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Comparison of Selected ERP Systems Supporting the Production Planning and Control on the Example of Automotive Industry

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Abstract
In many companies, along with the economic development, the use of integrated management systems is becoming more and more common, which are subject to evolution in terms of, inter alia, offered functions and new user requirements. The main purpose of this paper is to compare selected ERP (Enterprise Resource Planning) systems in the field of production planning and control on the example of the automotive industry. The paper presents the contemporary functioning of the automotive industry against the background of issues related to the integrated management systems used in them. The research part presents the proprietary methodology for the assessment of IT systems used in the automotive industry, which included a user survey. The obtained score allowed to indicate the optimal ERP class system supporting production planning and control.

Keywords
Information technology, Enterprise management systems, Automotive industry.

Introduction

Many enterprises nowadays from various areas of the economy are struggling with the problem of effective production planning and control. The automotive industry has been one of the most important pillars of the global economy for many years. It consists mainly of two sectors (Eckhardt, 2020; Pavlinek, 2020; Farys et al., 2021):

- automotive industry,
- automotive trade and services.

In recent years, there has been a noticeable dynamic development of industrial production and enterprises from the automotive industry, which are still facing serious challenges. This is due to the use of modern materials and manufacturing technologies related to waste and non-waste technologies (Xu et al., 2018; Szymanski, P. et al., 2020; Szymanski, M., et al., 2020; Rosenthal et al., 2020; Matysiak et al., 2016; Obergfell et al., 2019). This in turn, it makes it necessary to obtain more efficient operating processes (Eckhardt, 2020; BPC GUIDE, 2021). Considering the above and the fact that nowadays this industry basically operates entirely on the basis of IT technologies, it is becoming more and more common to support the management of all company processes with the use of ERP (Enterprise Resource Planning) systems (BPC GUIDE, 2021; Beskese et al., 2019).

These systems have a variety of functionalities that allow the implementation of the most important assumptions related to the keepping and increasing the company's competitiveness by improving work efficiency at every stage of the company's operation.

As a result, modern ERP systems are an indispensable tool for reliable data analysis and supporting processes taking place in the enterprise (Beskese et al., 2019; Mahmood et al., 2020). ERP class systems are characterized by the use of modules covering particular areas of the enterprise. These modules are related to, among others:

- supply chain management,
- financial management and accounting,
- production management,
- service management,
- sales management,

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- human capital management,
- customer relationship management.

In addition, ERP systems include dedicated tools such as: Business Intelligence (BI) and Manufacturing Execution System (MES) (Htun Borisovich, 2019).

In recent years, the level of computerization of enterprises in the world has been gradually increasing. In 2019, Belgium was the leader in the European Union member states, where as many as 53% of enterprises have an ERP-class IT system. Denmark was also on the podium with a score of 50%, and France, Lithuania and the Netherlands with 48% of companies using ERP. In terms of IT advancement, Polish enterprises rank 11th from the end in Europe (29%). A surprise is also the low result obtained by Great Britain, because only 24% of enterprises in this country use ERP systems. On the other hand, the last places belong to Turkey and Hungary (21% and 14% respectively) (Eurostat, 2021).

Literature review

The automotive industry is one of the largest industries in the world. Its main pillar is the production of passenger cars, delivery vehicles and trucks. In addition to vehicles, the automotive industry also includes the production of engines, trailers and semi-trailers, tires, parts and accessories. It should also be taken into account that the advanced services are related to core competencies of the car manufacturers, complex collaborative arrangements are the primary market strategy choice (Pavlinek, 2020; Nazir & Shavarebi, 2019; Genzlinger et al., 2020).

Manufactured engines and car parts are mainly used in the production process of vehicles in other factories. In the case of accessories and tires, production takes place at a high level of unification, both for vehicle manufacturers and for sale. In each of the above cases, tools for monitoring the product life cycle are very often implemented (Mekonnen & Mahmut, 2020; Glushchenko & Fedotova, 2018).

The car production process is carried out in 4 main stages, following each other (Alszer & Krystek, 2017; Kadnar, 2021):

- stage 1: STAMPING – the main purpose of this stage is to deliver the steel to the stamping press, and then to form it into various types of body parts, including doors and flaps using appropriate transfer presses.
- stage 2: WELDING – the main purpose of this stage is welding or fusing all the delivered body parts together.
- stage 3: PAINTING – the main purpose of this stage is to apply the chosen color.
- stage 4: ASSEMBLY – the main purpose of this stage is to assemble the appropriate parts of the car together and prepare the car for use.

The automotive industry is characterized by diverse technological processes, high quality standards, safety requirements, a huge amount of data, variability and ever shorter production times increasing the risk of causing damage or errors and the pressure of competition. All these factors contribute to the need to develop more and more efficient processes at each level of operation in the enterprise. Therefore, it is necessary taking into account the most accurate of production resources planning as well planned energy consumption in manufacturing (Hamrol & Grabowska, 2020; Varela et al., 2021; Rewers et al., 2018; Giampieri et al., 2020). Nowadays, manufacturing companies use IT systems that are designed to optimize multi-criteria processes in the enterprise and provide the ability to manage, track and analyze all activities carried out in it. The above applies to various levels, such as planning, management or technical levels related to the design and simulation of manufactured products (Ignaszak & Popielarski, 2011; Kujawinska & Rogalewicz, 2018; Sika & Hajkowski, 2017; Zdobytskyi et al., 2021a).

In the past, enterprises supported each area of the company with a different IT system (Kadry, 2014; Lee, 2011). Modern integrated IT management systems, more and more often combine the used, among others, integrated technical Computer Aided systems (CAx) and Production Planning and Control systems (PPC) in the automotive industry, providing guidance and management support at all levels of the company.

The tasks of technical systems include the use of all technical information and significant acceleration of processes related to the development of technology and production supervision. Integrated technical systems are understood to mean CAx computer techniques. The most important CAx systems include CAD (Computer Aided Design), CAE (Computer Aided Engineering), CAM (Computer Aided Manufacturing), CAP (Computer Aided Planning), CAPP (Computer Aided Process Planning), CAQ (Computer Aided Quality Control), CAS (Computer Aided Service) (Zdobytskyi et al., 2021b; Jauhal et al., 2021; Liu, 2020; Trzepiecinski et al., 2021; Ignaszak et al., 2013; Al-wswasi et al., 2018; Stupnytskyy & Hrytsay, 2020).

The systems used by companies from the automotive industry also include PPC – Production Planning and Control systems. They support planning, preparation, control and supervision of the course of pro-

duction processes with the use of administrative information concerning the company's resources (Schuh & Wetzchewald, 2019; de Andrade et al., 2020). The history of integrated PPC systems dates back to the 1950s, because already in those years there were the first inventory systems supported by simple software based on statistical methods of inventory control, IC – Inventory Control. IC systems supported warehouse management with the use of information on the consumption of stocks in previous periods. These applications are still used today, for example in the field of increasing the regulability of production planning and control systems (Bunker & Elsherbeni, 2017).

In the 1970s, the expansion of MRP systems – Material Requirements Planning began. The main tasks of the MRP class systems included the reduction of inventories, reliable determination of production costs and the determination of material delivery dates (Strasser et al., 2018; Miclo et al., 2017). The further development of IT and the need to develop the aforementioned group of systems resulted in the extension of the MRP methodology in the 1980s with modules relating to production planning, sales processes, inventory management, business planning and taking into account the demand. The MRP standard with the introduced extensions was adopted as MRP II (Manufacturing Resource Planning) – planning of production resources (CFI, 2021; Janakkumar & Vyas, 2017).

The ERP (Enterprise Resource Planning) class, also referred to as MRP III, is related to the planning of all enterprise resources and is an extension of MRP II with procedures for planning and managing the company's finances (Caserio & Trucco, 2018; Katuu, 2020). Some areas of the ERP class system are also found in MRP and MRP II class systems, but they are not fully integrated with each other. Therefore, the implementation of the ERP system does not automatically achieve the full MRP II standards (Sherwood et al., 2017). The most modern extension of the modular ERP is the ERP II concept, where it is possible to control factors and events taking place outside the enterprise. The ERP II class system is a system of open integrated planning with full use of Internet technology and the XLM language standard, as well as mobile solutions (Haddara & Constantini, 2020; Vasilev, 2014). The concept of the ERP III system is an extension of ERP I and ERP II systems towards the construction of new functionalities in the field of integration between production companies and their further partners (Vasilev, 2014).

In addition, the automotive industry is increasingly using systems that improve and automate the control of production processes, such as: MES (Manufacturing Execution System) and SCADA (Supervisory Control and Data Acquisition) (Moshko & Stotckaia, 2018; Welsch, 2016). The MES (Manufacturing Execution Systems) system brings together planning systems and industrial automation systems, while controlling the overall course of the production processes. On the other hand, the SCADA (Supervisory Control and Data Acquisition) data supervision and acquisition system is implemented in the form of a network of connected servers whose task is to supervise and archive data from production processes. After delivering data about the process to the system, SCADA visualizes the course of this process and enables its control, including starting machines or sending commands to perform specific activities. In addition, process visualization interfaces, HMI (Human Machine Interface) are also used. HMI systems are used for direct contact and information exchange between the operator and the operated device. HMI is most often understood as an operator panel (Fleischmann et al., 2017).

The automotive industry more and more often uses comprehensive IT solutions to support the operation of many various production processes. Comprehensiveness here means maximum ability to integrate IT solutions from the aforementioned CAx and PPC areas. The most popular and indicated as necessary systems for enterprises from the automotive industry are integrated ERP class systems, and more and more often ERP systems in integration with MES systems (Htun & Borisovich, 2019). Choosing such a system is not a simple matter and the key here is to get to know the possibilities and, above all, to understand the important functions and integration possibilities at each level of process management.

Methodology

The methodology of selecting the ERP system to the automotive industry was based on setting evaluation criteria, assigning them appropriate weights and developing an evaluation method. The evaluation criteria were developed based on the requirements for the use of IT solutions as part of production planning and control, the capabilities of ERP systems and the expectations of potential customers. The evaluation criteria taken into account are described below (BPC GUIDE, 2021).

Production type – this criterion applies to the type of supported production in which the IT system is used. There are several types of production in the automotive industry. Improper selection of the system to the production nature may be associated with fail-

ure in the operation of the system or failure to achieve the expected results. Therefore, the following types of production have been distinguished: unit, serial, mass and design.

Prediction the necessary amount of resources – this criterion applies to the possibility of prediction the necessary amount of resources, including human or material (machines).

Resource load – this criterion applies to resource loads and is associated with the ability to control the resource loads of the production system and the ability to balance resource loads – load balancing.

Material order – this criterion has been divided into two possibilities. Standard requirement: the ability to manually generate material orders in the IT system and a more advanced requirement: the ability to automatically generate and send orders or reservations for material by the IT system with minimum inventory levels.

Scheduling – this criterion applies to production scheduling, which is closely related to production planning and can be done using a variety of methods. Therefore, this criterion has been divided into the following requirements:

- possibility of production planning with distinction: planning according to demand and planning according to the delivery time of raw materials,
- possibility of scheduling production with distinction: manual scheduling and automatic scheduling,
- possibility of scheduling with distinction: forward scheduling (from the indicated date) and backward scheduling (for the specified date).

Assigning employees / positions to orders – this criterion applies to the possibility of assigning employees or positions to specific orders with the distinction of manual assignment and automatic assignment.

Production plan – this criterion concerns the possibility of optimizing the production plan taking into account selected parameters, e.g. production plan in a paint shop – ordering orders from the lightest color to the darkest in order to shorten the changeover time (SMED – Single Minute Exchange of Die). In addition, the IT system should have the functions of introducing ongoing corrections and updates to the production plan, as well as informing about disturbances in the production plan.

Production orders – this criterion applies to the possibility of issuing and generating production orders for execution by the system.

PULL system – this criterion applies to a marketing strategy that enables planning in the "customer attraction" system.

Areas of activity – this criterion concerns the possibility of supporting the company's activity areas by the ERP system, distinguishing the following areas: production preparation, production, inventory, warehouse, deliveries, finances, sales, customer service, reports, service and human resources.

Warehouse – this criterion concerns the possibility of running many warehouses at the same time. This function enables to individually manage warehouses in various sectors of the company.

Current tracking – this criterion applies to the possibility of ongoing tracking of the execution of production orders, inventory and orders. With this function, it is possible to access the necessary information or data at any time.

Cost calculations – this criterion concerns the possibility of carrying out various cost calculations. Cost calculations created and generated in the system should concern production, e.g. cost calculations of a production batch. In addition, for the purposes of cost control in the enterprise, the system should be able to indicate a period that will be presented in the calculations. This function is important due to the fact that various types of costs are generated in the enterprise.

System maintenance – MAINTENANCE – this criterion concerns the cost of system maintenance, i.e. correcting errors on an ongoing basis, adapting the system to the changing ICT environment as well as technical and substantive assistance.

System price – this criterion applies to the amount of financial expenditure related to the implementation of a given ERP system in the enterprise.

Demo version – this criterion applies to the possibility of testing the system before purchasing with a demo version (DEMO). The criterion determines the availability on the manufacturer's website of a given ERP system or the lack thereof.

Enterprise size – this criterion applies to the size of the enterprise for which the system is dedicated: small, medium and large enterprise.

System personalization – this criterion concerns the possibility of personalizing the system for specific users. The function of personalizing the system is important due to the variety of functions covered by the company's employees.

Additional options – this criterion concerns the possibility of having the following functions by the system:

- possibility of extending the system – this function enables the extension of the system by adding various types of modules, depending on the current needs of the user.

- possibility to integrate the system with the production device – this function enables the connection of the IT system with the production apparatus through appropriate protocols enabling data import,
- possibility of integration with systems such as: CAD, CAM, MES, other,
- ability to quickly switch files during work – this function allows you to run multiple files at the same time and quickly switch between them,
- possibility of generating notifications – this function enables automatic sending of information to the user in the form of a notification when any irregularities arise, e.g. when there are missing data when entering a given material order,
- the ability to work in a web browser – this function enables the use of the system via the Internet without the need to install it on a computer,
- ability to export documentation to: PDF, Microsoft WORD, Microsoft EXCEL, OPEN Office (ODT), other.

In order to indicate the significance of individual criteria, appropriate weights were assigned to them. The division criterion was made as a result of the survey process of 60 enterprises from the SME sector, which are related to the automotive industry (Table 1).

Weighting 3 was given to the most important criteria, which are closely related to production planning and control. Fulfilling the criteria with the weighting 3 is necessary for the IT system to support a given company in the planning and control of production in accordance with their essence. Weighting 2 was assigned to criteria that relate to the possibilities offered by the systems and those that are not necessary in the planning and control of production, but will support the company in this regard. On the other hand, the weighting 1 was assigned to criteria resulting from potential customer expectations. These criteria are intended to facilitate the use of the system.

The method of evaluating ERP systems consisted in awarding:

- 5 points – for each criterion met by the system,
- 3 points – if it is possible to purchase an additional module that meets the criterion (current prices were not given, possibly only a percentage share),
- 1 point – if the system does not meet the criterion.

Table 1
Weights assigned to the criteria

Weight	Criteria
3	• Production type. • The company's areas of activity supported by the ERP system: production preparation, production, inventory, warehouse. • Ability to predict the necessary number of resources. • Ability to control the load on the production system resources. • The ability to balance resource loads. • Possibility to generate material orders. • Automatic generation and sending of orders or reservations for material with minimal inventory. • Possibility of production planning taking into account the demand and the delivery time of raw materials. • Possibility to schedule production: manually, automatically. • Scheduling forwards and backwards • Possibility to manually assign employees or positions to specific orders. • Possibility to optimize the production plan taking into account selected parameters. • Possibility of making corrections and updating to the production plan on an ongoing basis. • Informing about disturbances in the production plan. • Possibility to issue production orders. • Possibility of planning in the PULL system. • Possibility of ongoing tracking: execution of production orders, inventory, orders.
2	• Maintaining the system. • System price. • The company's areas of activity supported by the ERP system: deliveries, finances, sales, customer service, reports, service, human resources. • The ability to automatically assign employees or positions to specific orders. • Possibility to run multiple warehouses at the same time. • The possibility of carrying out various cost calculations.
1	• Demo version. • The size of the company to which the system is dedicated. • Possibility to personalize the system for specific users. • Additional options.

Only in terms of price and maintenance of the system, the evaluation method will differ. Points will be awarded based on a scale. The system will be able to get a maximum of 5 points and a minimum of 1 point. In the event that a given system obtains 5 points, the remaining ones will be able to receive only 4, 3, 2 or 1 point. According to the formula (1), the maximum number of points that can be obtained by the system is 635.

$$\text{ERPeff} = \sum_{i=1}^{n} (w_i * p_i) \tag{1}$$

where: ERPeff – ERP system evaluation index, w – weight, p – number of points awarded, n – number of all criteria.

Results

In order to support the selection of a group of assessment systems, the BPC Guide system catalog was used (BPC GUIDE, 2021). The IT systems search engine contained in the catalog allowed for the adjustment of systems taking into account the area to be computerized, the sector and the industry. As ERP systems for the manufacturing sector in the automotive industry, the search engine in the BPC Guide catalog indicated: SAP S/4HANA, Comarch ERP XL, IFS Applications, proALPHA ERP, Sage Symfonia ERP, and Microsoft Dynamics 365. Then the following factors were analyzed:

- purpose of the system – dedication of the system by the manufacturer to the production sector and the automotive industry,
- popularity of the system – number of implementations in the automotive industry.

Despite the high popularity of the Microsoft Dynamics 365 system in terms of its intended use for production in the automotive industry, it differs significantly from the others due not only to the strictly defined purpose of the latest update for the automotive industry. Dynamics 365 Automotive Accelerator only for distributors and dealers, but also support only in the field of marketing, sales and services in the automotive industry.

Therefore, the following ERP systems used in the automotive industry were selected for the comparative analysis:

- IFS Applications,
- Comarch ERP XL,
- Sage Symfonia ERP,
- SAP S/4HANA,
- proALPHA ERP.

In order to clearly characterize the similarities and differences of the systems, Table 2 (excerpt) presents a comparison of the functionalities of the five ERP systems that support production planning and control.

After analyzing the available materials and information regarding the SAP S/4HANA system, it was not possible to obtain sufficient information for a reliable comparison. Attempts to obtain information with SAP system experts failed because the representatives refused to provide any information. In connection with the above, only: IFS Applications, Comarch ERP XL, Sage Symfonia ERP, proALPHA ERP were analyzed.

The price is the most important criterion to which the systems compared were subjected (due to the fact that these data are in most cases sensitive, the awarded points have been included in equation (1), but will not be presented here in detail). The second criterion that the systems have been subjected to is system maintenance. Sage Symfonia ERP received 4 points. The remaining points were distributed as follows: Comarch ERP XL – 3 points, proALPHA ERP – 2 points, IFS Applications – 1 point.

Scoring for the functionality criteria was awarded in accordance with the developed evaluation method: 5 points – each criterion met, 3 points – when it is possible to purchase an additional module that meets the criterion, and 1 point – when the system does not meet the criterion. The ratings took into account the weights mentioned in Table 1.

The results obtained by the systems are:

- IFS Applications – 577 points,
- proALPHA ERP – 569 points,
- Comarch ERP XL – 561 points,
- Sage Symphony ERP – 491 points.

The total number of points awarded to individual systems for criteria related to system maintenance and functions is presented in Figure 1.

In the global ranking (functions, system maintenance), IFS Applications received the highest number of points for the criteria related to functions and the lowest for system maintenance, but after summing up all the points awarded for individual criteria, it received 577 points, which resulted in taking the first place in the IT systems ranking ERP classes supporting production planning and control. The proALPHA ERP system was in second place in the global ranking with 569 points. In terms of the functions performed, it came second. In the case of maintaining the system, it won the third place. The Comarch ERP XL system with 561 points was ranked third in the global ranking. In terms of the functions performed, it came third . In the case of maintaining the system, he was

Table 2
Comparison of the chosen functionalities ERP systems that support production planning and control

ERP SYSTEM / CRITERIA		IFS Applications	Comarch ERP XL	Sage Symfonia ERP	SAP S/4HANA	proALPHA ERP
SYSTEM MAINTENANCE		ANNUAL FEE: 21% OF THE VALUE OF PURCHASED LICENSES	ANNUAL FEE: 12% OF THE SOFTWARE VALUE	TECHNICAL SUPPORT ADDITIONAL COST	STANDARD SUPPORT: AROUND 21% OF THE CONTRACT VALUE ENTERPRISE SUPPORT: 22% OF THE CONTRACT VALUE	ANNUAL FEE: 18% OF THE CONTRACT VALUE
DEMONSTRATION VERSION		+	+	+	+	NO DATA
THE SIZE OF THE COMPANY TO WHICH THE SYSTEM IS DEDICATED	SMALL < 50 EMPLOYEES	+	+	+	+	+
	MEDIUM 50–250 EMPLOYEES	+	+	+	+	+
	BIG ≥ 250 EMPLOYEES	+	+	–	+	+
PRODUCTION TYPE	INDIVIDUAL	+	+	+	NO DATA	+
	SERIAL	+	+	+	NO DATA	+
	MASS	+	+	+	NO DATA	+
	DESIGN	+	+	–	NO DATA	+
AREAS OF BUSINESS ACTIVITY SUPPORTED BY THE ERP SYSTEM	PREPARATION OF PRODUCTION	+	+	+	+	+
	PRODUCTION	+	+	+	+	+
	INVENTORY RESOURCES	+	+	+	+	+
	WAREHOUSE	+	+	+	+	+
	DELIVERY	+	+	+	+	+
	FINANCES	+	+	ADD PAID: FINANCES AND ACCOUNTANCY	+	+
	SALE	+	+	+	+	+
	CUSTOMER SERVICE	+	+	+	–	+
	REPORTS	+	+	+	+	+
	SERVICE	+	+	–	+	+
AREAS OF BUSINESS ACTIVITY SUPPORTED BY THE ERP SYSTEM	HR	+	ADDITIONALLY PAID MODULE: HR AND PAYROLL	+	+	–
POSSIBILITY OF PERSONALIZING THE SYSTEM FOR SPECIFIC USERS		+	+	+	NO DATA	+
THE POSSIBILITY OF FORECASTING THE NECESSARY AMOUNT OF RESOURCES		+	+	+	+	+

Table 2 [cont.]

ERP SYSTEM / CRITERIA		IFS Applications	Comarch ERP XL	Sage Symfonia ERP	SAP S/4HANA	proALPHA ERP
THE CAPABILITY OF CONTROLLING THE LOAD OF RESOURCES PRODUCTION SYSTEM		+	+	+	+	+
POSSIBILITY OF BALANCING RESOURCES		–	–	–	+	+
POSSIBILITY OF GENERATING MATERIAL ORDERS		+	+	+	+	+
AUTOMATIC GENERATION AND SENDING OF ORDERS / BOOKINGS ON THE MATERIAL WITH MINIMUM STOCK AMOUNTS		+	+	–	NO DATA	+
POSSIBILITY OF PRODUCTION PLANNING, TAKING INTO ACCOUNT:	DEMAND	+	+	–	+	+
	DATE OF RAW MATERIAL DELIVERY	+	+	–	+	+
POSSIBILITY OF PRODUCTION SCHEDULE:	MANUALLY	+	+	+	+	+
	AUTOMATICALLY	+	+	+	+	+
POSSIBILITY OF SCHEDULING:	FORWARD (FROM INDICATED DATE)	+	+	+	+	+
	BACK (ON THE INDICATED DATE)	+	+	–	+	+
POSSIBILITY OF ASSIGNING WORKERS/POSITION FOR SPECIFIC ORDERS:	MANUALLY	+	+	+	NO DATA	+
	AUTOMATICALLY	+	+	+	NO DATA	+
POSSIBILITY OF OPTIMIZATION OF THE PRODUCTION PLAN, TAKING INTO ACCOUNT SELECTED PARAMETERS		+	+	+	+	+
POSSIBILITY OF CURRENT CORRECTIONS AND UPDATES TO THE PRODUCTION PLAN		+	+	+	NO DATA	+
INFORMATION ON PRODUCTION PLAN DISTURBANCES		+	+	+	+	+
POSSIBILITY TO ISSUE PRODUCTION ORDERS		+	+	+	+	+
POSSIBILITY OF PLANNING IN THE PULL SYSTEM		+	+	+	NO DATA	+
DETERMINING KPI INDICATORS (CURRENT UPDATE AND CONTROL)	PRODUCTION CAPACITY USE	NO DATA	–	–	NO DATA	+
	QUALITY	NO DATA	–	–	NO DATA	+
	PUNCTUALITY	NO DATA	–	–	NO DATA	+
	EFFICIENCY	NO DATA	–	–	NO DATA	+
	ACCURACY OF STOCK	NO DATA	–	ADDITIONALLY PAID MODULE	NO DATA	+
	ANOTHER	NO DATA	–	ADDITIONALLY PAID MODULE	NO DATA	+
POSSIBILITY TO RUN MULTIPLE WAREHOUSES AT THE SAME TIME		+	+	+	+	+
POSSIBILITY OF CURRENT TRACKING:	COMPLETION OF PRODUCTION ORDERS	+	+	+	+	+
	STOCK	+	+	+	+	+
	ORDERS	+	+	+	NO DATA	+

Table 2 [cont.]

ERP SYSTEM / CRITERIA			IFS Applications	Comarch ERP XL	Sage Symfonia ERP	SAP S/4HANA	proALPHA ERP
POSSIBILITY OF DIVERSE COST CALCULATION			+	+	+	+	+
ADDITIONAL OPTIONS	POSSIBILITY PURCHASING ADDITIONAL MODULES		+	+	+	NO DATA	+
	INTEGRATING THE SYSTEM WITH PRODUCTION EQUIPMENT		–	–	–	NO DATA	+
	POSSIBILITY OF INTEGRATION WITH TYPE SYSTEMS:	CAD	+	–	–	NO DATA	+
		CAM	–	–	–	NO DATA	–
		MES	+	+	–	NO DATA	+
		ANOTHER	+	–	–	NO DATA	+
	POSSIBILITY OF QUICK SWITCHING PAPERS DURING WORK		+	+	+	+	+
	POSSIBILITY OF GENERATING NOTIFICATIONS		+	–	–	NO DATA	+
	POSSIBILITY TO WORK IN A BROWSER INTERNET		–	–	–	–	+
	EXPORTING TO	PDF / WORD / EXCEL / ODT	+/+/+/+	+/+/+/+	+/+/+/–	NO DATA	+

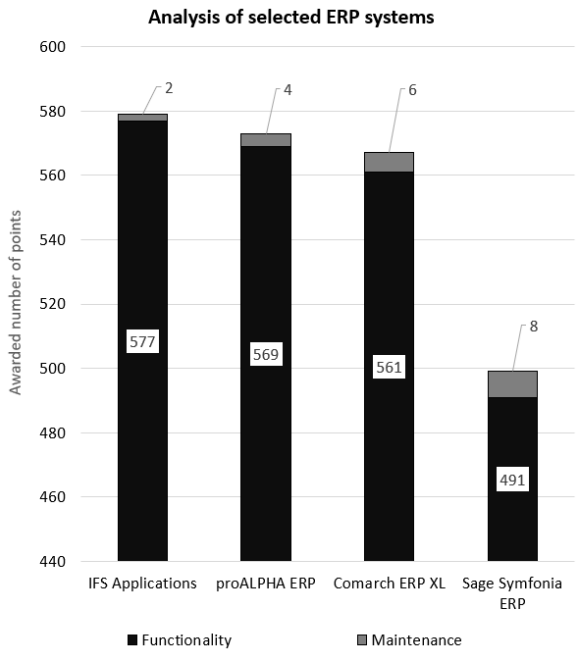

Fig. 1. Results of the comparative analysis of IT systems

ranked second. The Sage Symfonia ERP system with the lowest cost of maintaining the system, due to the fact that it fulfilled the smallest number of functions included in the developed criteria, obtained the lowest number of points after counting the total score – 499. As a result, it was placed fourth in the global ranking.

After the comparative analysis of ERP systems supporting production planning and control, it can be noticed that, taking into account the nature and area of activity, they will prove themselves in various types of enterprises from the automotive industry.

IFS Applications – the system with the most functions. It has both basic and extended functions for planning and production control. In addition, it contains many different possibilities and options related to the work in the system. The analysis shows that it is a very useful system for companies in the automotive industry that expect support in the field of servicing the entire production process as part of their activities, as well as in companies specializing in the assembly itself due to the functions specially developed for this area of activity, including planning of the supply of variable parts resulting from the needs of the service. IFS Applications is perfect for medium and large enterprises focused on a variety of functions.

proALPHA ERP – a system designed for most companies in the automotive industry. The functionality of proALPHA ERP covers all aspects of planning and controlling automotive-specific production. Moreover, the system distinguishes itself from the others with a more favorable adaptation to the automotive industry due to its membership in the APA (Automotive Partnership Association), which results in having knowledge about the latest trends in the automotive industry and using it to adjust the system to the needs of customers from this sector. The system

will find a perfect application in companies producing both vehicles and machine parts.

Comarch ERP XL – the system performs all basic functions related to production planning and control and gives support in the automotive industry in the field of planning, orders, implementation and control of production processes. The system will find the best application in enterprises which, as part of their current activity, manufacture and pass on products, but in the future also plan to sell them on their own. The Comarch ERP XL manufacturer enables easy transition to more advanced and expanded versions. The system will prove itself properly in medium and large enterprises.

Sage Symfonia ERP – the system has only basic functions related to the support in the field of production planning and control. Therefore, it is intended for companies that expect a cheap and simple system that facilitates the management of an uncomplicated production process. In addition, the Production Management module is available only with Sage Symfonia ERP Handel, therefore it will be a good system for SMEs enterprises that, as part of their activities, produce parts for the automotive industry as well as conduct commercial processes.

Conclusions

Planning and production control are important steps in the production process. Due to the continuous development of the production sector and the competitiveness of companies, a special role in enterprises is played by dedicated systems supporting the efficiency and effectiveness of production management. Modern production companies more and more often decide to purchase and implement ERP systems.

IFS Applications and proALPHA stood out from the rest in terms of the availability of the largest number of functions included in the developed criteria. Another criterion was the maintenance of the system. In this case, the leader is Sage Symfonia ERP, whose maintenance cost was only 4.65% of the value of the purchased system. Therefore, Sage Symfonia ERP was indicated as the cheapest in terms of the annual cost of maintenance. Functionality and the availability of functions in the systems played the most important role of all criteria. In the end, mentioned systems performed best on all criteria. It should be added, however, that the cost of maintenance are quite high.

Knowledge about the analyzed IT systems was taken from the websites, test of the demo version and conversations with specialists from the manufacturers. All of the systems offer extensive websites presenting a given system and, in the case of most of them, a demo version. The contact with the consultants of a significant part of the systems was possibly, all questions and doubts were quickly answered. However, there was insufficient knowledge with SAP S/4HANA. Therefore, this system was excluded from the comparative analysis during the comparison.

The benefits of using ERP systems in supporting production planning and control include: significant improvement in the execution of orders and orders, an increase in the level of enterprise resource management and the improvement of the production planning process. By using ERP systems, all processes and related information are integrated in one environment. Moreover, they allow manufacturing companies to react quickly to constantly changing market needs and factors in the environment. However, in order for the applied IT systems to bring the expected results and improve the functioning of the enterprise, it is extremely important to correctly select the appropriate system to the needs and nature of the enterprise.

On the market diverse ERP systems in terms of functionality, appearance, price and manufacturer are available. Each of these systems is presented as "best", "most advantageous" and "unrivaled". The rankings for comparing such systems usually refer to a general description of the individual system or are associated with a high cost of purchase. This paper is not intended to promote a specific ERP system and should be treated as a set of guidelines that can be followed in selecting the optimal system, applying to a particular SME, based on the example of the automotive industry.

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