



SPECIFIC FEATURES AND FUNCTIONALITIES OF A NEW ERP SOFTWARE PACKAGE FOR TECHNOLOGICAL RESOURCES MANAGEMENT IN FMC

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Abstract: *Using the specific features and functionalities from the adequate modules of a built ERP software system adjacent with a flexible manufacturing cell (FMC) system, highly increases the efficiency in production programming. It was developed a new software system composed from an ERP solution as .NET web application and an SQL database dedicated to the activities and components from the studied FMC level. In description of the new ERP software package and data base were considered the interfaces for the modules of the system, the specific features and functionalities in part production, the inputs and outputs of the system together with the part production features and the specific management reports.*

Key words: *technological system, informatics system, ERP, management, manufacturing, software, FMC.*

1. INTRODUCTION

In the paper are shown the interfaces of component modules of the ERP application developed in the doctoral activity by the authors, the functional workflow, the inputs and outputs of ERP application for technological resources management in FMC for machining. The paper present the specific features and functionalities of ERP software package with data base for technological resources management in FMC together whit the practical way for managing the data about a complex machining part production in the composed referential FMC. In the paper are presented too the main reports for utilization at the FMC level and in monitoring/ tracking the production.

2. INFORMATION

Initially it was composed the FMC system for machining. It was made an analysis of the components and activities from the level of FMC referential model for machining with Gantry robot [6]. The components and activities are formed the basis of developing the ERP application for production planning and the database. So were identified the features of application functionalities and database. In the activity of analyzing the needs of a FMC system for production planning were identified also the component modules of the ERP application corresponding to practical functionalities and work flow.

2.1. The specific features and functionalities in part production

The specific features and functionalities of the ERP software system in part production are describing the manufacturing of the parts whit revolutions shapes starting from the bar piece until completion.

In Fig.1 is presented the functional interface of the parts manufacturing technology module, showing the tables and controls corresponding to the steps of machining contained in the part technology. It can be observed the hyperlink corresponding to each step,

pointing to the interface shown in Fig. 2 where are sated the machining parameters and the image of the machining with tools and dimensions. In Fig. 3 is presented the interface containing the overall production planning with the Gantt chart preview and the control for introduction of the total number of part manufactured at the moment of completion [1]. Once the planning is performed the personnel from FMC level generate the appropriate reports accessing the ERP application with an intranet/ internet terminal. Based on the reports is started the production. After the production is started, an operator complete daily the total number of parts manufactured at the completion time. The production is tracked/ monitored by checking/ listing the report containing the production ratio with all parts manufactured at the time. For each part is possible the tracking of production evolution in time. Following the steps presented above is completed the practical way of data management in the ERP software system.

The utilization of the ERP software system is started whit the introduction of data about the machines, industrial robots, parts, bar pieces and machining. Next in the ERP system is possible to compose the manufacturing technology for the part whit revolutions surfaces and to introduce the parameters for each technological step. For planning the production, the ERP software system was designed whit the Production Planning module where the user can introduce the start date, the finishing date and the total number of manufacturing parts and also it is possible to manage the Project file containing the production plan. For planning the production it is essential to know the functional status of the machines, and once the availability of it is identified the production can be planned. After the production is launched it is possible to track the status of it in time by monitoring the ratio calculated as percent of the total number of parts manufactured at the time and the total number of parts planned to be manufactured. It is possible also to generate specific reports at FMC level.

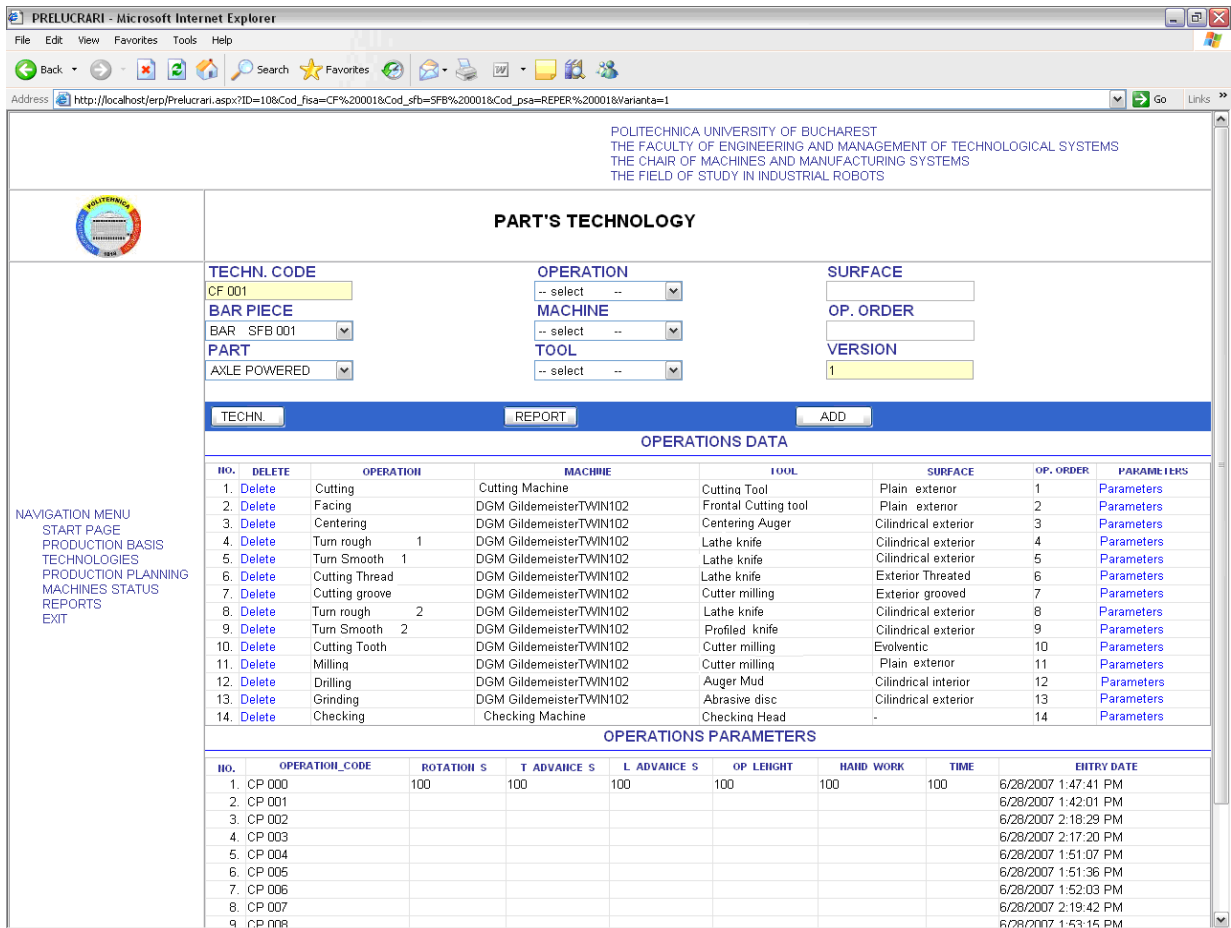


Fig. 1. Part's manufacturing technology.

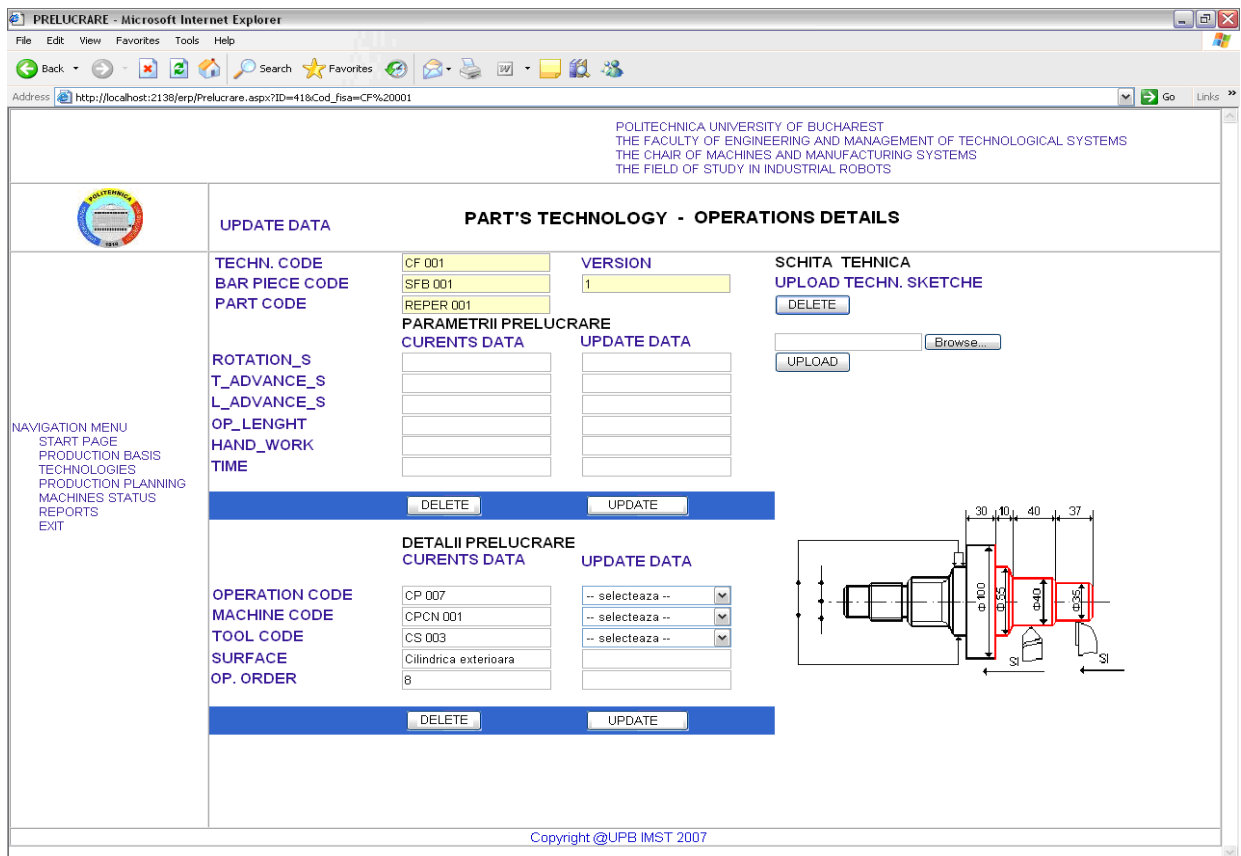


Fig. 2. Technological parameters setting.

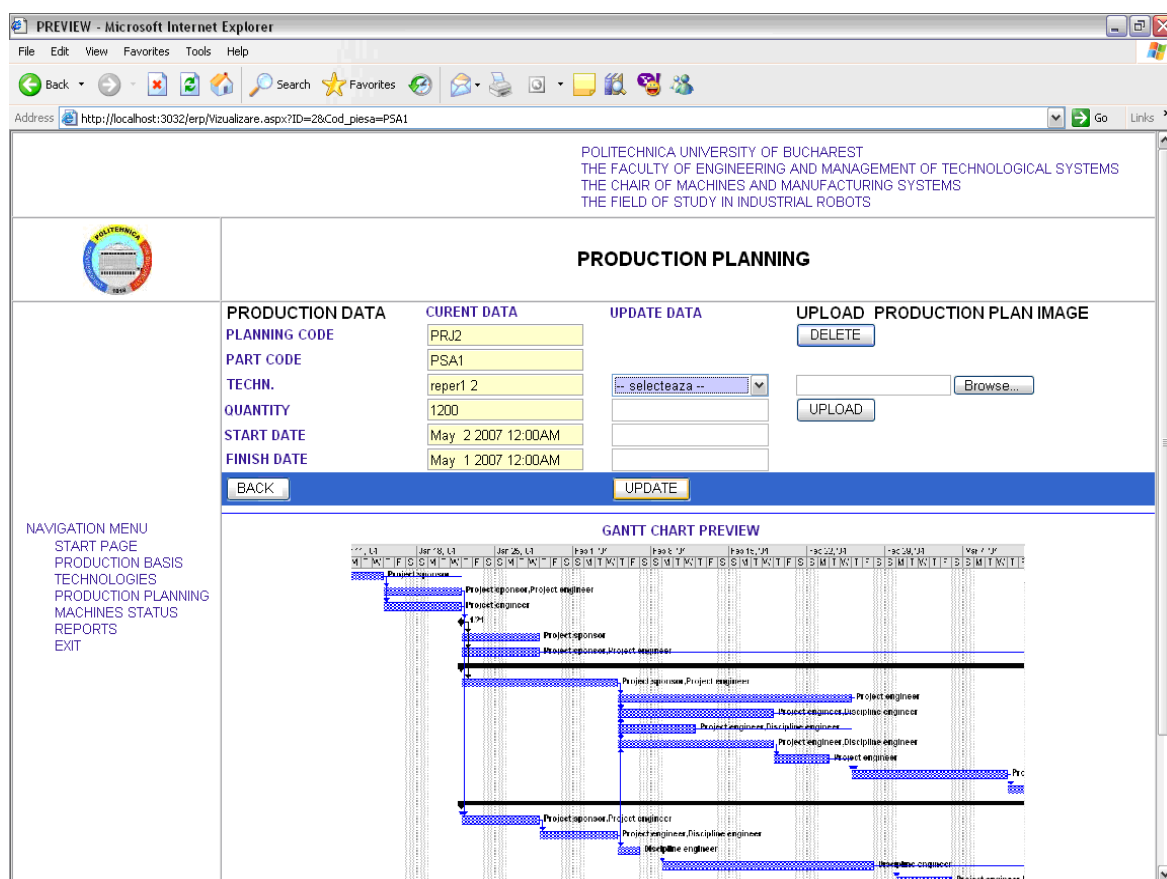


Fig. 3. Application interface – the overall production planning.

Table 1
The Utilization of technological–informatics system

The Input/ Output data in technological – informatics systems		
	INFORMATICS SYSTEM	TECHNOLOGICAL SYSTEM
INPUT DATA	Data about: - FMC Components - Manufactured part - Semi-part	- FMC Components - Data about part - Semi-part - Input data from informatics system
ACTIVITIES	- Data input - Part technology - Project and Web planning - Launching production reports	- Revisions and machines maintenance - Tools sets - Machines programming - Machining
OUTPUT DATA	- Reports - Part technology - Film technology - Manufacturing planning - TCs status.	- Parts - Production status (Project planning, no. of parts, web report)

2.2. The Inputs and Outputs of the New System

In Table 1 the input data, activities and output data are presented for the informatics system, technological

system forming holistically the table of technological-informatics system utilization.

Every system is characterized by the inputs and the outputs and also by the specific activities enterprise at its level. The output data from informatics system is the input data for the technological system and similar the output data from technological system become input data for informatics system. It can be observed the integration of the two systems and the main outputs consisting of manufactured parts and specific reports for launching and monitoring the production.

2.3. Part production in the new ERP software system

Starting from the Production Basis module of the ERP software system is possible to manage the data about shape and dimensions of every part possible to be manufactured in the FMC technological system. In the interface of the Production Basis module is available a hyperlink to the manufacturing drawing for part and a hyperlink to the part manufacturing technology. The file containing the manufacturing drawing for part is managed in the interface and can be updated with a newer version at any time. The part manufacturing technology is selected from the existing part manufacturing technologies composed in the specific module with the same name. In the same interface is possible to generate an Excel report containing the data of the parts manufactured in the FMC. After the parts data are introduced in the informatics system the user proceed to compose the part manufacturing technology. In the Part's manufacturing technology module are

introduced the preliminary data of the technology consisting of an identifying code, the starting bar piece and the part to be manufactured. In the data table from the interface is available a hyperlink pointing to the interface for introduction of each step of machining by selecting from the existing data in the system introduced in the Production Basis module. In each line of data are contained the details of machining as the Tool Center, the tools, the machining type and the functional parameters. The parameters data are managed in a distinct interface accessible by a hyperlink from the interface containing the steps of the part's manufacturing technology. In the parameters setting interface is possible to manage all the data about a machining step and also the image containing the representation of part and the tools in working position. Once the parameters, steps and the entire part manufacturing technology are saved the user can verify the availability of the machines from the FMC, in the next future, in the Machine Status module of the ERP software system. When the availability of the machines is saved, the user can proceed to production planning of the part.

2.4. Reports supplied by the informatics system

The ERP software application is composed from five functional modules: the Production basis module, the Technologies module, the Production Planning module, the Machines Status module and the Reports module. In each module is possible to generate reports containing the data existing in the database at the moment of generating. Those reports are shown in tables of the interfaces. Each interface contains the functionality for generating the report from the screen as Excel file report. On the overall activity the main reports are generated in the Reports module. The Report module contains a control for selecting the category of reports to be generated. The categories contained in the selection control are: standing assets, mobile assets, technologies, production. The standing assets category report contains the data about the machines and the robot from FMC system. The mobile assets category contains a subsequent control for selecting the group of assets. The groups of assets contained in the subsequent selecting control are bar-pieces, parts and tools. Selecting the wanted options is possible to generate the corresponding reports containing the data about selected group or category listed in the selection controls. The main reports for launching the production at the FMC level are generated selecting the Technologies and Production categories from the Report module level. The production launching reports contain all the information needed at the FMC level about technology and planning for starting the manufacturing. In the ERP application for technological resources management in flexible manufacturing cells is possible to generate reports about part manufacturing technology and part's manufacturing drawings chart, tool sets, machines status, production planning and monitoring. The main reports contain the information to answer to questions like: when to start and finish the production, which are the machines, machining needed, machining parameters, tools to use, in a word how to do the manufacturing.

After the production is started is possible to know the status of manufacturing. Having the right information the technicians from FMC level can program the machines, can select the right tools for machining and ask for the appropriate piece-bars for manufacturing the part.

2.5. Specific Management Reports supplied by the informatics system

All the reports are generated containing the data existing in the database at the moment of generating. The data contained in the database is managed by the ERP software application modules. In the ERP software application for technological resources management in FMC is possible to generate the needed reports at the production starting and monitoring, mainly in the Reports module but also to the each specific component module.

In the Reports module with the selected category Production, the interface contain a table where are listed the information about production as direct data or as hyperlinks to relevant adjacent reports. From the Production interface of the Reports module is possible to see the current status of manufacturing, the part manufacturing technology, the part manufacturing drawings chart, the machines and tools used the machines status and the Project file of production planning. In Fig. 4 is presented the Part's production planning using Gantt chart in Microsoft Project. In Fig. 5 is presented overall part's manufacturing technology report containing the machines, tools, machining and parameters. The report is printable from the browser level. In Fig. 6 is presented the part manufacturing drawings chart report. For each step of manufacturing, the report contains a graphical representation of the part in the moment with the tools in work position. The report also contains the name of machining, the tools and machines (Fig. 7).

3. CONCLUSIONS

It was presented the new technological-informatics system made from referential FMC for machining and the ERP application developed in the doctoral preparation activity by the authors.

There were presented the advantages of using the informatics systems for resources management together with technological systems. There were presented the specific features and functionalities of ERP software package with data base for technological resources management in FMC. It was presented the practical way for managing the data about a complex machining part production in the composed referential FMC. There were presented the goals of operating the technological-informatics systems and the specific reports corresponding to the need of activity. It was detailed the practical utility of the generated reports in the informatics system. The technological-informatics systems are the step forward in the development of industrial manufacturing systems. The developed ERP software system is a dedicated tool for efficient technological resources planning in FMC for machining parts whit revolution surfaces. Overall there was made original contributions by forming the referential FMC

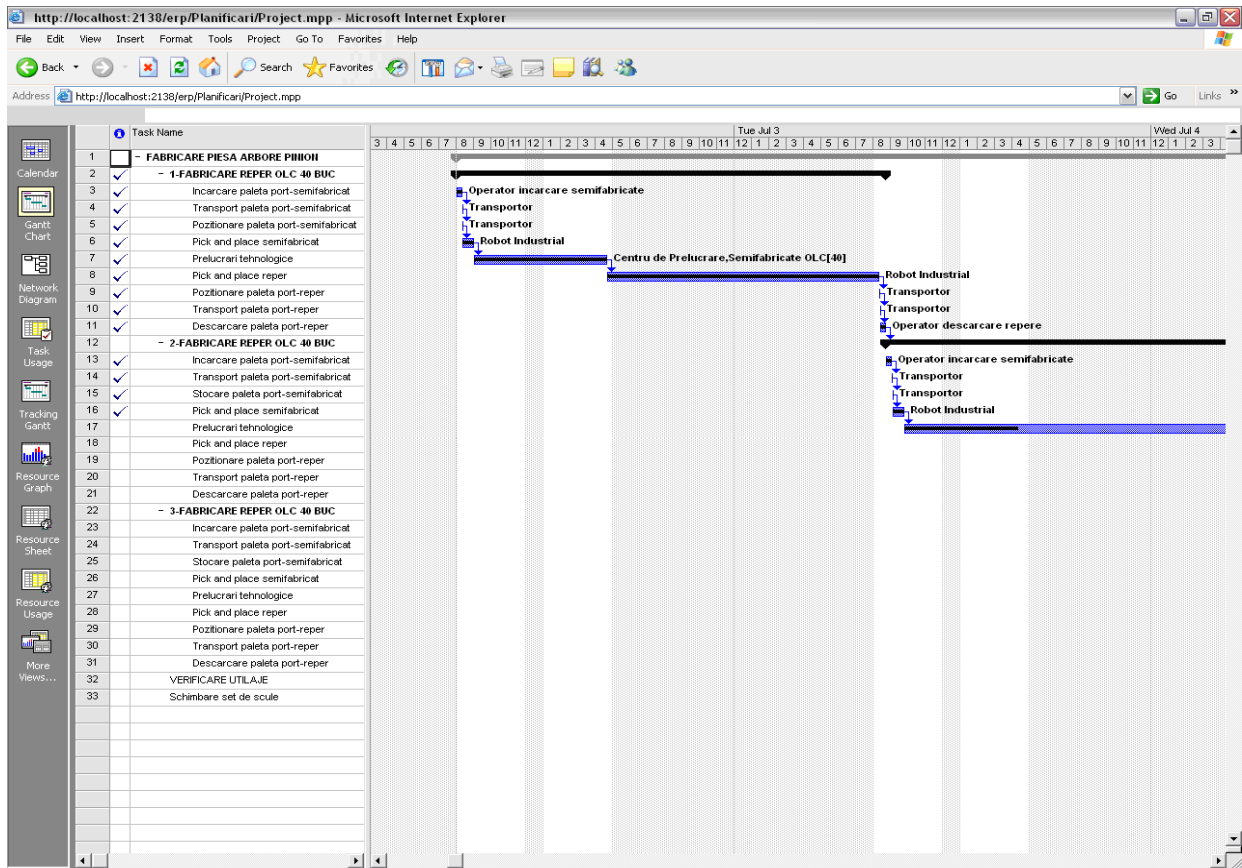


Fig. 4. Part's production planning using Gantt chart in Microsoft Project.

TECHN. CODE		VERSION		PART			BAR PIECE						
CF 001		1		ARBORE PINION			BARA						
NO.	MACHINE	MACH CODE	TOOL	TOOL CODE	OPERATION	OPERATION CODE	Rotation speed	Tadvance speed	Ladvance speed	Operation Length	SURFACE	HAND WORK	TIME
1	Cutting Machine	UTJ 002	Cutting Tool	CS 011	Cutting	CP 000	100	100	100	100	Plain exterior	100	100
2	DGM Gildemeister TWIN102	CPCN 001	Frontal Cutting tool	CS 001	Facing	CP 001					Plain exterior		
3	DGM Gildemeister TWIN102	CPCN 001	Centering Auger	CS 002	Centering	CP 002					Cilindrical interior		
4	DGM Gildemeister TWIN102	CPCN 001	Lathe knife	CS 003	Turn rough 1	CP 003					Cilindrical exterior		
5	DGM Gildemeister TWIN102	CPCN 001	Lathe knife	CS 003	Turn Smooth 1	CP 004					Cilindrical exterior		
6	DGM Gildemeister TWIN102	CPCN 001	Profiled knife	CS 005	Cutting Thread	CP 005					Exterior Throated		
7	DGM Gildemeister TWIN102	CPCN 001	Cutter milling	CS 006	Cutting groove	CP 006					Exterior grooved		
8	DGM Gildemeister TWIN102	CPCN 001	Lathe knife	CS 003	Turn rough 2	CP 007					Cilindrical exterior		
9	DGM Gildemeister TWIN102	CPCN 001	Lathe knife	CS 003	Turn Smooth 2	CP 008					Cilindrical exterior		
10	DGM Gildemeister TWIN102	CPCN 001	Cutter milling	CS 007	Cuttina Tooth	CP 009					Evolvertic		
11	DGM Gildemeister TWIN102	CPCN 001	Cutter milling	CS 008	Milling	CP 010					Plain exterior		
12	DGM Gildemeister TWIN102	CPCN 001	Auger Mud	CS 009	Drilling	CP 011					Cilindrical interior		
13	DGM Gildemeister TWIN102	CPCN 001	Abrasive disc	CS 010	Grinding	CP 012					Cilindrical exterior		
14	Checking Machine	UTJ 003	Checking Head	CS 012	Checking	CP 013					-		

Fig. 5. Overall part's manufacturing technology report.

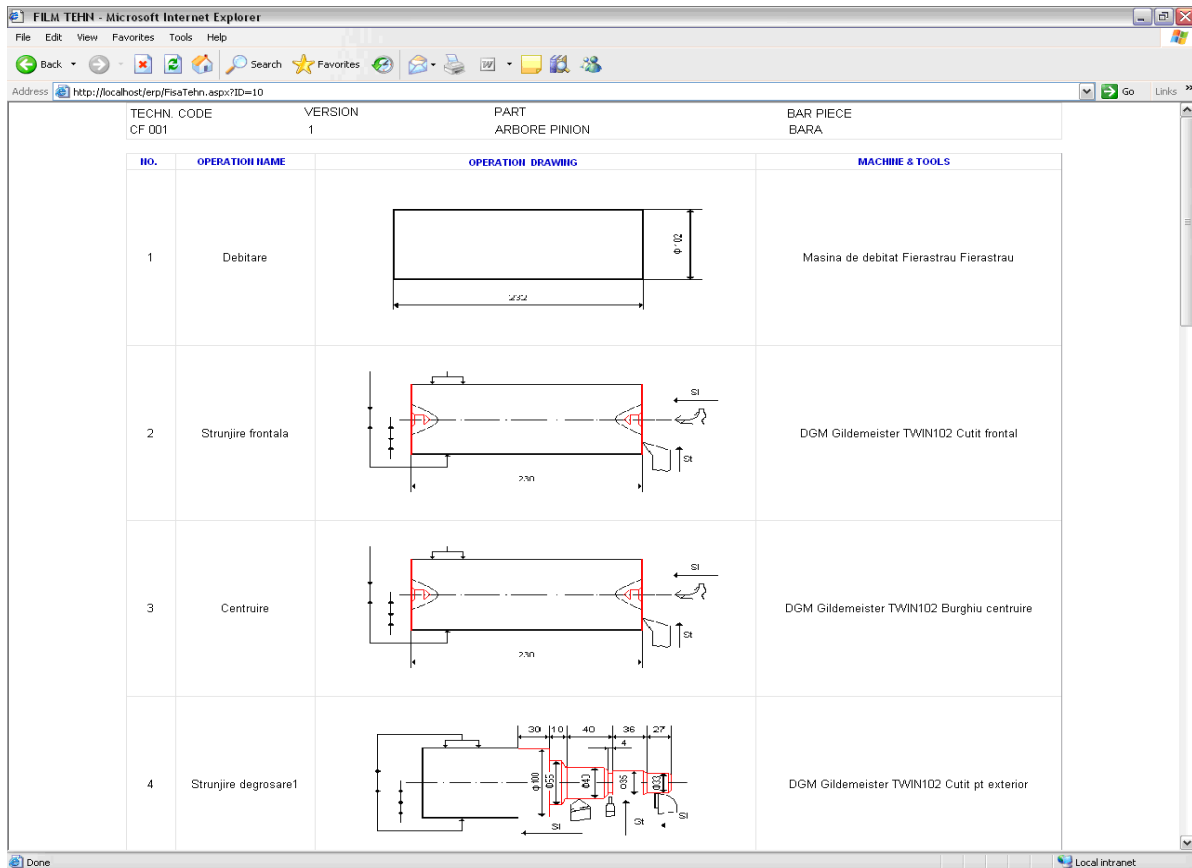


Fig. 6. Part’s manufacturing drawings chart.

ERP APPLICATION FOR TECHNOLOGICAL RESOURCES MANAGEMENT IN FLEXIBLE MANUFACTURING CELLS
PRODUCTION LAUNCHING REPORTS
PART MANUFACTURING TECHNOLOGY
PART TECHNOLOGICAL FILM
TOOL SETS
MACHINES STATUS - AVAILABILITY
PRODUCTION PLANNING – START/END DATE
PRODUCTION TRACKING/ MONITORING

Fig. 7. Reports supplied by the informatics system.

and building the software system made from ERP application and database. The contributions are conducting to an increasing the efficiency of work in planning, organizing, managing and tracking/ monitoring the production in FMC for machining. Next is intended the development of the entire software system in an assembly of modular software product useful to different industrial partners.

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