quantity	150 pieces			
Unit of measure	piece	Operator	Warehouseman	Worker		Auditor
Unit of cost	EUR					
Rate	80 pieces/plate					

Fig. 2. Takeover note

Before the actual start of the production cycle the material-issuing document in the form of "takeover note" is to be filled in. This document contains the name and the code of the finished part produced from raw material   Other information here contained is: raw material name and code, raw material issuing quantity, the inventory name and code from which the raw material is to be taken, unit of measure for raw material quantity, quantity of raw material actually issued, etc. While the planning and control department fills other information, the inventory staff to reflect actual situation of raw material issued fills the last one.

At the end of the production cycle the finished parts commitment document in the form of the "delivery note" is to be filled in by the production shop floor department. This document contains similar product and inventory identification information as a "takeover note", as well as planned quantity of finished parts for delivery and actual delivered quantity. Of course, the units of measure for part quantities are also specified.

If printed paper forms are to be omitted, all data have to be filled, passed and processed electronically. The way to achieve this is by using a web enabled system for delivery and communication of documents, and a spreadsheet software that is available on both standalone PC as well as on PDA devices. Another possible way is to use a web enabled system for both delivery of information as well as for entering data through web forms. The majority of today available open source groupware system are plug-in enabled, which means that an independent module with adequate web forms for entering, recording and sharing of production control data can be made.

2.2   Production control information flow by means of a groupware software

Activities flowchart is a good tool for presenting the flow of information between the production planning and control department and other departments involved in the complete production cycle from ordering raw materials through production process to sales and distribution [5].

As seen on flowchart fig. 3., the first step towards the automation of production planning, control and execution process is to prepare a master production schedule (MPS) by means of a MRP enabled software [4]. The groupware web portal is not a tool designed for the purpose of MRP planning activity. Yet it can still be useful to further automate the planning process by enabling at this point the sales and distribution department to issue the notification that the preparation of the sales and distribution plan is finished. This notification is automatically displayed on screens in the planning and control department. The main advantage of this system if compared to an e-mail system is that the receiving of information by the intended party is assured. Moreover, every information is logged so that the whole process can be tracked back.

After the MRP data are ready the reviewing of these data is to be performed. This review is intended to check weather the present situation, in terms of resource availability, is in accordance with the plan. Otherwise, the re-planning is to be done. If all MRP data are correct, the spreadsheet forms or web forms are filled with product, process, resource information and planned data as explained in 2.1. These data are uploaded to the groupware web server, and on its completion, the formal production starts with the creation of a named project in the groupware web portal projects module. When the project is created and associated with the involved parties (e.g. ordering department, inventories department, shop floor department), the notification is issued for the involved parties. All involved parties upon receiving the notification download the production control documents either to their local PC computers, PDA, or they access this document by opening an associated web form.

The ordering department upon receiving the notification prepares the order forms for raw materials and parts not already available on stock that has to be purchased. The inventories department completes the forms, with the necessary information concerning the issuing of raw material, tools and parts. The production shop floor department continually updates material tracking information. Every worker involved in the production updates information by means of his PDA. At the end of the production process information about finished product delivery are updated by means of headman. All information is uploaded to the groupware web server through the LAN or WLAN Then the final notification for the planning and control department is issued and the project is closed.
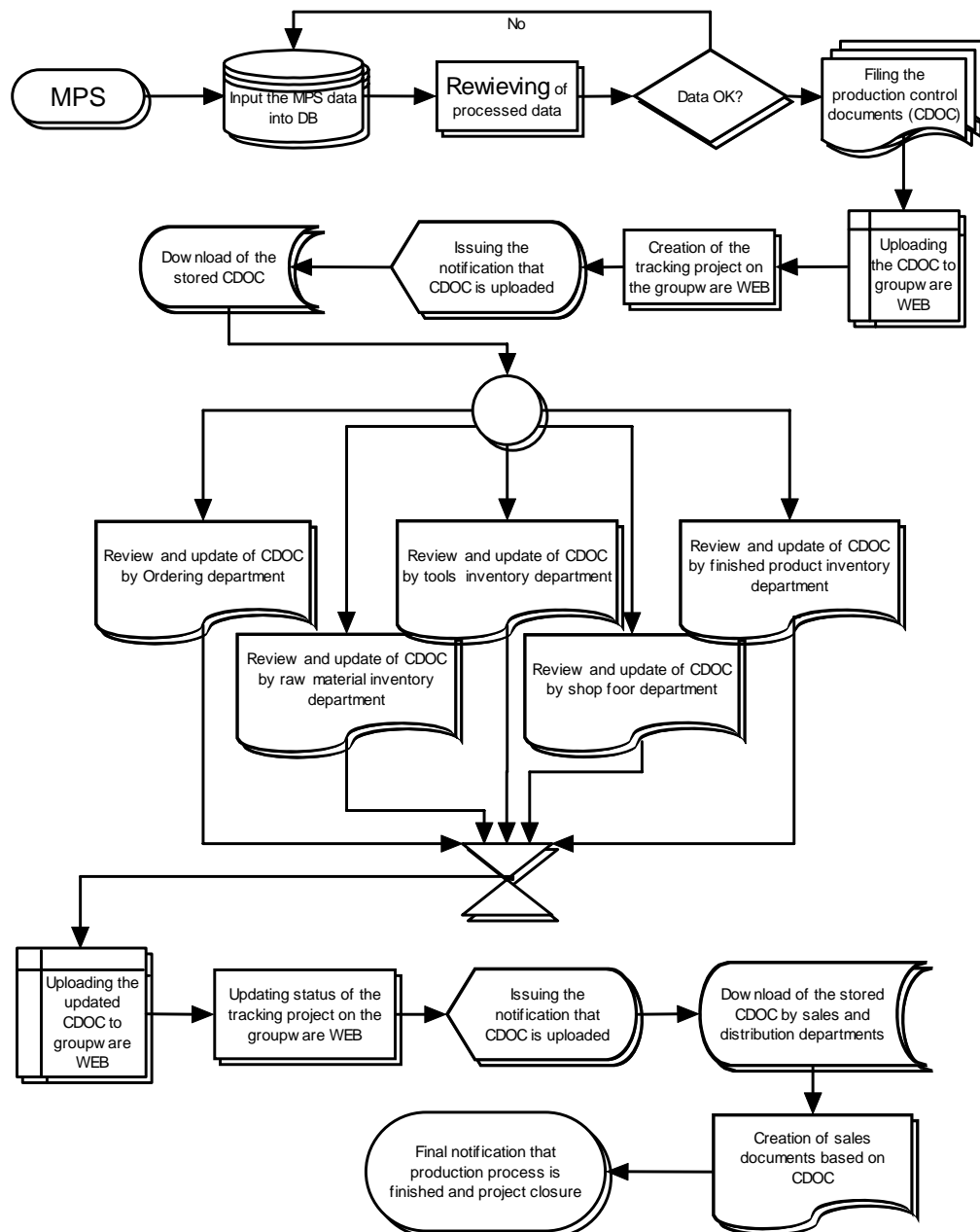
Fig. 3. Production planning and control activities flowchart

3. HARDWARE AND SOFTWARE PLATFORMS FOR AUTOMATING THE OPERATIONS MANAGEMENT PROCESS

In order to enable the automation of the production control by means of the groupware web software, specific networking topology is to be used (fig. 4.). Let us assume that specialized MRP software is used for MPS for which the multiple workstation licence is unnecessarily expensive. In such case only one production planning workstation and the dedicated or even multipurpose corporate database server can be used. For all other production control activities numberless PC workstations and PDA devices can be used.

These workstations are connected trough the backbone to the groupware web server by means of a (preferably) wire network for PC workstations and a wireless network for the PDA devices. All PDA devices should have a web browser installed to be able to access the groupware web server. The installed web browser should have the capability to display the web page on a small screen correctly (without the need for major left-right scrolling).
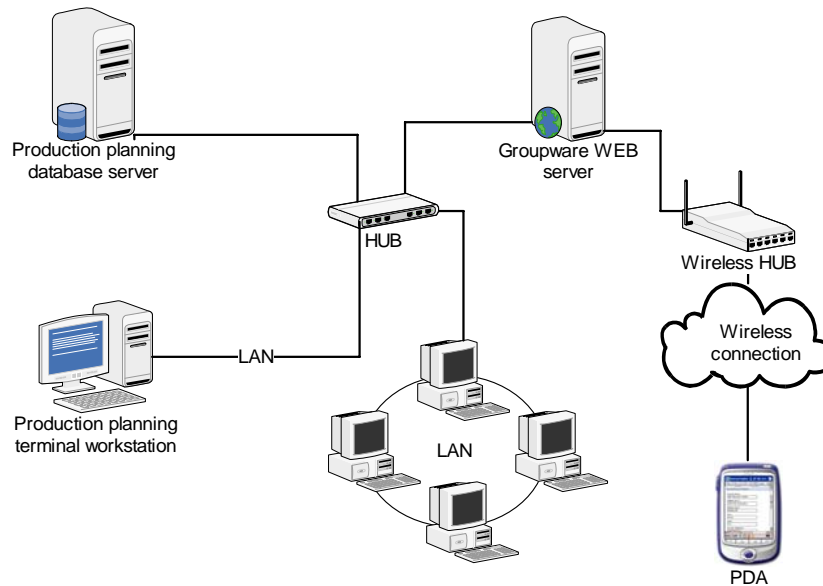
Fig. 4. Networking diagram for the groupware enabled for production control automation.

4.   EXAMPLE OF PRODUCTION AND CONTROL MANAGEMENT PROCESS AUTOMATION BY MEANS OF GROUPWARE SOFTWARE

For the purpose of testing the given theoretical approaches, the open source "More.groupware" software is used (www.moregroupware.de). This is a general-purpose groupware software suited to automate any office and interoffice communication and to reduce paperwork to its minimum.

After installing the software on the web server, the initial setup of the software must be performed. The most important setup task is date/time and currency format. After the initial setup the organization scheme needs to be implemented into the software. This is done by defining the departments, the roles and the users of the system, and by assigning rights to the roles and the users. The users are all employees collaborating and communicating during the complete production cycle. In other words the cycle from the planning to the finished product sales and distribution.

Having assigned rights to the users and the roles, the manager of the planning and control department issues a notice to his collaborators (MPS planner in this case) in form of a delegated To-Do list (fig. 5.). Collaborators are alerted of the arrival of the notice by a pop-up message, an instant message or an e-mail, depending on the system setup preferences.

Fig. 5. Screenshot of the To-Do list

At this point the tracking documents are prepared and uploaded to the server and the tracking project is created (fig. 6.). All communication and milestone tasks for checking the production process are assigned to the project. This serves for financial calculations and for backtracking the finished production.

Fig. 6. Screenshot of the initial tracking project created

5.   CONCLUSION

There are several integrated approaches towards the automation of the most common production planning and control tasks. Many of these approaches presume expensive software implementations. This paper has demonstrated that by using a free available open source groupware software the majority of these tasks, or almost all, can be automated. This can even be done by using a standard functionality of an available open-source groupware software and by adding to it a custom-made software module in form of a plug-in or a simple spreadsheet program. Moreover, this concept has introduced a further initiative towards a complete paperless execution of the production control process by using PDA devices and an adequate networking system.

6.   REFERENCES

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