

# Business process automation – new challenges to increasing the efficiency and competitiveness of companies<sup>1</sup>

**Miriama Blahušiaková**

University of Economics, Faculty of Economic Informatics, Bratislava, Slovakia

<https://orcid.org/0000-0002-3386-7589>

## Abstract

**Background:** Scientific and technical progress are unstoppable. Nowadays, information technology affects every sphere of social and economic life. The automation of business processes is a common part of business and accounting practice. Moreover, the COVID-19 pandemic has accelerated the automation in companies. Regularly occurring transactions, which were performed manually before, are gradually being replaced by information technology and automatic robotic systems. The companies fully use cloud storages, artificial intelligence, or blockchain technologies.

**Purpose:** The purpose of the paper is to identify areas and possibilities for improvement of business and accounting processes with use of information technologies, digitalization, and automation.

**Methodology:** For the purpose of the paper, a standard methodology review of literature sources was performed. Then we conducted a brief questionnaire survey in order to find out the level of automation and digitization of business processes in companies in the Slovak Republic.

**Findings and conclusions:** It is expected that, as a result of robotization and automation of business processes, some professions will gradually disappear within a few decades. Even the crisis related to COVID-19 pandemic had an impact on the acceleration of using information technologies in business processes related to their digitalization and automation. The paper describes possibilities of automation with focus on e-shop, which make the processes safer, faster, more effective, eco-friendly, with fewer errors. On the other hand, there are some challenges and threats the accounting entities have to consider when implementing artificial intelligence, information technology in their business processes, such as cyber security, the Internet and electricity outages. We have observed that companies in Slovakia have their business processes more or less automated. However, the automation is the domain of bigger and multinational companies. The higher initial costs related to automation are limitation for smaller companies that need to consider benefits and costs the automation requires.

**Limitations and future research:** Our paper is based on the theoretical background with a brief research in the area of implementing information technologies in companies in the Slovak Republic. The number of returned questionnaire surveys that were the base for our brief and initial research was very low. More detailed analysis of level of automation in the Slovak companies in comparison with companies abroad, their readiness for changes related to automation, as well as threats, challenges, pros and cons of automation may be the topic for the future research.

## Keywords

Accounting, automation, digitalization, e-invoicing, DMS, ERP, COVID-19 pandemic

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<sup>1</sup> Extended version of the paper presented at Scientific Conference Strategic Management and Decision Support Systems in Strategic Management SM 2022

## Introduction

In the recent period, the use of information technology in business processes as a part of Industry 4.0 has been growing. Industry 4.0 is a shortened title for Fourth Industrial Revolution that is also known as the Digital Revolution. According to Blahušiaková, Mateášová and Meluchová (2022), Industry 4.0 is characterized by creation of industrial networks, introduction of smart technologies, establishment of smart factories, and building the so-called intelligent industry. The basic condition for Industry 4.0 is widely accessible Internet that allows a very easy connection of a large number of people around the world. According to Majstorovic and Mitrovic (2019), Industry 4.0 is a Program initiated by German Government and industry as a new model of automatization of manufacturing technologies.

Information technologies affect all spheres of human life, social, and business environment. Especially in the business area, we can see the growing use of information technologies connected with automation and digitization of business processes. According to Budnik, Macaulay and O'Donnell (2017), the impact of advanced information technologies touches virtually every sector and company on various levels, from strategic planning and marketing to supply chain management and customer services. Digital technologies offer new opportunities for establishment of new infrastructures, products, and business models and, thus, can change the ways in which companies organize for innovation (Drechsler, Gregory, Wagner & Tumbas, 2020).

If companies want to remain competitive, they should focus on more efficient business process solutions, with accent on digitalization and automation. This is supported by Erceg and Zoranović (2022), who state that if companies want to gain or rise market share in the digital era, they must act quickly when a new business opportunity appears. Kantić and Vidicki, (2018) state that the key factors, which determine the company's potential to become a digital organization are proactive leadership and investment.

Digitalization relates to all business processes, such as acquiring new customers, taking care of existing ones, developing new products, automatic tracking orders, mobile warehousing, online invoicing, intelligent store management, or remote document approval. Information technologies help to optimize and automate these processes. Nowadays, it is obvious to issue an invoice right

from the smart phone, or to pay invoice just by one click. Electronic banking belongs to areas where we can see a huge development in digitalization and increasing usage of artificial intelligence. Payments realized just using smart phone or smart watch, payment of invoice by QR code scanning, or creating an account using smart phone with an Internet connection belong to a several examples of information technologies application in business.

Numerous challenges in the area of digitalization (Gulin, Hladika & Valenta, 2019; Gotthardt et al., 2020; Marshall & Lambert, 2018), such as the use of big data in accounting, cloud computing, artificial intelligence and blockchain technology affect the future of business processes. Traditional methods are replaced by Internet based accounting systems (Mancini, Lamboglia, Castellano & Corsi, 2017). This is supported by Dečman, Mališ and Sačer (2019), who state that earlier the focus of accounting staff was on recording historical business transactions, while advanced accounting information systems are now being used as a main support when it comes to making important business decisions. The accountants play significant role in automation of business processes. The clients expect them to provide more complex services, because they themselves do not have time, professional capacity or financial sources to be spent to analyze their problems and search for optimal solution. Thus, the accountant is not only the person who takes responsibility for recording accounting documents, but also the person who is required to provide the ready-made comprehensive solutions for their current problems that should be implemented in a short time.

Implementing information technologies in business processes may contribute to increasing of competitiveness of economy, as well as of competitiveness of micro-entities (Domazet, Zubović & Lazić, 2018). Due to massive digitalization it is expected that many professions will disappear altogether (Jylhä & Syyrimaa, 2019; Pajarinen, Rouvinen & Ekeland, 2015). According to Grace, Salvatier, Dafoe, Zhang and Evans (2018), artificial intelligence is expected to beat the human beings' performance within 45 years and completely replace the human workforce within 120 years. Concerning this, Frey and Osborne (2017) have realized a research to find out, how susceptible are jobs to computerization.

COVID-19 outbreak has affected many common stereotypes. The shift of work

performance into the online environment, meeting restrictions, or a curfew have had a great impact on the change of standardized ways of work performance of several professions. Not only information technologies, but technologies in general have strong impact on work and organization. This is supported by Mičić, Khamooshi, Raković and Matković (2022), who state that social and technological changes have the impact on the ways of communication, cooperation and collaboration.

Nowadays, still more and more companies are using the e-commerce. Business in e-commerce has thrived in recent years, and this growth has also been significantly affected by the COVID-19 pandemic. In the first and second wave of COVID-19 pandemic, switch to e-commerce, or just establishment of e-shops for companies that did not use it before, was the only way to survive during those times.

Legislation has to reflect these rapid changes in business processes connected to growing usage of information technologies. The increasing number of electronic documents, use of electronic signature, using cloud storages, or online communication between business partners need to be regulated by legislation.

What are the possibilities of automation in companies? How to automate and optimize business processes in e-commerce conditions? How to interconnect these processes with accounting system? We have tried to answer these questions in the paper.

## 1. Methods

The purpose of the paper is to identify areas and possibilities for improvement of business and accounting processes with the use of information technologies, digitalization and automation.

For the purposes of the paper, the systematic review of the relevant printed and electronic sources of literature was performed. The literature review started by defining the research purposes, followed by identification of the key databases and papers in these databases based on defined keywords. The basic databases were Web of Science and Scopus database, as well as professional papers from websites of biggest accounting and auditing companies, and professional bodies. The first selection was performed based on keywords, then according to the title of the papers, abstract and finally based on conclusion of the papers. The basic keywords were: automation, digitization, Document

Management System (DMS), Enterprise Resource Planning (ERP), Robotic Process Automation (RPA), Industry 4.0, e-shop, e-commerce, automation in human resources. We focused on articles not older than 5 years. The literature review continued with the analysis, selection and quality assessment of papers. The final step was data extractions and synthesis.

Based on the keywords we extracted more than 100 records from which we removed those that are not relevant to our work. The basis was the papers included in the Web of Science and Scopus databases, as we consider these papers to be of higher quality. After qualitative evaluation of the papers we chose those sources that are stated in references, which have related to the subject of our research and have contributed to our research the most.

Due to the fact that the subject of our paper is to analyse the possibilities of automation, digitalization and robotization of business processes in companies comprehensively, the resources that we selected in the literature review were the basis for the analysis of all areas of business processes that can be automated and which we discuss in the Results section. Specifically, it is an analysis of procedures related to the digitization of documents, the possibilities of automation in the electronic shop (such as Enterprise Resource Planning, automation of invoicing and processing documents, automation of warehousing and the logistics processes), and automation in the HR field.

Automation of business processes cannot work without a legislative framework. That is why we also focus on legislative changes in the field of automation in the Slovak Republic, which have resulted from the increasing degree of automation of business processes, especially the growing number of electronic documents, in our paper.

In order to investigate the level of automation of business processes in Slovak companies we have realized the brief questionnaire survey among accounting entities in the Slovak Republic in the period from February 4, 2022 to February 18, 2022. The questionnaire survey was distributed to e-mail addresses of companies' representatives (managers, heads of accounting departments, or other responsible persons). We approached 2,358 accounting entities from all Slovak Regions, but only 132 respondents have responded to our survey. The data obtained by this survey were analysed and interpreted.

The main scientific methods that we used when writing this paper were analysis, comparison, selection, deduction and generalization.

## 2. Results and discussion

### 2.1. Document management systems (DMS)

The shift of businesses into the online environment due to restrictions related to COVID-19 outbreak has the technology industry growing faster more than ever. New challenges regarding digitizing accounting records caused by movement and meetings restriction, have forced companies to digitize paper documents into the electronic format. The very popular form of processing accounting documents was just scanning them and sending them in .pdf format to responsible persons, or just using the electronic format with the electronic signature.

The increasing number of electronic documents and accounting records put new requirements and challenges on accounting documentation, issuing accounting records, their circulation in the company, and their storage (archiving). Many accounting entities, or companies fully use the cloud storage in their processes for these purposes, with possibility of electronic storage of accounting ledger, automatic recording and e-storage of invoices, as well as e-invoicing. According to Avokaado (2021), almost up to 48.00% of companies choose to store their confidential and important data in the cloud, as the cloud-based documentation enables flexibility and security. In spite of massive digitalization, there are still documents which accounting entities are obliged to issue and store in the paper form (such as documents related to employment relations, or labour law documents). These documents can be stored in the paper form, but also in the electronic form. Avokaado (2021) states some statistics that prove the inefficiency of on-premise paper documentation:

- Companies spend an average of \$25,000 to fill their file cabinets plus \$2,100 a year to maintain them.
- Managers miss important info daily because they cannot find it because it is on paper.
- Almost up to 80% of the information in paper documents is never used again.
- Using paper can cost anywhere from 13 to 31 times more than the paper itself.

- 70% of today's businesses would go down in 3 weeks if they lost their paper records in a fire or flood.
- Each lost document takes about 25 hours to recreate.
- Redoing documents has cost US companies \$1.5 trillion.
- A copy-paste error cost a company 10% of its annual profits.
- Workers waste 20-30% of their time managing documents. and
- Businesses lose \$600 billion every year because of inaccurate or missing data.

To avoid the inefficiency, the integrated cloud-based document management systems (DMS) has been established. The document management system could be defined as a computer-based system used to receive, track, manage and store documents, as well as reduce paper, which offers many benefits (Figure 1).

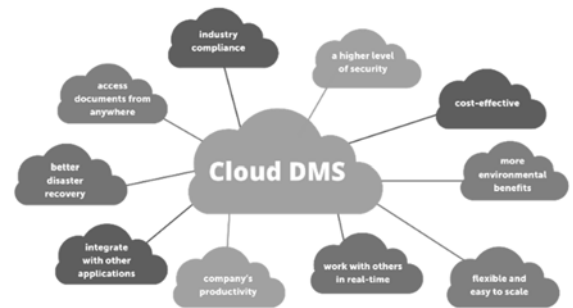


Figure 1 Cloud Document Management System

Source: Avokaado, 2021

The process of storing documents in digital form may in practice look as follows: the incoming invoice is scanned and meta-data are extracted from it. Afterwards, the electronic invoice is circulating in the company instead of the paper form. The electronic form of document is being approved in DMS. After approval, the invoice is being recorded in accounting. Thus, based on digital data stored in the document management system, it is much easier for companies to prepare tax returns.

According to Filipe, Martins and Rocha (2019), implementation of DMS dematerializes, optimizes and simplifies the internal processes. Thanks to document management system, documents stored in the cloud can be accessed remotely, the only condition is an Internet connection. Documents can be retrieved, sorted by defined criteria. DMS regulates company's compliance with legislation, which mandates the accounting entity to organize

documents in a reliable host. Cloud DMS provides a higher level of security through cloud providers, who take security very seriously. Fees for cloud-based DMS are lower in comparison with maintenance expenses, expenses for new computers, disk space, paper, or ink. This leads to reduction of overall expenses for electronic document processing. Cloud document management system, which is based on digital documents, has environmental benefits due to less paper, less energy. Collaboration and documents sharing within the company are easier with cloud-based DMS. The company can control who to give access to, so negotiating with other team members becomes easier. Thanks to DMS, the management can concentrate on decision-heavy tasks that directly impact company's growth. DMS could be integrated with other company's applications, systems, and software. It speeds up and streamlines the work. A cloud-based disaster recovery solution provides continued operations despite disruptions. This is more efficient in comparison with paper-based systems, because if unforeseen or unexpected circumstances, such as lockdowns, fires, or system failures occur, the company still can have access to its data, or can recover data much faster.

The advantage of documents digitization and electronic archives is mainly (Filipe, et al., 2019; Smith, 2018) their accessibility for every employee of the company with an access. The documents do not need to circulate physically in the company. It saves costs, time, increases transparency and reliability, and on the other hand, reduces errors. An integral part of building an information system is backup and security. The basic requirement is the possibility to control an access to the system by name and password, the authorization of the user to work only with certain documents, and to use only allowed functionalities.

If the company wants to be able to operate as much as possible without paper and fully use the potential of digitalization, the electronic signature plays a significant role. In the Slovak Republic, the *Act No. 215/2002 Coll. on Electronic Signature as amended* was issued in 2002. It was replaced by the *Act. No. 272/2016 Coll. on Trusted Services for Electronic Transactions in the Internal Market and Amending Certain Laws (Trust Services Act)* as amended in 2016. Both acts defined basic terms, such as electronic document, electronic signature, electronic seal, public key, private key, certified authority, and so on. They also specified the rights and obligations of entities using the electronic

signature and electronic seals, the authenticity and protection of electronic documents signed electronically. There can be three different types of signatures (Podnikajte, 2021a):

- the simple electronic signature without exactly defined format criteria or security level criteria, such as scanned handwritten signature at the end of the e-mail;
- the improved electronic signature that guarantees higher security, as it must meet certain criteria, e. g. allows to identify the signatory, for example signing of documents in internet banking, where it is possible to sign by entering a password from two-factor authentication;
- the qualified electronic signature that represents the form of improved electronic signature with additional requirement for security and identification of the signatory (through identity card with an electronic chip). Using this type, the business partners can check and sign the documents using web application from any place in the world with Internet connection.

The qualified electronic signature is legally equal to the handwritten signature. It ensures the authenticity and integrity of the electronic document. The signatories no longer need to own a hardware cryptographic facility to obtain a qualified electronic signature. The secure signature creation facility may be managed by the issuing certification authority, in particular by a trust service provider. In the Slovak Republic, the D. Trust Certified Authority a. s. (DTCA) is the exclusive service provider of an accredited certification authority.

The safer way of signing business contracts and agreements is creation of secure electronic signature with application of biometric-based cryptographic techniques. The techniques combine password and biometric authentication factors into the Biometric Authenticated Key Exchange protocol, which provides mutual authentication and multi-factor authentication of users, as well as preventing phishing and man-in-the-middle attacks (Griffin, 2019).

Introduction of e-signature requires the change of processes and habits in the company. The experts argue that introduction of electronic signature brings many benefits, such as improvement of documents storage, time savings, elimination of manual errors, reducing the need for printing and scanning signed documents, or

ecological aspect – paper savings. On the other hand, there are many threats related to electronic signature, to which belongs mainly the cybercrime. The users of electronic signature become aware that the electronic signature methods they use are adequate and the two or three-degree authentication process will not be broken by criminals.

## 2.2. Automation in electronic shop

Another area of automation of business processes is an electronic shop (e-shop). The popularity of purchasing goods is growing, and due to several lockdowns during the COVID-19 pandemic, when most stores had been closed, e-shops were the solution for many entrepreneurs. In a fast-growing e-commerce business, the e-shopper must respond flexibly to new market trends, not to lag behind the competition, constantly innovate, look for new sales channels, and improve existing ones. However, the process of ordering goods, payment and registration of payment, until goods are delivered to the customer, consists of many steps. This process can be significantly facilitated by automation using the Enterprise Resource Planning (ERP) information system.

### 2.2.1. Enterprise resource planning (ERP)

The enterprise resource planning (ERP) system can be defined (Moon, 2007; Ruivo, Johansson, Sarker & Oliveira, 2020) as an enterprise information system designed with the purpose of integrating and optimising the business processes and transactions in a company. It is the internal integrated information system used for management and coordination of all sources, workplaces and functions of business sphere through shared data storage. It is a category of business management software, usually a suite of integrated applications that a company can use to collect, store, manage, and interpret data from many business activities.

According to Nikitović and Mahmutović (2019) the acronym ERP can be explained like: E represents Enterprise with emphasis on the integrity of business system, R means Resources representing all resources of a company (human, material, financial, information, organizational), respectively all resources at disposal in a company, while P is Planning, whereby the focus is on providing all resources and their best allocation for the achievement of objectives. The ERP is something like the central brain for all company's activities that helps companies with enterprise

resource planning and management (Král, 2019).

Due to globalization, it is necessary to look for any tools that will give the company a competitive advantage. Many companies achieve this advantage by using the ERP system. The ERP system combines customer management, human resources, enterprise intelligence, financial management, inventory and supply chain capabilities into one system (Figure 2).

The ERP stores all entered data in one database, which allows all departments to work with the same information. The advantages of the ERP are (Midasto, 2021):

- increasing profit using the ERP system,
- streamlining internal processes,
- better analysis and data evaluation,
- higher productivity,
- customer satisfaction,
- easier compliance and risk management,
- easier warehouse management, and
- more accurate production planning and resource management.



**Figure 2** Enterprise resource planning  
Source: Král, 2019

When integrating enterprise resource planning with the online store (e-shop), the list of products and the data update are done only in one system, in that of ERP, and the e-shop gets this information automatically. This integration brings many advantages, such as reducing of personnel costs, minimizing errors or the number of complaints, and increasing the e-shop credibility for its customers. Thus, the company can eliminate human errors and make the work of their employees more efficient. At the same time, the company has all the data needed for accounting for in the economic system. Due to this integration and adaptation, many processes run without the need for human intervention. The operation of the company is faster, more accurate and more efficient. Anyone in the company can check the

order status, the number of issued invoices, or how the sales are rising or falling. The biggest benefit of the ERP system is the centralization of all the e-shop agendas in one place (Podnikajte, 2021b) – from order registration, requirements for the purchase of goods or materials (if the e-shop does not have it in warehouse), through issuing inventories from the warehouse, invoicing, accounting for, up to payment matching. Thanks to the ERP system, it is possible to have an immediate overview of the company as a whole, including related analyzes. The manager can evaluate the consumption of individual customers, the best-selling products, or product categories. All outputs from the ERP, to which e-shop also belongs, contain up to date data about prices, or stock in warehouse. The efficiency in order processing and in other automated processes is maximized. The human factor is eliminated, and the error rate during data transmission is minimized. The costs related to order processing are also minimized and the profitability of the whole e-shop increases.

The most frequent ways of ERP and e-shop interconnection are either regular data transfers using files in .csv format or .xml format through FTP (File Transport Protocol) folder, or “online” transfers of data through API (Application Programming Interface). An API is a software intermediary that enables two applications to communicate with each other. It is an interface with various pre-programmed features, which provide a third party or an internal programmer with the possibility of exchanging data with the e-shop.

Despite many advantages of ERP, Mahmood, Khan and Bokhari (2019) state 31 challenges, or issues that are faced by small and large organizations during ERP implementation. The topmost ten challenges include especially top management approach, change management, training and development, effective communication, system integration, business process reengineering, consultant/vendor selection, project management, project team formation, team empowerment / skilled people, and data conversing / migration. They also state other issues, such as data security, cloud awareness, functionality limitations, or subscription expenses. This is supported by Janssens, Kusters and Martin (2021) who state that ERP implementation is complex, risky, time-consuming, and very expensive. ERP implementations often exceed budget and time, and fall short of stakeholders' expectations.

Nikitović and Mahmutović (2019) agree with this opinion, as they state that ERP implementation is a cost demanding for every organization.

When thinking about integration the ERP system with the e-shop, the company should define functions, which will be provided by the e-shop and those which will be provided by the ERP system itself. If the entrepreneur handles a couple of orders a day, the interconnection between e-shop and the ERP system is not necessary.

### 2.2.2. Automation of invoicing and processing of documents

Choosing the right invoicing application is a very important step. The e-shop company should answer questions, how to automate the invoicing and how to import these data into accounting (Podnikajte, 2022c). E-shops with only a few orders a day can issue invoices manually, using invoicing application or accounting software. If the number of orders exceeds the certain level, this manually provided activity becomes an unnecessary burden, unbearable for the entrepreneur, as well as for the accountant, and as the number of cases increases, so does the error rate. According to the Slovak legislation, the seller is obliged to confirm the order immediately. If the confirmation of orders is automated, the automation of invoicing can be the next step.

The invoicing depends on the time the payment is realized and, on the time, when the goods or services are actually delivered. The settings of invoice's content, or mode of VAT, especially when a company delivers goods or provides services to customers abroad, are among other issues that should be considered, when setting up invoicing processes.

Automated invoicing has many advantages:

- reduction of administrative and time burden on this agenda,
- real-time overview of company's income, profit, expected tax liability for VAT, unpaid receivables,
- integration with warehouse,
- integration with payment gateways, and
- integration with transport companies.

This is supported by Bellon, Dabla-Norris, Khalid, and Lima (2022) who argue that e-invoicing increases reported company's sales, purchases and VAT liabilities by more than 5% in the first year after adoption.

Invoices are generated automatically without the need for manual intervention and are imported

into the accounting software, which also reduces the cost for the accountant's work. Furthermore, the interconnection between the e-shop and the warehouse enables to monitor the amount of stocks and to predict the need of purchasing goods or materials for production. The e-shop operator can plan the purchase of inputs before he needs them, which provides a competitive advantage.

Narayanamm, et al., (2020) suggest to organizations to implement blockchain-based e-invoicing systems to reduce invoice disputes, reduce dispute resolution time, and provide real-time auditing.

### 2.2.3. Automation of warehousing and the logistics processes

Having enough inventory in the warehouse is one of the key factors for companies, especially for e-shops. If the goods are missing, the processing of the order is postponed, and the customer's dissatisfaction grows. On the other hand, it is not appropriate to have a warehouse full of products, for which there is no demand. Therefore, the effective warehouse management, quantity optimization and automation of the purchasing process are important. According to Anđelković and Radosavljević (2018), the functioning of order-picking process, which is very significant in terms of contribution to the competitiveness of company, depends on information technology, such as warehouse managements system.

Thus, the solution can be the investment into new technologies, such as semi-automated stackers with guidance, robotic registration sorting - packing line, automated table workstations, or the autonomous mobile robots (AMRs). Autonomous mobile robots are (Fragapane, de Koster, Sgarbossa & Strandgagen, 2021) currently being introduced in many intralogistics operations, like manufacturing, warehousing, cross-docks, terminals, and hospitals. AMRs can communicate and negotiate independently with other resources like machines and systems and thus decentralize the decision-making process. Despite many advantages, Liaqat, et al., (2019) state that a dynamic and flexible manufacturing environment presents many challenges in moving of autonomous mobile robots, leading to delays due to the complexity of operations while negotiating even a simple route.

Investing in technology should be based on economic base and quick return. The key indicator is turnover. The entrepreneur should be informed about how fast the inventories are selling. The

purpose is the highest turnover at the lowest number of inventories in the warehouse. Many companies use inventory mirroring, cluster picking or dynamic slotting (Podnikajte, 2022b). Inventory mirroring means that the bestsellers are not only in one place in a warehouse, but in several zones. The cluster generation method, which groups orders with the same priority and their individual items close to each other, helps to process orders more efficiently. Dynamic slotting helps to determine where the optimal place for storing a particular item is. The storage of inventory items is not static, but varies according to season, the development of orders and their items. The virtual copy of the whole warehouse belongs to often used technology in e-shop.

The entrepreneur is thus able to automate purchase and sale of goods, and set up online campaign for low-turnover goods he needs to get rid of. Systems based on artificial intelligence can automatically select missing items with the necessity to re-order them. Sometimes these systems are able to send the order directly to supplier.

Intelligent technologies, modern systems and complex solutions help companies to save time, costs and even "feet" of their employees. Orders are processed faster, customers are more satisfied and the error rate is lower. As from the future perspective and the expansion of operations to more warehouses, the necessary capacities can be relocated and the technologies can be used exactly, where they are most needed at the moment. This will have a positive impact on sustainability and the environment, too.

Many companies use mathematical models to optimize the purchase and the quantity of inventories (Podnikajte, 2022a). It helps to improve the stock records, to settle automatic reminders, when inventories decrease under the minimum level, or to predict the inventory consumption. The automatic generation of online invoices, their export into the accounting software and their automatic accounting for, as well as the payment matching, are other examples of automated business processes.

Another step in the order processing is issuing of goods from the stock. Artificial intelligence, such as automated control system, is most often used in warehouses in order to reduce errors caused by humans. Companies use all available technical means, such as code readers, Radio Frequency Identification (RFID) tags, calibrated proportional scales connected via a network to their ERP



system, or PDA devices. Radio frequency identification tags are a type of tracking system that uses smart barcodes in order to identify items (Pontius, 2022).

The automated control system may look like this: The first level of control is being carried out in the individual sectors of the warehouse. The employee can verify the position of the item in the warehouse via the PDA at any time. Number of items are checked via a special scale. The system shows the storekeeper the corresponding number of pieces. The second level of control is being carried out at the output control, where the system, after reading the barcode, also displays an image of the component on the monitor for check in. The whole process of the output control can be recorded by cameras.

### 2.3. Automation in the human resources sphere

Digitalization and technological progress have been applied in the human resources (HR) sphere, too. This is supported by Kholod, et al., (2021) who argue that the use of digital technology significantly affects the entire cycle of personnel in an organization, including hiring, onboarding, and firing. Automatic recording of employees' attendance, using virtual reality system for trainings of pilots or doctors, using a cloud solution (data storage) for storing of employees' data are only some of the examples of implementation of information technologies in human resources sphere. The cloud data storage is a safer solution for employees' registration in comparison with the paper form. Moreover, the external cloud companies invest more money to secure the systems they are providing for these purposes than the company itself.

Owing to the information technologies, HR activities, such as monitoring and recording attendance, absences, sick leave, annual leave, payments of wages, benefits, training, and employee contract are faster, more accurate, and easier than before (Berber, Đorđević & Milanović, 2018). According to Slavić, Bjekić and Berber (2017), the use of social networking sites, such as LinkedIn, Facebook and Twitter, in recruitment process is becoming increasingly popular. Artificial intelligence, such as chatbots are a good help in onboarding (the adaptive process) of new employees. The chatbot answers frequent questions from newcomers and replaces HR staff. Deploying Robotic Process Automation (RPA) can according to Balasundaram and Venkatagiri (2020)

help to offer better service to employees and managers, ensure compliance of HR processes with standards and regulations, facilitate rapid start-up and completion of human resource processes, increase efficiency by digitizing data and auditing process data, increase and improve HR productivity, and save costs by automating manual and repetitive tasks. Robotic process automation is a new technology which automates tasks by interacting with other software through appropriate user interfaces (Herm, Janiesch, Reijers & Seubert, 2021). Results of the RPA are (Johansson, Engberg, Lindgren & Sordal, 2020) upskilling, job satisfaction, and that the employees perceive an increased level of job enlargement. RPA has also been adopted in many industries (Huang & Vasarhelyi, 2019), including the accounting and auditing industry, to automate well-defined and repetitive tasks.

The common example of automation in human resources is interconnection of the attendance system with the payroll software, and with the accounting software, where the salaries are subsequently being accounted for.

According to Berber et al. (2018), the key advantages of electronic human resource management are faster, more accurate and simpler processing of information about employees, cost savings, freeing human resources managers from administrative tasks, better access to human resources data, standardization of human resources processes within the company, more consistent and up-to-date data about employees and their performance, and the like. Thanks to digitalization of human resources processes (Kholod et al., 2021), as well as the use of such elements in personnel management as cloud technology, remote working, big data, social media and artificial intelligence, companies can increase their lead over their competitors.

### 2.4. Legislative changes related to automated processing of accounting documents in the Slovak Republic

Accounting practice has been impacted by digitalization and automation since the first computers and accounting software started to be used by processing accounting documentation. Thus, accounting books in the paper form have been gradually replaced by the electronic format because accounting documents started to be processed automatically. In the Slovak Republic, according to the *Act No. 431/2002 Coll. on Accounting as amended* (hereafter referred to as

“Act on Accounting”), the accounting documentation shall include all accounting records. Till the end of the 2021, the accounting record could have either the written form or the technical form. *The Act No. 456/2021 amending Act on Accounting*, which entered into force on January 1, 2022, responded mainly to the growing number of electronic accounting records in accounting practice. The amendment specifies conditions the companies are required to follow when processing accounting records and states information the accounting documents must contain. The paper accounting record and the electronic accounting record are the new terms that have replaced previously used terms – the written form of the accounting record and the technical form of the accounting record. In the amendment of *Act on Accounting*, the electronic accounting record has been specified as the accounting record made:

- in the electronic format, and received or made available in the electronic format, whereby the electronic format is determined by the issuer of the accounting record or is determined on the basis of agreements with the recipient of the accounting record;
- in accordance with *Act on Accounting* and sent electronically, for example as an attachment of an e-mail;
- in the electronic format for internal purposes of the accounting entity.

The accounting entity is required to ensure the credibility of the origin, the integrity of the content, and the legibility of the accounting record from the moment the accounting record is made (received, made available) until the end of the archiving period of 10 years. The credibility of the origin and the integrity of the content of the accounting record can be ensured (Blahušiaková, et al., 2022) by the signature of the responsible person, by electronic data exchange, or by the internal control system of the accounting records. The electronic data exchange can be understood as the computer-to-computer exchange of business documents in a standard electronic format among business partners, which goes through the processes of verification, coordination, approval, and recording in accounting books, without human intervention in the content of the accounting record. The signature can be either a handwritten signature, a qualified electronic signature or a similar verifiable signature replacing a handwritten signature in electronic form, which allows unambiguously

verifiable identification of the person who made the signature. The signature is accepted only if the person uses a personal access code (name, password, key) to enter the information system.

The transformation of the accounting record from the paper form into the electronic form, or vice versa, can be performed by a guaranteed conversion or by scanning into a file format in raster graphic form, saved in .pdf, .png, or .jpg format. The electronic accounting records can be stored on data storage device, such as optical drive, flash drive, memory stick, hard drive, cloud storage, and so on.

The amendment of *Act on Accounting* effective from January 1, 2022 requires companies to deliver all the required accounting documentation, such as the financial statements, the annual reports, the Announcement on the approval of the financial statements, auditor’s report and so on, only in the electronic form to the Register of Financial Statements (hereafter referred to as “Register”). The Register represents the information system of public administration that is administered by the Ministry of Finance of the Slovak Republic, which is responsible for establishment, maintaining, and operating the Register and for other duties arising from the *Act on Accounting*. The Register is divided into the public part and the non-public part. The public part of the Register consists of documents of almost all companies in the Slovak Republic if financial statements of these companies shall be publicly accessible besides those stated in the *Act on Accounting*. As of the January 1, 2022, all the accounting entities are required to deliver all the accounting documentation only in the electronic form into the Register. The process of filing the documentation is simplified and the errors are eliminated. The required documents are delivered via the electronic mailroom. The Financial Directorate of the Slovak Republic passes documents delivered in the electronic form on to the Register administrator. The Register administrator subsequently makes documents of accounting entities accessible in the public part of the Register to all persons through the website in the electronic form. The public part of the Register enables companies to have an access to financial statements of other accounting entities, so they can work with datasets including information from financial statements and compare their economic results, financial position, and financial performance with other companies.

As of the January 1, 2022, the communication between the Financial Administration Authority of the Slovak Republic (hereinafter referred to as “FAA”) and taxpayers is carried out only electronically through the Central Government Portal, Slovensko.sk. It reduces operating financial costs, decreases the number of printed paper documents and makes the communication between FAA and clients more effective. On the other hand, the outages of Internet or electricity, failure of the system may cause many problems, such as delays when delivering the documents electronically.

The issuers whose securities are admitted to trading on a regulated market in the European Union are required to publish a European Single Electronic Format for accounting periods beginning on or after January 1, 2020. It is a new uniform electronic reporting format for issuing annual financial reports. The provisions on a European Single Electronic Format included in the Transparency Directive are based on the premise that a harmonised electronic format for reporting would be highly beneficial for issuers, investors and competent authorities, as it would facilitate reporting and make annual financial reports easier to access, analyse and compare. This regulation does not relate with COVID-19 pandemic but it is a new issue that auditors had to deal with during the difficult times of the pandemic, and as well, it increases the level of automation in accountancy and auditor profession.

## 2.5. The level of automation in Slovak companies

Digitalization and automation are and will be connected with additional costs the accounting entities will have to bear, either for the technical and software equipment, or trainings of employees in the area of digital skills. Are the accounting entities ready for changes related with automation and digitalization? To what level are their business processes automated? The answers to these questions we have observed through the questionnaire survey.

The structure of respondents consisted of 37.1% of micro accounting entities, 28.0% of small accounting entities, 24.2% of large accounting entities, 5.3% of accounting entities under IFRS and 5.3% of other accounting entities. The respondents have their headquarters in all Slovak Regions. The most respondents have their headquarters in the Bratislava Region (39.4%), Žilina Region (16.7%), Prešov Region (9.8%), Trenčín Region (7.6%), Banská Bystrica Region

(7.6%), Nitra Region (7.6%), Trnava Region (6.1%), Košice Region (5.3%). Regarding the number of employees, almost 50% of respondents have been smaller accounting entities employing less than 10 employees (49.2%). Up to 22.7% of respondents employed more than 100 employees. Based on the legal form of accounting entities, most respondents were limited liability companies (77.3%), joint stock companies (15.9%), self-employed persons (5.3%). Two respondents were the organizational unit of a foreign accounting entity. The most respondents were accounting entities providing the services (63.6%), the accounting entities operating in the wholesale and retail (18.9%), and the accounting entities operating in the manufacture (17.4%).

Based on the results of our research, up to 29.5% of respondents have all business processes in the company fully automated (from orders, through purchasing of goods, invoicing, payments, up to accounting for, including automation of payrolls and warehouse). Other respondents have stated partial automation of only several processes. For example, up to 38.6% of respondents have integrated invoicing with accounting system; up to 37.9% of respondents have only communication with the Financial Administration Authority automated; up to 33.3% of respondents have interconnected payroll and accounting; up to 30.3% of respondents is using the electronic invoicing and electronic signature; and up to 17.4% respondents have reported the warehouse management automation. Some respondents have stated that they have most of the software and databases interconnected, which enables any employee to log in to the system from anywhere via the Internet. One respondent from the retail sector has stated that they have several processes within the company automated, they are still working on automation, but the physical presence of the employees is still necessary. One respondent (a joint-stock company operating in the engineering sector, with more than 100 employees) has reported that despite the full automation of all business processes, including electronic invoicing, the archiving of documents in their company is still carried out in the paper form.

The level of automation in accounting entities participating in our questionnaire survey based on the size of the accounting entity and legal form is stated in Table 1 and Table 2. As Table 1 shows, full automation of business processes we can see in 19 of 32 large accounting entities (59.4%). Only six small accounting entities (16.2%), and ten

micro accounting entities (20.4%) have business processes fully automated. The results of our research also proved that six of seven accounting entities under IFRS have their business processes fully automated. Self-Employed persons automate their business processes at the lowest level. As the results of our research proved, one self-employed person has warehouse management automation, one is using electronic invoicing and signature, but on the other hand six self-employed persons have automated communication with FAA. Based on these results, we assume that bigger accounting entities automate business processes to a much greater extent than smaller ones. The questionnaire survey has also proved that most accounting entities have automated invoicing with accounting system (51 respondents), electronic communication with FAA (50 respondents), and integrated payroll with accounting system (44 respondents), as well as electronic invoicing and signature (40 respondents).

**Table 1** The level of automation based on the size of accounting entity

Automated Processes	Large AE	Small AE	Micro AE
Fully automated processes	19	6	10
Warehouse management automation	7	7	7
Automated payroll tool integrated with accounting system	11	13	19
Automated invoicing integrated with accounting system	14	19	18
Electronic invoicing and signature	6	10	23
Communication with FAA	6	14	24
<b>Total sum of individual types of accounting entities</b>	<b>32</b>	<b>37</b>	<b>49</b>

**Source:** Own research based on questionnaire survey  
Legend: AE – accounting entity

Based on results shown in Table 2, we can see that more than a half of joint stock companies (57.1%) have fully automated business processes. From nine joint-stock companies, which do not have fully automated business processes, up to eight companies have warehouse management automation, automated payroll, invoicing and also the communication with FAA. Only 28 from 102 limited liability companies have their business processes fully automated. Up to six limited liability companies have automated payroll, invoicing, as well as warehouse management automation. Up to fifteen limited liability companies have reported automation in payrolls and invoicing synchronously; up to thirty respondents have stated interconnection between

payroll system and accounting software; and up to 38 respondents have automated only invoicing that is interconnected with accounting software.

**Table 2** The level of automation based on the legal form

Automated Processes	Joint-stock company	Limited Liability Company
Fully automated processes	12	28
Warehouse management automation	8	13
Automated payroll tool integrated with accounting system	9	34
Automated invoicing integrated with accounting system	8	42
Electronic invoicing and signature	5	33
Communication with FAA	9	35
<b>Total sum of individual types of accounting entities</b>	<b>21</b>	<b>102</b>

**Source:** Own research based on questionnaire survey

The results of our research also proved that one of two organizational unit of foreign accounting entity has fully automated business processes.

Up to 65.2% of all respondents have reported that they had implemented automation and digitalization on their own, up to 44.7% of respondents had used services of external company for these purposes. Based on this, we can state that up to 9.9% of respondents combines these two variants – some processes they have implemented by themselves, some processes through external supplier.

Up to 52.3% of respondents have reported additional costs related to automation of businesses processes, while 47.7% of respondents have not reported any additional costs related to automation. Up to 19.7% of respondents have stated no or minimal automation costs. Up to 21.2% of respondents have stated automation costs up to 10% of the total costs. Automation costs in the amount of 11 – 50% of the total costs have been reported by 4.5% of respondents. According to respondents, the costs are related mainly to the purchase of technology, software, payments for external data storage, payments for electronic communication, and electronic signature.

## Conclusion

The paper focuses on digitalization and automation of business processes which, nowadays, create an integral part of business practice. Activities surrounding order processing, order tracking, invoicing, accounting, payroll processing, or inventory management are the main candidates for automation.

Digitizing of accounting records requires to store these data in cloud storage so that anyone in the company had the access to them. Cloud based documentation enables flexibility and security. We agree with Avokaado (2021) who recommend establishing the integral cloud-based document management system in order to avoid the inefficiency of on-premise paper documentation. This computer-based system is defined as system that receives, tracks, manages, and stores documents, and which offers many benefits at the same time. The main benefits are reducing expenses, optimizing and simplifying the internal processes, increasing of security, and social sustainability. The DMS could be integrated with other company's applications, systems, and software.

Another system designed to integrate and optimize the business processes and transactions in companies is the enterprise resource planning system, which is according to Moon (2007), Ruivo et al. (2020) used for management and coordination of all sources, workplaces and functions of business sphere through shared data storage. The ERP can be interconnected with e-shop, which leads to centralization of all the e-shop agendas in one place. Many companies use automated invoicing, automation of warehousing, electronic signature, or e-invoicing in their practice. As the practice showed, automation and digitization save costs, time, increase security, transparency, reliability, and company's credibility for its customers, as well as reduce errors or the number of complaints. On the other hand, there are some challenges that are faced by both, small and large organizations during ERP implementation (Mahmood et al., 2019; Janssens et al., 2021; Nikitović & Mahmutović, 2019), such as data security, cloud awareness, functionality limitations, or subscription expenses. The ERP implementation is a cost demanding for every organization.

Nowadays, autonomous mobile robots are still more often used to make processes in warehouses, manufacturing, terminals, or hospitals, more effective. Despite many advantages the AMRs bring, there are some authors who mention the limitations in moving of AMRs.

HR processes are also the area where we can see the growing trend of automation and technological progress. As several researchers (Balasundaram & Venkatagiri, 2020; Slavić, et al., 2017; Herm, et al., 2021) state, monitoring and recording attendance, absences, sick leave,

trainings, employee contracts are due to the information technology faster and easier. The use of chatbots or RPA leads to an increase in skills, job satisfaction and an increase in the level of job enhancement as perceived by employees. Still more and more companies use social network sites in recruitment processes.

As our research, as well as previous research and practice, shows, information technology plays an important role in all spheres of business processes, making them faster, simpler, safer, more reliable, and less error-prone.

As the practice proved, the legislation has to reflect changes in business processes resulting from automation, digitalization, and increasing number of electronic documents. Amendment of *Act on Accounting* effective from January 1, 2022 brought some changes related to automation, to which belong amendments in the area of Register of financial statements, electronic signature, as well as the definition of the electronic accounting record and its equality with the paper accounting record.

Regarding the growing level of automation in business processes resulting partially from the COVID-19 pandemic, we have performed a brief research among companies in the Slovak Republic. The aim of the research was to investigate the level of automation in the Slovak companies. We found out that companies in the Slovak Republic have their business processes more or less automated. The COVID-19 pandemic with its meeting and moving restrictions has also affected the level of automation in the Slovak accounting entities. The paper form of documents has been gradually replaced by their electronic form, which has contributed to increasing level of automation in the Slovak companies.

The bigger companies, especially those presenting their financial statements in accordance with IFRS and joint-stock companies, are usually on higher level of automation in comparison with smaller accounting entities, which are not able to spend so much money on purchasing and implementing of these automated systems. The bigger companies dealing with large number of documents usually benefit from automation. Accounting, payroll processing, internet banking, communication with FAA are the main areas, where we can see the highest level of automation in almost all responded accounting entities. Up to 40.9% of respondents have reported automation costs in the amount up to 10% of the total costs.

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processes require high level of cyber security, which belongs to the main challenges the companies have to face. Internet and electricity outages can also be a complication, when a company automates its business processes, because the employees would not have the access to the company's data. When thinking about automation and digitalization of their business processes, companies should compare the costs for technical and software support for automation with benefits the automation brings to them.

Automation and digitization are linked with many challenges the companies have to consider. Only their implementation will show the companies' readiness for that. Our research of the level of automation among the Slovak companies was based on a very low number of returned questionnaire surveys. Moreover, the questionnaire survey was very brief and aimed only to find out the basic information about the level of automation. More detailed analysis of level of automation in Slovak companies, their readiness for that, challenges, limitations, pros and cons of automation are issues that could be the topic for the future research.

## Acknowledgements

This paper has been supported by the VEGA project 1/0121/21 "The Analysis of Impact of Crises Related to COVID-19 on Financial Health of Entities in the Slovak Republic"

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#### ✉ Correspondence

##### Miriama Blahušiaková

Faculty of Economic Informatics, University of Economics in Bratislava  
Dolnozemska cesta 1/b, 852 35 Bratislava, Slovakia  
E-mail: miriama.blahusiakova@euba.sk