THE USE OF MANAGERIAL DASHBOARDS
IN MANUFACTURING COMPANIES

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Purpose: The aim of the publication is to diagnose the level and to assess the possibility of using managerial dashboards created in an Excel spreadsheet to supervise management processes in enterprises.

Design/methodology/approach: The research developed the method of a directed interview with the staff at various management levels. The supervision of technological processes, economic analysis, and the provision of broadly understood services for citizens have been the subject of the research.

Findings: Managers show little interest in improving their employees' analytical skills. Training in this area is not planned and the impact of analytical capabilities of the tools available for the functioning of the company are not appreciated.

Research limitations/implications: The results of the research are not representative, but they encourage the authors to carry out a broader and more in-depth analysis of the existing situation in enterprises.

Practical implications: The research shows the need to rationalize human resources management. This process requires an increased supervision over employee development planning with the use of the appropriate training. This may have a significant impact on efficient management and, consequently, on the company's financial results.

Originality/value: The article is to be an element stimulating the management to more thoughtful activities in the field of selection, training, and use of personnel at various levels of management in the company.

Keywords: dashboards, data visualization, business intelligence, BI.

Category of the paper: research paper.

1. Introduction

Nowadays, it is difficult to imagine a large company or even medium-sized one operating without the support of IT systems. In the case of many enterprises, one of the most popular and most frequently implemented systems is ERP (Enterprise Resource Planning), which in the short term translates into the improvement of management processes, and in the long term may help build a competitive advantage. However, the implementation of the ERP system in many cases has not changed the fact that the production planning itself still takes place in the Excel sheet.

Excel spreadsheet has a wide range of uses in business. It is no different in the field of production planning or services, where - primarily due to its availability, low purchase costs and functionality - it has quickly become the main tool for planning processes in enterprises. The popularity of the use of Excel in enterprises is confirmed by the information obtained from company managers with whom the authors have had a daily contact in the process of teaching IT subjects at practical studies.

According to interviews with company managers, most employees know this tool and use it freely. It enables more advanced users to create an infinite number of algorithms and to manage them thanks to the visualization of results applying manager dashboards. It is the most useful and advanced form of using Excel in enterprises in BI solutions.

A crucial role of managerial dashboards as a tool facilitating the management of manufacturing processes is their use to analyse the company's situation, which allows decision-makers to take necessary actions. At the same time, they constitute a set of information, data analysis and presentation that guide, support the company in carrying out changes, implementing new solutions to contribute both to reducing the existing problems and finding solutions to them.

Traditional forms of conveying information by means of text or numbers turn out to be too slow and not effective enough, as they require too much time from the recipient to read their content. The use of data visualization may turn out to be extremely helpful in solving these difficulties. The conducted research proves that an individual mainly perceives the information delivered to their central nervous system through their eyesight (87%), and 10% through hearing, and only 3% through other channels, such as touch, taste, smell, pain, and heat (Bartos, 2010). The speed of human reading of information written in the form of text, contained in a graphic image and in the verbal form was also examined. It is estimated that the speed of text perception is max. approx. 300 bit/s, while the image perception reaches approx. 10^6 bit/s. (Dudycz, 1998).

The cockpit task is to provide the management staff with immediate information about the base values of indicators and indications of incorrect phenomena occurring in their area of responsibility (Ziuziański, Furmankiewicz, 2014).

To check how the processes of using tools for managing current tasks are carried out and whether the knowledge gained in teaching processes is used for this purpose, pilot studies were carried out in selected facilities.

2. The aim and method of research

The aim of the publication is to diagnose the level and to assess the possibility of using managerial dashboards created in an Excel spreadsheet to supervise management processes in enterprises.

MS Office software has been taught in Poland for many years at the primary, secondary and higher level of the education system. However, the most advanced uses of Excel are only available in technically or field-oriented studies. Therefore, the use of Excel spreadsheet only in its simplest implementations is most often encountered in practice. Regardless of the ERP class management systems used in companies, the practice of supporting decision-making processes with their own algorithms in Excel is frequently implemented by employees.

Object-oriented research in 5 companies was carried out by means of free interviews, targeted at employees participating in the process of organization management at enterprises at various levels, in departments related to the settlement of services with customers, planning, preparation and supervision of the production process, service activities and distribution of services and products. The research was conducted in 2019-2021 in enterprises from the central part of Poland.

3. Managerial dashboards as an analytical tool

The history of managerial dashboards goes back to the 80s and is directly related to the development of Business Intelligence tools. They evolved from the IT systems used at that time to support decision-making, such as: DSS (Decision Support Systems), EIS (Executive Information Systems) or MIS (Management Information Systems). Comprehensive analytical solutions, based on data warehouses and OLAP (OnLine Analytical Processing) real-time data analysis systems, appeared a bit later, only in the 90s. In 1989, Howard Dresner proposed "business intelligence" as an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems" (Power, Sharda, 2015).

Business Intelligence is described as a set of techniques and tools to convert data into meaningful information for analysing business by utilizing the use of technology and the Internet (Vercellis, 2009) or as applications and technologies that are used in gathering,

transforming, and analysing data about an enterprise or a concern to provide better decision-making process (Moss, Atre, 2004). The dynamic development of the BI market, as well as the enormous technological progress, contributed to the evolution of dashboards, making them more effective and interactive.

According to Stephen Few's most cited definition, a dashboard is "a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" (Few, 2009). According to Korczak et al., (2014) a managerial cockpit should meet certain conditions: constitute an analytical and information system supported by management knowledge, facilitate the global supervision of the company's financial situation along with its economic environment, use such architecture and technology which will guarantee further extensions of functionality, ensure ease of integration in the environment of small and medium-sized enterprises, provide users with an intuitive interface, consistent with the best patterns of visual data presentation, gives the opportunity to implement solutions in line with the forecasts and trends in the development of Business Intelligence systems..

BI is to provide simple, personal analytical tools, using an ontology that supports the exploration of data sources, searching for relevant information based on semantic relations and without a priori knowledge of data structures and data access methods.

One of the simplest, but also the most effective forms of information transfer is visualization, as it guarantees proper data understanding by a recipient in the communication system. The most important goal of data visualization is to present them in a way that is readable for a recipient, while explaining the correlations and relationships between them. An unquestionable advantage is the possibility to perform analysis at various levels of detail. Selecting the appropriate form of data visualization, especially in case of extensive data sets or in case of comparing different sets, is a task that requires skills confirmed by experience.

While creating a visualization of information, it is necessary to establish a graphic form that is legible and simple to establish conclusions and to make the best decisions. According to Davenport et al., (2010) data visualisation is important to stay close to data. For example, by looking at a simple graph the decision maker can notice a pattern or relationship. In sales analysis, the technique of line charts is used as the best presenting relationships and trends in subsequent periods. For fast synthesis, bar or line charts would be most appropriate. It is these formats that are most useful for general trends in data placement. However, when the most important task of data visualization is to present a large amount of data that must be easy to read, the best way to do this is to show the values in the form of a table.

According to some studies, a decision-makers typically prefer to look at graphs for trends, but at tables for decisions that required calculation. Presthus and Canales (2015) concluded that a dashboard should contain both data formats if the decision maker's task is complex. When analysing the essence of visualization, the recipient's limitations, education, perception

abilities and the ability to read graphic images are not without significance, because these conditions are the basis of the proper visualization preparation.

The effective managerial dashboard should consist of a reasonable number of elements and does not evoke chaos. Transparency and aesthetics can be achieved using charts, readable formatting numbers, right application of data labels and titles. Successful implementation of the Business Intelligence system is closely connected to the use of its functionality by individual end-users. In practice, this means that the success of the Business Intelligence system implementation is determined by its correspondence with the organization's expectations (Furmankiewicz et al., 2015).

Another important condition in the process of reading information from graphic images is experience. Lack of training with a specific graphic image may result in the inability to properly interpret it. When providing information to employees via the IT system, it is necessary to ensure that they are properly trained in the use of the program, as well as that they accept this form of communication (Ziuziański, Furmankiewicz, 2014).

4. The use of management dashboards in manufacturing companies

Managerial dashboards are a tool that has been used in enterprises for a short time, even though their origins date back to the 90s of the twentieth century, when the first Business Intelligence systems began to appear in manufacturing companies. It is an extremely useful tool in managing a production company and it is certain that in the coming years the number of companies applying such solutions will systematically increase.

One of the dashboard strengths is the ease of presenting data. The excess of information collected in the company very often makes it difficult to have it interpreted, and thanks to data visualization, it can become much easier. The communication of the most important information can be implemented in numerous applications:

- Windows computer desktop – includes icons, the Start button, and the message window;
- Apple Mac Dashboard – provides a handy overview of everyday information such as the local weather forecast, quick notes, and a calculator;
- Filmweb dashboard – allows to personalize the home page of the website and to set appropriate sections and alerts;
- Google Analytics Dashboard – is a web analytics solution that provides a detailed insight into website traffic and the effectiveness of your marketing efforts. This solution allows its user to analyse the above information quickly and correctly, which facilitates making decisions about the analysed website. The user has the full possibility of personalizing the charts, for example, they can set their goals and observe their implementation;

- The panel in mBank – this banking system solution allows not only to configure personal settings, but also to visualize data from the system – account balance, compare expenses, savings, or exchange rates;
- A very good example is COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU), presented by Pisz (2021). It shows both detailed data on cases of infection by a country, a graph of the number of daily cases, as well as the world map with cumulative cases marked.

The dashboard can be used as a tool for analysing the restaurant executives to continuously review menus, activities and promos that have an impact on profits. Through the dashboard, executives can easily make decisions to carry out promotions or activities based on the information displayed. Consumer consumption patterns will continue to change over time; therefore, this pattern needs to be monitored using dashboards. The dashboard allows to calculate the monthly costs incurred by the restaurant, to analyse the most popular menu in the restaurant, to distribute the time of consumer arrivals, to analyse the promotion, etc. (Halim, Halim, 2019).

Another area where dashboards are successfully applied are marketing departments of various companies. It has turned out that the characteristic feature of dashboards, i.e., the use of simplified graphic forms to present data makes it attractive for employees of marketing departments to use this tool to monitor the effectiveness of e-marketing activities. By using dashboards to analyse your web activities, you can leverage the range of key performance indicators available. In case of e-marketing activities, this could, for example, be the average number of visits to a website per hour or the average number of times a particular visitor was visited by a particular identified visitor.

The managerial dashboards used in management accounting focus on supporting decisions related to operational management in the company. The data collected as part of management accounting is to support decision-makers such as top-level managers, directors and managers of sales, procurement, and production in taking the right actions. With the help of a clear graphic form, it is possible to present on managerial dashboards the data that is often difficult for companies to receive. But thanks to a clear interface for management, it is easier to understand the segment analysis of the income statement, it is easier to analyse the break-even point or analyse operational indicators.

It is worth emphasizing that managerial dashboards are highly flexible and can be used in various areas of the company's operations. It can support sales by indicating the number of orders and reservations. It can also be used as technical support and show the number of customers reporting complaints, and how many of the reported problems have been resolved. Another interesting area of application is also the employee affairs department. It may indicate the staff turnover, the number of vacancies a given company manages, and even the employees' satisfaction with their work and working conditions.

5. Findings

5.1. Case study 1

Case 1 is a service company located in the Kujawsko-Pomorskie Voivodeship, employing over 500 people. The company uses the eMedia IT system by LogicSynergy, intended for the water and sewage sector enterprises. The eMedia system has modules fed with data from one common database, based on MS SQL Server. The advantage of the software is the full integration of modules for managing economic, administrative, and technical areas.

The program has been adapted to the needs of each department. It allows to collect readings from devices that enable remote readings in the field, as well as manually enter readings, modify them, issue invoices and corrections, control the information necessary for invoicing and for control purposes (addresses, names, balances, amounts to be paid, overpayments, underpayments). The program is used to perform all basic operations in the enterprise. However, to complete the eMedia system, the data flow is additionally supplemented by the Lotus application that ensures identification, edition, and of document registration.

Generating managerial dashboards is provided by the SmartReporting program integrated with eMedia, which is used to prepare on-line analysis and reports. The research shows that SmartReporting is the basic tool for compiling analytical and managerial data in the examined facility. The tool used does not provide flexibility in changing and unusual situations. Therefore, in the company, employees at various management levels occasionally supplement the analysis with simple Excel implementations. No training concerning improving competences in the use of analytical tools has been planned by the company.

5.2. Case study 2

Case 2 is a company from the eco-energy industry that offers locations, provides documentation development, and provides investment supervision over entrusted projects in the field of construction of photovoltaic farms, agricultural and waste biogas plants, and hybrid solutions. The company employs about 10 people.

In the process of management and supervision, the integrated IT system of ERP class is not applied. The CRM HubSpot program is used for order management, control, and the current report on their status. All data is stored in the data cloud service. Solar farm projects are implemented in ZWCAD, in addition, the Geoportal website, Electronic Land and Mortgage Registers and eBin (power networks) are also used.

The lack of an integrated system results in the episodic creation of statements using a spreadsheet. Employees use the simplest sets and formulas in tables on their own when they need to make decisions. Unlike the direct supervisors, managers show little interest in the more advanced use of Excel licensed by the company. They are also unable to justify the lack of employee training plans in this regard.

5.3. Case study 3

Case 3 is a housing cooperative (HC) in the Kujawsko-Pomorskie voivodship, managing its own real estate and housing cooperatives. The real estate owned and managed by HC is inhabited by tens of thousands of people. In accordance with the adopted Quality Policy, over 130 employees operate under the quality management system EN ISO 9001: 2008.

The use of Papirus SQL Integrated IT System (IITS) has been recently started, which integrates and streamlines analytical and business processes. The common SQL database is used for the purposes of accounting, billing, media settlements, debt collection, technical service of real estate, creating tax declarations, reporting and communication with contractors.

However, operational data is a subject to a process of multiple input and verification in different places due to the non-adaptation of the new integrated system to all functions in HC. In addition, an older version of the software for servicing the estate administration is run in parallel. Employees at various levels do not have or have very limited access to analytical and managerial tools. The managers indicate a possible improvement of the situation in the perspective of several months, after the planned update and refinement of the new IT system functionality. The inconsistency of the applied solutions is exacerbated by the fact that it is not possible to integrate the IT system with applications for the supervision and redistribution of utilities, e.g., central heating. Consequently, employees settle central heating costs using simple Excel statements, which requires multiple verification and completion of data in the IITS used to generate invoices for tenants. Managers do not feel the need to train employees in the more efficient use of available tools, such as MS Office.

5.4. Case study 4

Case 4 is a company from the fat industry in central Poland, which dominant activity is the production of bottled oils, vegetable fats for bakery and confectionery, and products for the biofuel and fodder industry. The company's activity is based on a fully integrated operating model, containing all the links in the oilseed processing process - from raw material acquisition, through its processing, to the packaging and distribution of products to the end user. This model maintains comprehensive control of the high-quality raw materials used in the production process and the final product.

According to managers, a very important area of managerial dashboard operation is the improvement of decision-making in the analysed organization. The awareness of employees in the field of Business Intelligence is high, because the vast majority believe that BI has a very large impact on improving the decision-making process in the enterprise, as well as on the cooperation of individual departments in the enterprise. One of the most important advantages of BI as tools used in the entire production process is the improvement of cooperation between all participants – departments of a given company, e.g., between the production hall and the maintenance department, or the department responsible for storage, but also the department dealing with company internal logistics. In addition, one of the elements in which management dashboards are widely used is internal and external logistics.

According to the respondents, management dashboards have an impact on the operation of quality control in the company and can contribute to improvement when working with finances and regulating costs of the company, they also have a very large impact on the management of manufacturing processes. The advantage of implementing the tools in question, indicated by managers, is necessary for efficient control of the manufacturing process. In a situation when there is a downtime in the production hall, manager cockpits can be used to efficiently diagnose a problem such as a machine failure, lack of electricity in the production hall, or a sudden lack of required materials. Finding the risk area immediately and neutralizing the problem in an area such as logistics can reduce downtime in the unloading and loading zone, and above all, reduce potential losses for the company, or prevent a similar loss in the future. Employees receive full support in the process of supervision and decision-making based on information from BI systems thanks to the IITS solutions implemented in the company with analytical modules.

Despite the high efficiency of the applied solutions, employees in many situations must use analysis made in a spreadsheet. The extensive scope of analyses and work on data conducted with the use of, for example, MS SQL Reporting Services, integration with various production and logistics subsystems (Quantum Qguar) and occasional reporting in Excel make the managers reluctant to accept such solutions. Therefore, Excel is used often, but in a limited way (without its BI integration capabilities, due to frequent problems resulting from the inability to ensure the consistency of data necessary for audits at different time intervals), and the company does not provide employees with training in this area.

5.5. Case study 5

Case 5 is a wood production company, one of the largest and oldest plants in Poland, employing approximately 240 people. Currently, the company operates in the field of production, processing, refining and sale of wooden products, full range of plywood, phenolic adhesives, foil, and other wooden products. The plant processes from 46,000 to 52,000 m^3 of wood per year.

The company uses the SIMPLE ERP class system, which applies accounting and financial modules, fixed assets management, production, warehousing, sales processes and customer service. The solutions used are reporting, not analytical and managerial. The remaining lists, necessary for operational activities, especially those related to the planning and organization of production, are compiled manually. Until recently, they were prepared by the production manager on large sheets of paper, and all calculations were performed on an ordinary calculator. Currently, an Excel spreadsheet is used to a greater extent, in which a management cockpit has been created and appropriate formulas have been prepared, allowing for quick conversion of parameters and data visualization, however, the data for the spreadsheet is not downloaded from any of the existing subsystems, but entered manually.

The knowledge used in this area by the planner was acquired on his own, the company lacks non-production training programs, extending the competences in the field of management or the use of Excel spreadsheet or existing systems to create more advanced statements.

6. Wnioski

The application of management dashboards in the production process can significantly contribute to the success of the companies that use them. It may concern the improvement of many areas of problem solving in enterprises.

Most companies, especially SMEs, collect data manually, using pen and paper, or basic spreadsheets. Business owners are often unaware of the need to implement improvements that can be carried out using their own resources (employees, Office software). Employee training seems in many analysed cases an option, not only not used, but also impossible to apply for various reasons.

The reason for such a situation may be the ongoing investment process adjusting IT systems to the supervision and management of the company. However, practice shows that in many cases such dashboards prepared in the near term, e.g., due to limited financial possibilities, will have to be supplemented with universal tools such as Excel.

It is essential to include the problems that affect enterprises, despite the use of management dashboards. Finding competent employees on the labour market is not an easy task. Only specialists who have extensive knowledge of managing dashboards and efficient detection of problems in the production process can effectively use BI tools.

Unfortunately, the lack of properly trained personnel, and at the same time the lack of plans for training middle-level personnel is the more common situation in enterprises. It seems that the management staff is not aware of the possibility of using Excel and Power BI to create efficient analytical and managerial tools. As a result, employees of lower management levels, due to the lack of system solutions, create their own, often complex algorithms based on office software, but with a significantly different level of functionality from the analytical needs of the enterprise.

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