LINKING INFORMATION TECHNOLOGY TO THE DIGITAL ENTERPRISE PLATFORM

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Effective business management is based on the use of relevant information. To be useful, information must be available in the right quantity, quality, place and time. In an enterprise, this function is often provided by an information system. The enterprise information system is one of the key factors for the competitiveness of not only large and multinational companies but also small and medium-sized enterprises. The information system gives the management of the enterprise access to various output reports and statistics, which are a source of information needed for flexible decision-making. However, flexibility requires timeliness, regularity and speed. Timeliness is understood as the actual input of information, regularity is understood as the flow of information at regular intervals to give an idea of developments in a given area, and speed means the time in which the necessary information can be obtained. However, in addition to flexible decision-making, the management has also set a long-term goal for which the most valuable information is also important. In order to be competitive today, a company must be able to react flexibly to changes in the external environment in response to customer demands and competitor behaviour. In general, there are two ways to adapt to these changes. The first is short-term, one-off or transitional measures. The second option is long-term action in the form of changes in the company's processes, its structure, or intervention in the corporate culture. An example of such a change can be the introduction of an enterprise-wide information system [Gala 2009].

KEYWORDS

Process, ERP system, interconnection, digital enterprise

1 INTRODUCTION

As stated in the document "Action Plan for Smart Industry in the Slovak Republic", the fourth industrial revolution, also known as digital transformation, implies a comprehensive change of perception also in the field of the labour market and education. With the automation and optimization of processes that it entails, the demand for some occupations will decline, if not disappear altogether, while new occupations are created. The education system at all levels of education, including retraining and lifelong learning, needs to prepare its graduates to be able to successfully manage all aspects of work processes within the scope of their professional qualifications, including the application of the requirements for decent working conditions in smart industry. Fixed job assignments and fixed working hours are becoming less and less important. These developments offer new opportunities but also risks [MHSR 2023].

The labour market is changing and increasingly requires higher level skills, increasing digital literacy. At the same time, there is a need to provide the workers that the labour market will need, with opportunities for professional development and new skills. Also important are employment requirements and ways to address the transformation of traditional/standard occupations to meet new labour market demands. The above must be a primary consideration in relevant sectoral development policies, including support activities for human resource development. At the same time, the process of human resources development in the context of smart industry must take into account the needs of all labour market participants, including disadvantaged people in the labour market, in order to support their access to training, in particular for the purpose of gaining or retaining employment. Measures must also be developed to increase the share of graduates in employment, to increase the share of graduates employed in their field of study and to reduce the cost of retraining graduates through the inclusion of apprenticeships [MHSR 2023].

To meet these strategic objectives, the following priority areas have been identified [MHSR 2023]:

- Research, development and innovation;
- Basic principles of IT security for the implementation of smart industry;
- Labour Market and Education;
- Reference Architecture, Standardisation and Technical Standards Development, European and National Legal Framework Conditions;
- Information and promotion.

Enterprise information systems

Any system that is capable of processing and delivering information efficiently and effectively can be called an information system. It is thus the sum of processes, activities, people and technologies that aim to collect relevant data, to store it until it is needed, to process it and to provide it to users who will act on it. In general, information systems solve and help to solve problems in business practice. Figure 1 shows typical problems solved by information systems [Hittmar 2013].

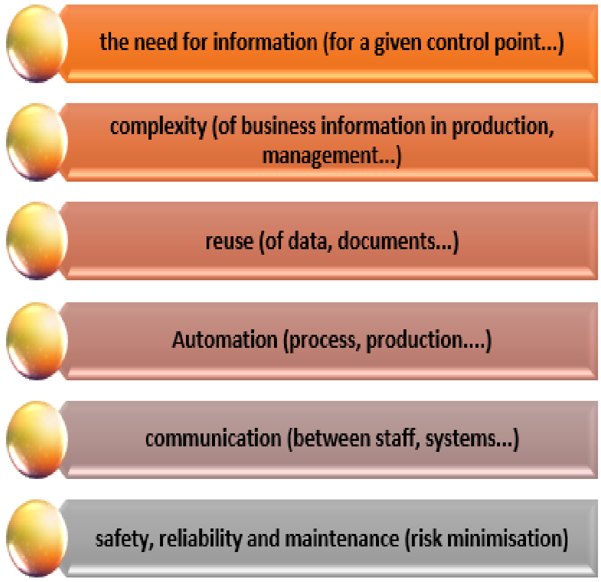


Figure 1. Typical problems solved by information systems (own processing according to [Hittmar 2013])

The objectives of the information system are identified as:

- strategic (use for planning purposes, e.g., investments...);
- tactical (use for management, control, decision making, ...);
- operational (use in daily routine);

- expert (use in knowledge-based systems...) [Rovnak 2012, Zamecnik 2023].

The role of the information system is:

- to provide the information required by the socio-economic environment;
- to ensure the coordination of tasks in such a way as to enable communication between the individualities that constitute the information system;
- assist in decision making by providing a set of rough or formal information [Brezaniova 2000].

An enterprise information system is a business data and information processing support system, made up of people and available technological resources that serve the enterprise to support business processes [Khosravi 2022]. Thus, an enterprise information system consists of people and available technological systems (e.g., PCs, software, etc.), and their setup and use must be consistent with the enterprise's information support strategy [Kucera 2017].

2 METHODOLOGY

In processing the analysis of the current state of the investigated issue, we based on two questionnaire surveys and the results of the semester work from the subject Exact methods in the management of industrial enterprises.

The first questionnaire survey was focused on the area of management information systems used in industrial enterprises operating in Slovakia. For the purpose of the pilot survey on the use of management information systems in industrial enterprises, the method of electronic questionnaire was chosen for data collection. Industrial enterprises were randomly selected through the Finstat.sk and Azet catalogue of companies' portals. The respondents of the survey were from small, medium and large enterprises. 104 respondents participated in the pilot survey.

Table 1. Size of enterprise (own elaboration)

	Numerosity	
Small business (up to 50)	26	25%
Medium enterprise (50 - 249)	162	59.6%
Large enterprise (more than 250)	216	15.4%

Of the total number of enterprises surveyed (Table 1), enterprises employing between 50 and 250 people (medium-sized enterprises) have the largest representation by number of employees, with a percentage of 59.6%. This was followed by enterprises employing up to 50 people (small enterprise) with a percentage representation of 25%. Enterprises employing more than 250 people (large enterprise) were the least represented with a percentage of 15.4%.

- Do you use enterprise information systems in your company?

The survey found that respondents overwhelmingly answered yes to the question with 98.1% of respondents answering yes and less than 1.9% of respondents answering no.

- If you answered yes to the previous question, what enterprise information system do you use?

Because there are different reasons and situations, not every business requires the same from an information system. From the analysis of Table 2, it can be seen that the most used information system is SAP with a percentage of 30.4%. The second most used information system is Custom IS with a percentage of 13.7%. It should also be noted that in some cases respondents reported that their company uses two information systems even three, all of which are listed in Table 2. The next in order is the Stormware Pohoda information system, which accounts for 12.7% representation. Furthermore, in the questionnaire, enterprises indicated that they use the Kros information system with a percentage of 9.8% followed by the Alfa and System21 Infor information systems, both of which have a percentage of 8.8%. MS Office and Asseco Spin information systems had the smallest representation with a percentage of 7.8%.

Table 2. Types of MIS used in enterprises (own processing)

	Numerosity	
MS Office	8	7.8%
System21 infor	9	8.8%
Custom IS	14	13.7%
Kros	10	9.8%
Asseco spin	8	7.8%
Stormware Pohoda	13	12.7%
SAP	31	30.4%
Alfa	9	8.8%

The analysis of our own survey showed that up to 98.1% of respondents use management information systems, but these are mainly large enterprises, which in many cases are multinational companies. They are primarily interested in collecting and evaluating data to improve the organisation and management of the company and at the same time to help make savings. To do this, companies need data on the utilisation of machinery and equipment, energy consumption, sources of waste. Businesses still have large gaps in this area. The transformation to Industry 4.0 is helping them to close these gaps, but it is resulting in the emergence of new professions without which digitisation will not be possible.

3 CONFIGURATION AND WORKFLOW WITH THE MODEL

The digital factory model is a model that allows the connection of a unified enterprise information system and Plant Simulation, which takes data from the IS, optimizes and simulates the production process and returns the new data back to the IS. The model thus represents a simulation of real production for 3 separate workplaces: Machine, Line and Assembly. In the first step, the user needs to retrieve the input data from the CITO ERP system. Each model is assigned to a specific PC and in the same way each model only retrieves the corresponding data from the ERP system [Benkovsky 2023].

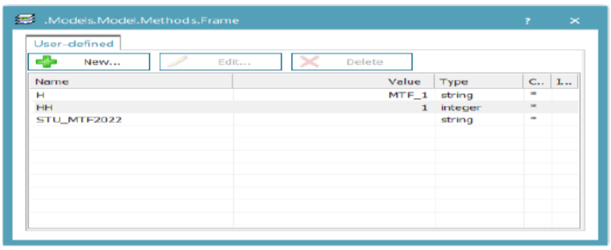


Figure 2. Setting up ODBC communication (own processing)

- Setting up ODBC communication between Plant Simulation and the database.

- In the H variable, choose the name that was used when configuring the ODBC data source. In the HH variable, choose any name you want, but what is set in the ODBC data source must match what is in Plant Simulation.

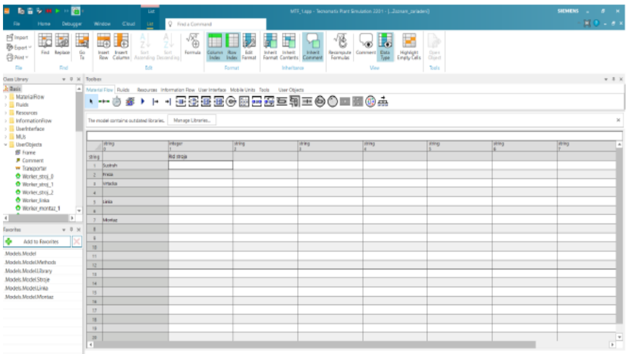
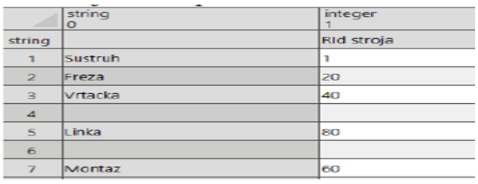


Figure 3. Settings (own processing)

- In methods, open the List_devices table (located under the Frame object). Select the RId of the Machine. The RId can be found in the Excel file machines.csv.



	string 0	integer 1
string		RId stroja
1	Sustruh	1
2	Freza	20
3	Vrtacka	40
4		
5	Linka	80
6		
7	Montaz	60

Figure 4. List_of_devices (own processing)

The digital factory works with data from the CITO ERP system but allows modification of some parameters. After successful data loading, the user can set additional parameters of the model by opening the MENU (Fig. 5.). Data modification is possible for each workplace separately.

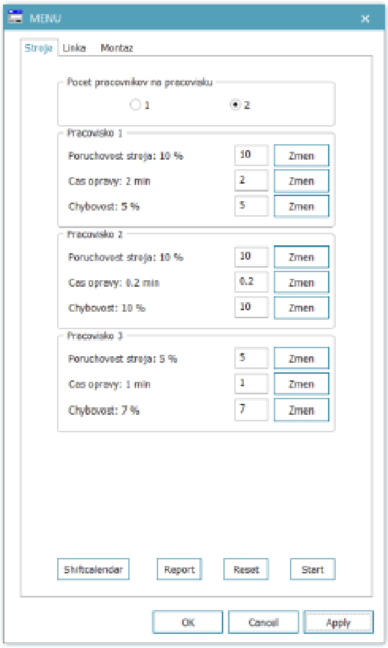


Figure 5. MENU (own processing)

In addition, it is possible to start the simulation directly via MENU, restart it or get a report. Another way to start the simulation is via the Event Controller, where you can set the simulation speed as well as the date and time when the simulation will start/end.

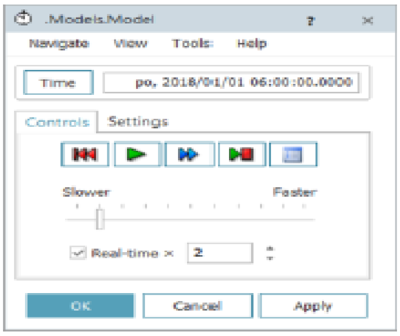


Figure 6. Event Controller (own processing)

The main desktop shows only the previews of the individual workplaces. A more detailed view of the 3D simulation is possible by double-clicking on one of the three workplaces. It is possible to switch between the workstations, the main screen and the MENU window using the buttons.

Each workstation also provides basic statistics in the form of graphs, possibly in the form of a report, which can be accessed via the MENU.

DESCRIPTION OF WORKPLACES

Machines

The workplace consists of three devices: a lathe, a milling machine and a drilling machine. The first two devices are operated by a worker. The user chooses whether one or two workers work on these two workstations. The third machine operates independently, but in the event of a malfunction it is repaired by a worker working behind the lathe. The delivery of materials as well as the subsequent removal of finished products is handled by an autonomous AGV trolley. The trolley pendulates between the warehouse and the individual workplaces.

The optional parameters for each machine are: machine failure rate (given in %), machine repair time by the worker (given in min) and production error rate (given in %).

In addition, the user has the possibility to influence the shifts and breaks of the workers: MENU -> Shiftcalendar.

Line

The material is transported to the workplace by AGV truck from the warehouse. A worker transfers the material onto a conveyor belt that moves the material to Stations 1 and 2 for processing. The empty pallet is transferred by the worker to a second conveyor belt, after which it travels to the loading area, where it is loaded with the processed product again. Stations 1 and 2 operate independently, but in the event of a malfunction a worker is called in to repair them. The user has the possibility to switch in the MENU between the repair options. If the repair option is not enabled, the product goes straight to the pallet loading station. No distinction is made as to whether the product is a non-product. If repair is enabled, the non-repairable products are returned along the conveyor belt to the Repair station where they are repaired by a worker before the products go to the loading station. This ensures that the output is 0 non-defective products. The pallet with the finished products then goes to the warehouse. The remaining optional parameters are the same as for the Machinery workstation.

Mounting

The workplace consists of 4 assembly stations, where the user initially chooses how many of them will be active. A worker at an assembly station assembles 2 parts together. The main part is transported by AGV trolley from the warehouse. The robotic arm transfers these parts onto a circular conveyor belt and then the trolley carries the pallet to the pallet warehouse. The main parts travel in a circle on the conveyor belt and the workers pick them up continuously. When a worker removes a part from the conveyor, he places it on the assembly station and takes a second part from an adjacent bin for assembly. The worker then returns the finished product to the conveyor belt. Finished products are removed from the conveyor belt by an inspector who sorts them and places them on pallets. When the pallet of finished products is full or the last part of the order has been loaded, an AGV truck is called in to take the finished products to the warehouse.

In addition to the number of active assembly workstations, the user also sets the assembly time at each workstation. He can set a minimum and maximum time, or by entering only one of these values, a constant assembly time is set for the worker. It is also possible to set the inspection time. The assembly error is not set for individual assembly workstations, but as a total.

CONCLUSION

If a company can forecast revenue and expenses for specific months, it has valuable information that can influence not only the present, but also the future. Paper-based information distribution or software that does not communicate with each other is still a reality in most manufacturing companies and is the reason for lengthy information retrieval. The enterprise information system eliminates paper, simplifies and makes technical documentation easier and more transparent. It is important to note that, although the emergency situation has exposed the need to digitize data and information, not only for crisis management, but it has also confirmed that access to accurate and up-to-date data, on the basis of which informed decisions are made in a highly responsive and responsible manner, is crucial for a well-managed enterprise in the long term [Krenicky 2022]. The correct flow and evaluation of data for the effective adjustment of processes that work in harmony, their logically interlinked inputs and outputs are one of the fundamental pillars of stabilization in the current complex situation and at the same time the starting point for sustainability and competitiveness of enterprises [Kantorova 2022].

In order for a business to uncover its hidden reserves, it needs data. Every enterprise has these today. The only problem is that it often can't get to them. Either it has them in multiple systems or diverse documents that do not cooperate or do not see each other. Often, they have many of them stored in a system, but they can't get them out of it. Most businesses have become accustomed to the idea that an enterprise information system should provide them with information about the current status of every important process at any given time. Today's information systems are focused on real business management - moving into supporting management in increasing production, reducing costs, and making the business more efficient. In doing so, they serve permanently rather than on a one-off basis.

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