



Research Article

# Enterprise Resource Planning based on Cloud Computing (Cloud ERP)

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## Abstract

Enhancing enterprise management and streamlining business processes can be achieved through the use of a variety of IT tools and means, most notably integrated ERP (Enterprise Resource Planning) IT management systems. The considerable functional scope of ERP systems enables IT support of almost all areas of enterprise activity. Cloud ERP is a trend in the development of ERP systems that is relatively new and gaining popularity in recent years. In recent years, there has been growing interest in ERP systems offered in the Cloud Computing model (Cloud ERP), as their ease of implementation, lack of need for in-house IT infrastructure, and low input costs mean that smaller companies can also benefit from this class of systems. Currently, almost all providers offer ERP systems in the Cloud Computing model. The purpose of the article is to identify the trends and directions of development of Cloud ERP systems. In order to realize the purpose of the article, the characteristics of ERP and Cloud ERP systems were briefly presented beforehand.

**Keywords:** Enterprise Resource, Computing, Cloud ERP.

## Introduction

ERP (Enterprise Resource Planning) systems are widely used in various types of enterprises to support management and streamline the implemented business processes. The considerable functional scope of ERP systems enables IT support of almost all areas of enterprise activity. The possibility of generating multidisciplinary reports in ERP systems supports the managerial staff of enterprises in

efficiently and effectively obtaining the necessary information, which is crucial in supporting decision-making processes. Currently, ERP systems streamline both internal business processes and those occurring in the immediate environment of the enterprise, i.e. those carried out jointly with providers and customers. ERP systems, by integrating all processes and also supporting the circulation of data and documents, facilitate the implementation of

strategic objectives and play a key role in the digital transformation of enterprises.

ERP systems can be acquired and operated in the on-premise model (relying on the customer's own IT resources) or in the Cloud Computing model (using the ERP system in the form of a paid e-service made available on the provider's IT infrastructure). In recent years, there has been growing interest in ERP systems offered in the Cloud Computing model (Cloud ERP), as their ease of implementation, lack of need for in-house IT infrastructure, and low input costs mean that smaller companies can also benefit from this class of systems. Currently, almost all providers offer ERP systems in the Cloud Computing model. The purpose of the article is to identify the trends and directions of development of Cloud ERP systems. In order to realize the purpose of the article, the characteristics of ERP and Cloud ERP systems were briefly presented beforehand.

### Outline and Evolution of ERP Systems

Enhancing enterprise management and streamlining business processes can be achieved through the use of a variety of IT tools and means, most notably integrated ERP (Enterprise Resource Planning) IT management systems. The term ERP has appeared in the 1990s, and has gained popularity since then (Nguyen, Nguyen, Misra 2014). In general, Enterprise Resource Planning (ERP) system is a set of business software packages for integrating and optimizing the process of business management (Almajali et al. 2022). A broader definition of an ERP system specifies that it is a packaged business software that automate and integrate the business processes of an organization, manage a common database across enterprise and access information in real time environment (Marnewick, Labuschagne 2005). In another view, ERP systems are defined as extensive software systems that integrate a number of business processes, such as manufacturing, supply chain, sales, finance, human resources, budgeting, and customer service activities (Weinrich, Ahmad, 2009), or as a complete and systematic management platform based on information technology, employing sophisticated enterprise management concepts, inheriting all company resource information, and providing organizations with decision-making, planning, control, and business performance evaluation (Hong, Zhongmin: 2020). ERP systems are also seen as a solution that organizes and integrates operational processes and information flow to optimally utilize resources such as people,

materials, money, and production machinery (Issar, Navon: 2016). As a result, ERP systems make it possible to comprehensively handle the core business areas of enterprises, and the use of a single central database ensures the interoperability of the various modules of the system forming an integrated IT system, the consistency of economic processes, and facilitates the generation of cross-sectional reports describing the current state of the enterprise, which affects the efficiency and effectiveness of decision-making by managers at various levels of management. ERP systems provide integration of data and optimization of their flow which allows faster identification of problems within the enterprise and emerging opportunities in the immediate environment.

The ERP system makes it possible to eliminate domain systems provided by different providers, which limited the flow of information and support of complex business processes often carried out within several areas of the enterprise. With an ERP system that comes from a single provider and integrates all of the processes carried out in the enterprise, users enter data once (which automatically updates the state of the system and becomes visible to other users) and each uses the same interface. ERP systems enable the realization of modern organizational and structural forms of enterprises, in which all data resources, management procedures, control and regulation of business processes (occurring both inside and outside the enterprise, i.e. together with partners) can be implemented with the support of information and communication technology. For this reason, ERP systems can be counted among the most extensive and complex IT systems supporting enterprises, which makes the purchase and implementation of an ERP system one of the most important and costly investments in information technology in organizations.

Among the most important properties of ERP systems are (Dziembek 2021, Gunia 2020):

- Functional comprehensiveness – ERP system can cover almost all spheres of technical and economic activity of the enterprise.
- Modular/component design – allows the ERP system to be implemented in stages and to implement only those of its areas that, given the nature of the enterprise and the specifics of its operations, are necessary.
- Substantive advancement – manifests itself in the support of information and decision-making processes and the incorporation of free data

extraction mechanisms, variants, optimization and forecasting, as well as the ability to apply management methods such as TQM (Total Quality Management) or JIT (Just in Time) in ERP systems.

- Technological advancement – compatibility of the ERP system with current hardware and software standards and the possibility of further development.

- High degree of integration – a significant degree of integration of procedures and data both within individual modules of the ERP system and in connections with other IT systems (including external ones).

- Process orientation – ability to provide comprehensive information support for individual business processes, rather than individual elements of the company's organizational structure.

- Flexibility – ability to adapt the ERP system to the needs of the enterprise and the ability to increase its functional scope and its operational parameters as the needs and requirements of the users increase.

- Openness – scalable architecture of the ERP system and the ability to expand the system with new modules and connect it with external systems.

- Regulatory compliance – the ERP system is compliant with the laws and rules of the country (e.g. the Accounting Act).

Originally, ERP systems were dedicated to large enterprises engaged in manufacturing activities. Basically, the development of ERP systems followed from systems (Bhadra et al. 2019, Berić et al.: 2018, Turek, Dziembek: 2018):

- IC (Inventory Control) systems – came into being in the late 1950s in production companies and supported stock records and warehouse management.

- MRP (Material Requirement Planning), the main task of which was to reduce inventories, determine production costs, control production stages and determine delivery times for raw materials and components for production; in addition, Closed Loop MRP was developed, which

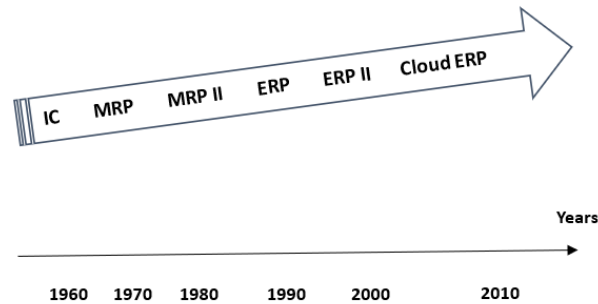
considered inventory and material supply planning in a closed loop of the production process.

- MRP II (Manufacturing Resources Planning), which additionally included planning and control of other production factors (human, machine and monetary resources) and enabling production planning, business planning, inventory and supply management, demand management and sales.

- ERP, which saw the full integration of the previous MRP and MRP II standards into virtually all spheres of the company's operations, i.e.: accounting, finance, controlling, marketing, human resources management or project management, along with strategic management tools.

- ERP II, which has been oriented towards cooperation with other IT systems of customers, cooperators and providers of a given enterprise, as well as automation of processes and exchange of data between cooperating business entities with active use of Internet technologies (e.g. XML). Systems such as CRM (Customer Relationship Management) and SCM (Supply Chain Management) supply chain management, among others, have been built into ERP II. In addition, access to the ERP system has become possible via web browsers (Web-based ERP) and mobile devices.

- Cloud ERP is a trend in the development of ERP systems that is relatively new and gaining popularity in recent years. Cloud ERP is typically an ERP system delivered as a service over the Internet and involves transferring the use of an ERP system from an enterprise's own local infrastructure to a web-based processing platform run by the system provider. The ERP system provider takes care of system maintenance, updates and data security, and the recipient does not buy a license, but leases the ERP system on an annual or monthly subscription basis. The evolution of ERP systems is shown in Figure 1.



**Fig. 1. Evolution of ERP class information systems**

*Source: Authors' own elaboration of Bhadra et al. 2019*

Modern ERP systems can be classified due to various criteria. One of them is the previously mentioned division based on the way ERP systems are installed and used, i.e. the on-premise model (where the ERP system is installed locally on a given enterprise's own servers) and the Cloud Computing model (where the ERP system is located on the provider's servers and used by the recipient via a web browser). ERP systems can be differentiated as universal (can be used in different types of enterprises regardless of their industry), dedicated i.e. designed for a specific industry (e.g. telecommunications, energy, automotive or food industry) or be created from scratch and tailored to the specifics of a particular enterprise (nowadays increasingly rare cases). ERP systems can also be classified into commercial (paid) systems offered by large providers (e.g. SAP, IFS, Infor) which are characterized by the need to incur significant costs including the purchase of licenses, implementation services and maintenance, and open-source systems (allowing free or low-cost use of the ERP system – such an example is the Odoo system). According to another division, ERP systems can be grouped as domestic (offered by providers and used only in one country, e.g. in Poland – Sage Symfonia, Soneta enova365) and international (provided by

multinationals and used in many countries, e.g. SAP S4/HANA, Oracle Cloud ERP, Microsoft Dynamics 365 Business Central). According to the last classification, one can distinguish between process-support ERP systems (in which there are modules and the ability to run functions to support the implementation of a given business process, but the activities and entire processes can occur independently of the company's modeled processes in external applications) and process ERP systems (in which the modules and functions are abandoned and the business process modeling tools are tightly integrated with the ERP system, which means that the modeled process, e.g. in BPMN notation, must be accurately implemented in the ERP system, and users can see exactly what tasks they have to perform in a given process). Process-enabled systems are the vast majority of current ERP systems. An example of a process-enabled ERP system is the Assec3o MERIT ERP system.

The proper implementation of an ERP system can provide an enterprise with many benefits considered in various dimensions. A presentation of the most important benefits of ERP systems grouped into several dimensions is shown in Table 1.

**Table 1. Benefits of implementing ERP systems**

<b>Benefits of proper ERP system implementation</b>	
<b>Dimension</b>	<b>Description</b>
Operational	Cost reduction (through e.g. improved timeliness of order fulfillment, effective calculation of profitability of individual purchases, automation of operations and activities, increased productivity through effective scheduling, verification of production plans and standards, reduction of inventories, rapid identification of cost-intensive activities, reduction of unnecessary or manual tasks), time reduction (through e.g. streamlining and acceleration of tasks, efficient acquisition of information in various cross sections and faster communication and response), improvement of quality (through e.g. control of entered data which reduces errors, greater accuracy, ongoing analysis of consumed resources).
Processes	Increasing the efficiency of business processes (through e.g. elimination of unnecessary activities, better use of resources and reduction of unnecessary costs through ongoing monitoring of their consumption, the ability to plan, monitor, verify and then reorganize internal and external processes, which enables faster response to changes in the environment), the ability to use ready-made business process templates and implement in them good practices used by companies that are leaders in their industry.
Data processing, document circulation and information flow	Acceleration of data processing (through e.g.: introduction of a centralized database, widespread validation of recorded data, unification of classifications, nomenclatures and registers in each organizational unit of the enterprise), increasing the speed of flow and availability of information in digital form, which improves cooperation between internal departments and contractors of the enterprise, improvement of security of processed data (e.g. by establishing data entry rules, unifying communication rules, precisely defining user roles and rights, which altogether increases the level of credibility of information resources), greater accuracy, reliability and transparency of information (the ability to define customized reports and statements, generate rules for document circulation and create legible documentation).
Management	Streamlining decision-making processes, improving the efficiency of managers' activities in the area of planning (through, for example, access to comprehensive data on the activities of the entire enterprise and its branches, the ability to create simulations and forecasts) and control (through, for example, ongoing monitoring, automatic generation of reports on the achievement of the assumed goals or exceeding the established norms and limits), and optimizing the management of tangible, intangible, financial and human resources (real-time access to comprehensive data on the current and past state of the enterprise and the processes implemented and resources used).
Strategic	Assisting in the implementation of digital transformation, support in the establishment of business alliances and links with external business partners and the implementation of new business models (e.g., implementation in the ERP system of different management methods, the ability to implement specific modules, define different powers and competencies of partners) and also facilitating the creation of business innovations (e.g. by analyzing and processing data and generating valuable information and knowledge, recording guidelines and effects of activities, exchanging data with partners) and providing business flexibility for current and future changes of the enterprise (dynamic adjustment of needs in terms of number of users, used modules and add-ons, etc.).
Organizational	Changing work performance patterns and transforming the enterprise into an organization that bases its activities on information, eliminating information asymmetry, strengthening the enterprise (e.g., a leader in digital transformation), developing user knowledge and competencies, building a common vision for the organization, facilitating organizational learning, moving toward an intelligent organization

Source: Authors' own elaboration based on Sadrzadehrafiei et al. 2013, Susanto, Meiryani 2018, Golarz 2017, Sari et al.: 2012

ERP systems also have some disadvantages and limitations, which include primarily (Murphy, Wood 2011, Waściński 2012): the significant cost of purchasing, implementing and maintaining and supporting the system and the need for additional expenditures (e.g., replacement of computer and network hardware, additional consulting), the complexity and time-consuming nature of ERP system implementation (resulting,

among other things, from tailoring the ERP system to the needs of the enterprise, analysis and reorganization of processes, staff training, testing and integration with other systems), inflexible licensing methods (licenses usually sold for a longer period of time, e.g., 1 year, with no possibility of return before their expiration), significant time expenses incurred in updating the ERP system and troubleshooting, significant

risk of poor choice of ERP system or its ineffective implementation, which may result in failure to meet important needs and expectations of the recipient, and the possibility of lack of professional support from the provider during or after implementation of the ERP system. Some of the above disadvantages and limitations may be offset by the Cloud ERP systems that have been developing rapidly in recent times.

### The Essence of Cloud ERP Systems

Companies interested in implementing ERP systems nowadays do not have to consider and use only a model based on their own IT resources (on-premise) and use various forms of traditional IT outsourcing. In recent years, as a result of the rapid development of information and communication technologies, the rapid increase in the amount of stored and processed data, competition in the ICT market, as well as the popularity of outsourcing services and the ubiquity of Internet access, the possibility of using ERP systems in a service model based on cloud computing has emerged and developed. In the Cloud Computing model, customers can use ERP systems in the form of services, accessible through ICT networks (usually the Internet).

Cloud computing is currently one of the most important trends in the IT market, redefining the way various technologies (e.g. ERP systems) are created, developed, deployed, scaled, updated, maintained and paid for. A general definition according to NIST states that Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g.,

networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell, Grance: 2011). Cloud Computing can also be defined as an IT service model in which computing services (both hardware and software) are delivered to customers on demand over a network in a self-service manner, regardless of device or location (Marston et al 2011). Another definition emphasizes that cloud computing is a computing model that is based on the use of IT services provided by external organizations (Raczko: 2015). Based on the above definitions, it can therefore be seen that, unlike the on-premise model, cloud computing ERP systems are offered as a paid e-service running on the IT provider's infrastructure, which the recipient can use remotely and regardless of his location and the type of device he has. There is no universally accepted definition of Cloud ERP systems in the literature and they are sometimes referred to as SaaS ERP and as ERP as a Service (Hao, Helo 2014). Synthetic approaches specify that Cloud ERP is nothing more than hosted ERP on a Cloud provider (Kiadehiand Mohammadi: 2012) or that Cloud ERP is package software delivered by the Internet that consist of all the solutions to manage simplified and standard business flows on a web-based architecture (De Maria et al.: 2011), or that Cloud ERP is basically a type of Enterprise Resource Planning software that is hosted on a cloud computing platform, rather than on-premises within an organization's own data center (Aulia et al. 2019). A summary of the key differences between traditional ERP (on-premise model) and Cloud ERP is presented in Table 2.

**Table 2. Comparison of ERP system (on-premise) and Cloud ERP system**

Aspect	Traditional ERP (on-premise)	Cloud ERP
Costs	Higher initial costs (licenses), usually annual maintenance costs, possibility of return on investment	Low and predictable initial costs (e.g. monthly), no maintenance costs
Customization	High opportunities for customization	Low opportunities for customization
Deployment	Usually in a local Data Center	Usually on a provider's server
Ability to reduce IT staff	Small	Large
Updates	Difficult (performed manually by IT staff)	Easy (performed automatically by provider)
Internet access	Not necessary	Necessary
Control over the system	High	Limited

Technical infrastructure	Requires investment in infrastructure (e.g. servers, backup equipment, air conditioners, UPS, etc.).	No technical infrastructure, all necessary equipment is provided by the provider
Typical customers	Large enterprises, with significant budgets and extensive IT infrastructure	Small and medium-sized enterprises with limited financial capabilities
Mobility	Access possible but requires additional investment	Access possible from anywhere
Data security	Responsibility of the enterprise	Responsibility of the provider
Implementation time	Rather long	Rather shorter

*Authors' Own elaboration e.g. Hadidi et al: 2020*

In general, Cloud ERP is defined as an Enterprise Resource Planning system that is hosted in a cloud computing environment and provides flexibility, adaptability, scalability, availability and cost-effectiveness for enterprises (Nguyen et al.: 2018). It can be assumed that combining the effects of an ERP system and the potential of cloud computing can provide new and much better IT solutions to support businesses today.

When considering the specifics of cloud computing, it is necessary to take a closer look on the implementation methods used in it and the typical services relevant to the provision of Cloud ERP. Due to the way of implementation and dissemination of cloud computing, which is related to the location of the infrastructure in which the provision of services takes place and the adopted principles of processing, one can distinguish: public cloud (available to the general public of interested enterprises, organizations and individual entities), private clouds (created and available only to a single enterprise or entity), partner clouds (available to a strictly defined group of organizations), hybrid clouds (a combination of different types of clouds, e.g. public and private).

ERP system providers can offer enterprises the use of Cloud ERP in different types of clouds. The use of an ERP system in the public cloud is a typical service model characterized by multi-tenancy (i.e. that the system is used by multiple companies, but their data are separated), no need to purchase licenses, operating the system through a web browser and making a monthly payment (dependent on the number of users, for example). The ERP system in the public cloud does not require recipients to bear the costs of purchasing the establishment and development of their own server room and having numerous IT staff. This form of ERP system usage can be particularly beneficial for small and medium-sized enterprises with limited financial

capabilities and without their own IT specialists. The public cloud typically does not provide the enterprise with full control over where the ERP system's data are stored, and does not offer significant customization options for ERP systems.

When using a private cloud ERP system, the enterprise in question does not share the system with other enterprises (the ERP system is only used by one enterprise), which can be important from a data security perspective. An ERP system offered in a private cloud resides on a separate server (usually virtual) and has significant customization capabilities to meet the specifics and current and future needs of the enterprise. An ERP system hosted in a private cloud also features flexibility, scalability and performance, and can be paid for using the subscription method but it is also possible to purchase a license. The interface to the ERP system in this case can be a special application or a web browser. A private cloud can be located by an enterprise in its own data center, which requires significant expenditures (not only for the necessary infrastructure but also for the IT team and the maintenance and development of IT resources). In this case, the company's IT staff manages the IT infrastructure necessary for the private cloud. Another option is to use the ERP system in a private cloud created for the enterprise in the data center of the ERP system provider or a cooperating entity. In such a configuration, responsibility for managing the public cloud infrastructure is transferred to the provider (or its partner). The construction and/or use of a private cloud involves incurring significant costs, which means that such a solution will not be of interest to companies with limited financial capabilities (e.g. SMEs).

Another scenario is the use of a hybrid cloud ERP system, i.e. a combination of public and private cloud. In this case, companies, analyzing their

own needs and capabilities, determine with the provider which elements of the ERP system will function in the public cloud (e.g. CRM) and which in the private cloud (e.g. Finance and Accounting, Production, Logistics, etc.). Such a solution ensures that the positive effects characteristic of both the public and private cloud are achieved, and most of the limitations and problems associated with their use are eliminated. On the other hand, an ERP system provided in a partner cloud may be of interest to a group of companies belonging to a single owner, or companies linked by capital or establishing permanent cooperation. Such a solution has similar characteristics to a private cloud.

Cloud computing generally offers several categories of typical services, which include:

- Infrastructure as a Service (IaaS) – the ability to use a variety of hardware solutions (i.e. servers, virtual machines and computing power, disk space, communication devices and operating systems);
- Platform as a Service (PaaS) – the ability to use a development environment that enables the creation, testing, and development of software;
- Software as a Service (SaaS) – the ability to use various types of applications (e.g. ERP systems, but also CRM, BI) along with additional provider services for software maintenance and development.

In the case of IaaS, ERP systems are installed and configured by enterprises on ICT infrastructure rented from providers. Enterprises purchase ERP system licenses and select the IT infrastructure offered in the service model to best suit the enterprise's needs. IaaS is characterized by scalability, so it can be dynamically adjusted as the demand for computing power necessary for the ERP system to function properly increases/decreases.

The PaaS model for ERP essentially offers the ability to develop, test, and distribute software (including ERP) as SaaS. PaaS is a specialized service that can only be an interesting option for IT companies or companies with a development team interested in further developing Cloud ERP systems in a specific development environment. Other enterprises will not use the ERP system in the PaaS model (in general, it is not possible for enterprises to use the ERP system in a single PaaS service). Enterprises will be able to use the ERP system in the case of a combination of PaaS and IaaS service.

In the SaaS model, the provider provides, maintains and develops the ERP system in the Internet space and a single enterprise (Single-tenant SaaS) or a larger number of enterprises (Multi-tenant SaaS) can use it remotely after signing a contract and paying a fee. The communication interface for employees of a given enterprise who use an ERP system offered in the SaaS model is usually a web browser. By choosing to use an ERP system in the SaaS model, an enterprise avoids investing in its own server infrastructure, and does not incur the costs of its administration and development, as the IT system is located in a Data Center owned by the software provider (or a cooperating entity). The necessary minimum to use an ERP system in the SaaS model is a computer or other device (tablet, smartphone) with access to the Internet. The ERP system offered in the SaaS model has a centralized structure, becoming available to users regardless of their physical location and the parameters of their device (e.g. operating system). Fees for the use of an ERP system are charged in the form of a subscription, the amount of which is determined mainly by the number of users. In some cases, subscription fees may be conditioned by the functional scope of the ERP class system in use or the amount of data processed in it. The provider bears full responsibility for the proper functioning of the ERP class system in the SaaS model. Multi-tenant SaaS is the most popular cloud ERP model and is designed for use by multiple enterprises and multiple users simultaneously, so the provider for each user must provide separate, dedicated, and properly secured server space. A multi-tenant SaaS ERP system does not offer significant customization opportunities for an enterprise, while choosing a single-tenant SaaS ERP system, on the other hand, offers an enterprise a greater ability to customize its ERP system.

### **Benefits and Risks of Implementing Cloud ERP Systems**

Using a Cloud ERP system can provide businesses interested in using it with many benefits, but there are also some risks associated with this form of software sharing and use. Table 3 summarizes the main benefits and risks of using Cloud ERP systems in the SaaS model, considered in five dimensions and presented from the point of view of enterprises (service recipients). It should be noted that not in every case the presented benefits of using Cloud ERP systems (SaaS model) will be noticeable and measurable for enterprises. In particular, the specifics of the enterprise and the characteristics of its



processes, the properties of a given Cloud ERP system, the course of the implementation process and the approach and professionalism of the

provider all determine the occurrence and measurability of the presented benefits.

**Table 3. Benefits and risks associated with the use of the Cloud ERP system (SaaS model)**

Dimension	Benefits associated with the use of Cloud ERP system (SaaS model)	Risks associated with the use of Cloud ERP system (SaaS model)
Strategic	<ul style="list-style-type: none"> <li>• Focus of the enterprise on core competencies and business development.</li> <li>• Greater flexibility of the business and support for the implementation and coordination of jointly implemented processes with business partners.</li> <li>• Lower IT barriers to innovation (e.g., faster launch of new business projects).</li> <li>• Support for global and mobile business operations.</li> </ul>	<ul style="list-style-type: none"> <li>• Partial dependence of the recipient on an external ERP system provider resulting in, among other things, a weakened ability to manage the IT area.</li> <li>• Lack of full control over ERP system data and the possibility of leakage or loss of critical information resources preventing or impeding the achievement of strategic goals.</li> </ul>
Organizational	<ul style="list-style-type: none"> <li>• A faster and easier way to acquire and implement the Cloud ERP system (along with a package of specialized services), necessary for the day-to-day operations of the company.</li> <li>• The use of Cloud ERP is independent of the geographic location of the enterprise and employees (support for mobile and telecommuting staff),</li> <li>• Ease of use of the Cloud ERP system by the enterprise's staff ("friendliness" of the software based on a familiar interface – i.e. a web browser), which reduces the time of system implementation, adoption and training of employees.</li> <li>• Transfer of responsibility for the operation of the Cloud ERP system to the provider (use of <i>IT outsourcing</i>).</li> <li>• Ability to dynamically add/subtract the required functionality of the Cloud ERP system depending on the current needs of the enterprise.</li> <li>• Faster and easier integration with other IT systems and services based on <i>Cloud Computing</i>.</li> <li>• Ability to standardize and simplify organizational procedures related to the use of Cloud ERP.</li> </ul>	<ul style="list-style-type: none"> <li>• Internet network failures preventing access and use of the Cloud ERP system.</li> <li>• Incomplete customizability of the ERP system.</li> <li>• Possibility of functional differences between the Cloud ERP system and ERP on premise.</li> <li>• Possibility of legal problems (different regulations in different countries, unfavorable contractual provisions, lack of model procedures, etc.).</li> <li>• Immaturity of the market generating the risk of cooperation with an unprofessional Cloud ERP system provider (e.g. possibility of sudden closure of the provider's business).</li> <li>• Risk of loss of knowledge in the IT area.</li> </ul>

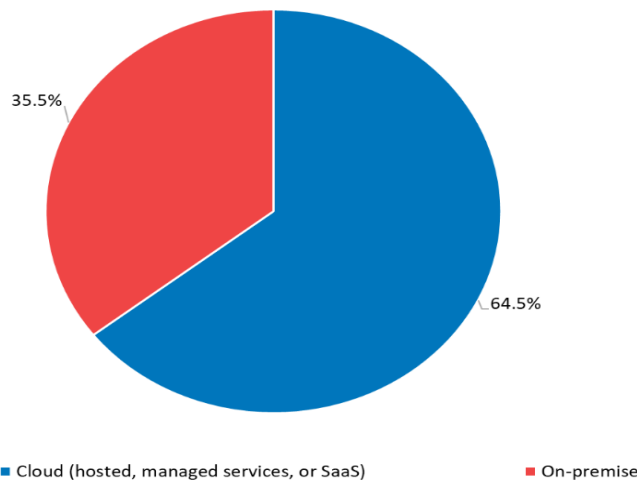
<b>Economic</b>	<ul style="list-style-type: none"> <li>• No need to purchase and develop hardware and software infrastructure (e.g., servers, NAS, UPS, databases) constituting the operating environment of the Cloud ERP system.</li> <li>• No need to incur costs associated with the planning, launch and maintenance of specialized premises (own Data Center) necessary for the secure operation of the Cloud ERP system.</li> <li>• Low cost of acquiring and using the Cloud ERP system (monthly subscription), which, together with the above-mentioned benefits, makes it possible to convert CAPEX investment costs into OPEX maintenance costs of the ERP system spread over time.</li> <li>• Less need for IT specialists (reducing the cost of acquiring, maintaining and developing administrators, including avoiding problems related to turnover, vacations, training, etc.).</li> <li>• Relatively lower costs of upgrading, updating and developing Cloud ERP systems (<i>upgrade</i>).</li> <li>• Reduction of investment risk in terms of Cloud ERP system.</li> <li>• Ability to avoid the cost of upgrading existing computer sets.</li> <li>• Better predictability of costs associated with the use of the Cloud ERP system.</li> </ul>	<ul style="list-style-type: none"> <li>• Significant costs incurred for high-bandwidth Internet connections (main link and backup link).</li> <li>• Need to incur expenses for integrating data from the previously used Cloud ERP system.</li> <li>• Possibility of incurring higher than expected costs due to unsatisfactory service levels.</li> <li>• Risk of not taking into account the hidden costs of using Cloud ERP systems (the cost of finding a provider, organizing implementation work, monitoring and coordinating Cloud ERP system activities, interacting with the provider to maintain the Cloud ERP system, etc.).</li> </ul>
<b>Technical</b>	<ul style="list-style-type: none"> <li>• Opportunity to benefit from a technologically and substantively advanced ERP system, previously available mainly to large enterprises.</li> <li>• Reliable enterprise access to the Cloud ERP system (availability of more than 99%).</li> <li>• High level of security in the collection, processing, transmission and archiving of data collected in the Cloud ERP system.</li> <li>• Possibility of professional and flexible technical support for the Cloud ERP system.</li> <li>• Constant access to the most up-to-date versions of the ERP system (taking into account legal changes, noted errors, etc.); version changes take place in a way that is unnoticeable to the user.</li> <li>• High scalability (in terms of the number of users) and considerable flexibility of the Cloud ERP system.</li> <li>• No need to install and configure software for remote access to Cloud ERP systems.</li> <li>• Ability to improve the performance of the Cloud ERP system (dependent on Internet bandwidth).</li> <li>• Significant independence of the Cloud ERP system in use from the type and performance of the users' computer hardware and the system software used by the enterprise, as well as reducing the occurrence of conflicts regarding hardware-software configurations.</li> </ul>	<ul style="list-style-type: none"> <li>• Likelihood of the occurrence of temporary performance degradation of the Cloud ERP system due to a temporary reduction in Internet bandwidth.</li> <li>• Possibility of occurrence of difficulties in data migration (e.g. from a previous ERP system).</li> <li>• Possibility of difficulties in integrating with other (e.g., previously used) IT systems.</li> <li>• Potential risk of creating in-house additional functionalities that are necessary for the enterprise and are not present in the Cloud ERP system.</li> <li>• Risk of unsatisfactory technical performance of the Cloud ERP system (e.g. scalability, security, etc.).</li> </ul>

<b>Social</b>	<ul style="list-style-type: none"> <li>• Protecting the environment by limiting energy consumption and reducing emissions of harmful substances (carbon dioxide emitted during energy production in conventional power plants).</li> <li>• Reducing business travel by providing freedom and mobility for users and specialists.</li> <li>• Activating employees to make deeper and wider use of Internet technologies in the business sphere and in the sphere of private life.</li> <li>• Development of employees' knowledge and stimulation of further development of new IT technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• Possibility of disruption of private (e.g. family) relations due to more frequent use of the Cloud ERP system (e.g. at the place of residence, during vacations, etc.).</li> <li>• Risk of loss of full anonymity of employees – users of the Cloud ERP system (collection of data by the provider regarding technical data of the device, software and even personal data, which may result, for example, in receiving spam).</li> </ul>
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Source: Authors' own elaboration based on Dziembek: 2014

The presented list of benefits and risks regarding the operation of Cloud ERP systems in the SaaS model is not exhaustive and the dynamic development of cloud computing should contribute to mitigating the highlighted risks. As a result, the popularity of Cloud ERP systems should increase in different types of enterprises, which is confirmed by studies of various analysis and consulting companies. According to research conducted by The Business Research Company, the global cloud-based ERP market size grew from \$40.49 billion in 2022 to \$43.91 billion in 2023 at a compound annual growth rate (CAGR) of 8.5%. The cloud-based ERP market size is

expected to grow to \$65.89 billion in 2027 at a CAGR of 10.7%. The significant growth in the global Cloud ERP market is also estimated by BlueWeave Consulting, with a projection of \$64.7 billion in 2022. During the forecast period between 2023 and 2029, the global cloud ERP market size is projected to grow at a robust CAGR of 15.37% reaching a value of USD 174.73 billion by 2029. According to Panorama Consulting Group in 2023, over half of the 183 surveyed enterprises (64.5%) selected cloud software instead of on-premise. Slightly more than 35% of the surveyed enterprises still use on-premise ERP (Figure 1).



**Figure 1: Popularity of basic ERP system implementation models (Cloud ERP and on-premise ERP)**

Source: Panorama Consulting Group: 2023

The range of Cloud ERP systems is steadily expanding, increasing the options for choosing these solutions to support the operations and processes of modern enterprises. The final decision to implement a Cloud ERP system must

be preceded by a thorough analysis, which establishes the goals and needs of the enterprise and the necessary organizational, functional, quality and technological requirements (including data security issues) that the

integrated management IT system should meet. The enterprise's management should also identify the key processes of the enterprise and determine their expected scope of support by the ERP system. Special attention to Cloud ERP systems should be paid by:

- emerging small and medium-sized enterprises,
- enterprises with few complex processes, using the simplest functions and a small number of ERP system modules,
- enterprises with only e-business operations,
- enterprises with a distributed organizational structure,
- enterprises interested in changing their existing ERP system,
- enterprises undergoing restructuring with variable needs,
- enterprises with IT personnel problems (outflow or high turnover of employees, lack of adequate knowledge, increasing salary demands, etc.).

Currently, many providers, due to having Cloud ERP systems in their range, can also encourage enterprises to implement them and replace the existing on-premise model of using ERP systems. However, enterprises may not be interested in using Cloud ERP which may be due to a lack of confidence in this form of using systems and transferring key data to the cloud, problems with stable Internet connections, and management's belief in the difficulty of integrating Cloud ERP systems with other local IT systems. Cloud ERP may also not be considered by enterprises that have already made significant investments in IT infrastructure, local ERP system implementation and its integration with other applications.

After analyzing the enterprise's own needs, goals and capabilities, in the next step it is important to establish criteria for analyzing and evaluating Cloud ERP systems and their providers. The criteria for analyzing and evaluating Cloud ERP systems can include, for example: functionality and scope of business process support, technology and architecture used, brand, price and flexibility in terms of user fees, possibility and ease of migration of data collected so far, integration with other systems used in the company, level of protections used (place and method of data archiving), users' opinions on the quality of services provided, quality of technical support functioning, speed of response to reported problem situations, market share, contractual terms and conditions for the acquisition, operation and cancellation of the Cloud ERP system (SLA provisions), guaranteed

level of service availability, number of customers, provider's experience in providing cloud services, provider's competence in process management, certificates held (e.g. ISO), the location of the Data Center and the quality of services provided by the provider's partners, evaluation of the initial testing of the Cloud ERP system. The selection of a provider and Cloud ERP system is a very important and often complex decision, however, the thoroughness of the pre-implementation work carried out will reduce the risk of inappropriate selection of a provider and Cloud ERP system, shorten the implementation time and reduce the costs and chaos in the initial period of Cloud ERP implementation.

### **Trends and Development Directions of Cloud ERP Systems**

Cloud ERP systems have been developed for more than 20 years, constantly expanding the ability of enterprises to support various areas of their operations. The development of Cloud ERP systems was driven not only by technological development, but also by other changes in the environment, such as tightening competition, changing customer needs, the development of connections, dependencies and processes implemented in the electronic economy. The requirements of the surroundings, the increase in the amount of data and the need to undertake tasks for digital transformation all urged further implementation of technology and expansion of the potential of IT systems (such as Cloud ERP) which enabled optimization of business operations and improvement of the company's market position.

Cloud ERP systems can become a central element of new business strategies focused on flexibility of business processes, cooperation with partners and customers, innovation and the ability to implement new business models. The further development of Cloud ERP systems can significantly affect the potential and competitiveness of enterprises, facilitating their dynamic adaptation to the needs of their customers, accelerating the mass digitization and automation of the implemented business processes (and, as a result, increasing their effectiveness and efficiency), and will enable the implementation of the subsequent stages of digital transformation.

Proposals for the directions of development of Cloud ERP systems are presented on the basis of the method of literature review, analysis of

reports and studies of consulting companies, analysts' insights and own observations of changes in the ERP industry. According to the authors, among the most important directions of development of Cloud ERP systems for supporting enterprises are:

- Verticalization – the emergence of Cloud ERP systems dedicated to the needs of enterprises in specific industries, in which capabilities are developed to handle processes that are specific and key to a particular type of business; providers will have a number of predefined processes and specialized knowledge, which together will enable dynamic and efficient launch of business processes.

- Processivity – the emergence of Cloud ERP systems that have built-in and integrated business process modeling tools (e.g., BPMN) and facilitate rapid mapping of generated processes into Cloud ERP systems, which improves process analysis and optimization, business flexibility and ultimately enables faster response to market changes.

- Internal and external integration – Cloud ERP systems will develop supported processes and cover more and more areas and processes previously supported by other dedicated IT systems (e.g. MES, CAD/CAM, BI, TMS, GIS). Cloud ERP systems will undergo a broad process of horizontal and vertical integration, which will significantly improve its cooperation with existing local (legacy) IT systems (ability to jointly support business processes) and increase integration with other IT systems and databases available in cloud computing (e.g. control and intermediary systems, portals and websites, social media sites, public organization systems, open public data, etc.). There will be automation and more flexible data exchange with cooperators, which will facilitate their access to necessary information resources in real time and consequently improve cooperation, increase the efficiency of promotional and sales activities, and jointly generate innovative solutions. Through the mass implementation of blockchain technology in Cloud ERP systems, a secure platform for cooperation, data flow and protection will be obtained. Cloud ERP systems, through dedicated interfaces, will have access to systems offering Big Data capabilities and provide the ability to perform advanced analytics for various types of internal and external data. Cloud ERP systems will implement mechanisms to automatically and without delay read from external sources all necessary legal changes relevant to the implementation of business processes. There will also be an increase in the possibility of adapting Cloud ERP systems to the

needs of the enterprise, i.e. the specifics of the processes implemented in the enterprise and the needs of its employees.

- Automation – Cloud ERP systems will fully meet the challenges of Industry 4.0. In particular, Cloud ERP systems will see increasing saturation with artificial intelligence solutions and machine learning algorithms, as a result of which business processes are automated, manual and routine tasks are reduced, productivity is increased, customer and provider relations are improved, and data processing and analysis is streamlined (e.g. optimization of production scheduling, analysis of user behavior which results in personalization of the interface and suggesting further actions, intelligent reporting enabling multidimensional analysis of data, three-dimensional visualizations, providing suggestions for improving tasks, activities or the entire process, generating notifications in case of exceeding set values, intelligent assistants advising users on further steps of conduct, the possibility of voice input of commands and instructions). Progress will also be observed in the implementation of Robotic Process Automation (RPA) solutions (special algorithms that automate users' tedious data processing activities) or self-driving solutions that can independently enter and analyze various types of data (e.g., automatic loading of documents into the Cloud ERP system, the ability to perform automatic configuration of the Cloud ERP system). Implementation in Cloud ERP systems of intelligent automation or hyper-automation will allow to comprehensively analyze and rebuild selected or all processes (dynamic process adaptation) and present their new improved proposals to users in a visual way (active use of BPMS, BI systems, artificial intelligence and process robotics chatbots with OCR) thus facilitating the digital transformation of the enterprise. Cloud ERP systems will see deeper adoption of Internet of Things (IoT) solutions, allowing an increasing number of sensors to retrieve, process and send relevant data and make automatic and independent decisions in various stages of business processes (e.g., production, logistics). Through the development of intelligent networks' linking processes, machines, sensors, products and various IT systems – Cloud ERP systems will gain the ability to predict or detect threats, present possible scenarios to solve problems and even automatically eliminate their negative effects. Artificial intelligence and automation of data processing in Cloud ERP systems will also assist companies in accurately interpreting new trends and phenomena, e.g. acquiring new customers

(analyzing and generating promotion proposals, analyzing data on unfulfilled expectations), new employees and providers (analyzing internal data and Internet resources and creating recommendations), which can lead to product development or improvement, generating an innovative product or strengthening the competitive position of an enterprise. The automation and fusion of processes will facilitate the control of a selected area of the company's operations (e.g. planning, monitoring and coordination in terms of the manufacturing process, the work of production personnel, machinery and the quantity and quality of available resources); it will also allow the automatic preparation of reports and their subsequent dispatch (e.g. to members of the board of directors or to public organizations). Cloud ERP systems will also acquire the ability to self-adapt to the dynamically changing needs of the enterprise and its employees; it will also be possible to increase the availability of Cloud ERP systems by automatically repairing their own defects (self-healing), which will take place without the intervention of technical support staff; however, the systems will automatically notify the appropriate services of the detection of errors or damage and the actions taken. Cloud ERP systems, having the ability to quickly collect and process data from various sources, will acquire, in the prospect, the ability to self-learn and create knowledge, which will, in effect, define and determine the "intelligence" of enterprises enabling them to better understand the market, respond quickly, adjust business processes and optimize the consumption of available resources.

- Mobility – enhancing the capabilities (readability, comprehensiveness, security) of the existing use of mobile tools for remote access and secure use of Cloud ERP systems, which will provide managers with: the ability to receive signals of emergency situations, full insight into the processes being implemented and the ability to make decisions in real time. For employees, improved mobility in Cloud ERP systems will enable remote and user-friendly access to data, documents and reports, improved readability of data presented on the screen, and real-time access to necessary information describing the status of processes. Mobile solutions will see a comprehensive increase in the level of security of access to Cloud ERP systems (e.g. multi-factor identification, built-in VPNs). As a result, the development of mobility will make it possible to improve the efficiency of processes carried out in many departments of the enterprise and to respond more quickly to market changes.

- Multimedia – Cloud ERP systems will be created that will enable users to: give voice commands, gesture commands, operate Cloud ERP in 3D and on multiple monitors. Multimedia Cloud ERP systems will increase automation of processes and operations and, by streamlining access to necessary data, information or knowledge, will enable optimized decision-making processes.
- Intuitiveness – Cloud ERP systems will become even more ergonomic and intuitive in the day-to-day execution of business processes by users (the use of new interfaces for accessing Cloud ERP systems to facilitate readability and operation, for example, for people with disabilities).
- Shorter implementation time – in recent years there is a clear reduction in the implementation time of Cloud ERP systems, including for medium and large enterprises. In the coming years, this trend will be sustained by providers providing improved tools and methodologies to facilitate the Cloud ERP implementation process (e.g. pre-configured systems for typical and repeatable business processes). A radical approach to implementing Cloud ERP systems (LIAD – Live in a Day model) will also develop, minimizing Cloud ERP system implementation to 24 hours (not including training and modifications), dedicated mainly to small businesses and startups without complex business processes.
- Increase in popularity of Open-Source systems – Cloud ERP systems offered as open source will have a larger market share in the coming years. The popularity of such solutions will be influenced by the pressure to reduce IT costs, the increasing number of entities implementing such systems and having experience in optimizing business processes, the dynamic development of social networks and the emergence of opportunities to subsidize both the development of such systems and the implementation work and support for enterprises.

All the above-mentioned directions and trends in the development of Cloud ERP systems are likely to intermingle and interact in various ways, making it possible to observe their positive impact and synergy in virtually all areas of enterprise activity. The scale and pace of the outlined changes in Cloud ERP systems will result in a gradual change in the role of the user in the enterprise as a result of which new professions will arise, responsibilities will change, new forms of communication and cooperation will appear, new competencies will need to be acquired. The increasing saturation of advanced technologies in Cloud ERP systems will mean that many processes and activities will be carried out by robots and artificial intelligence, and the user will

be primarily concerned with interpreting data and making decisions, responding dynamically, and cooperating with other users and entities in order to best meet the needs of customers and achieve the set goals of the enterprise. In the future, the use of Cloud ERP will be embedded in the process of digital transformation leading to the improvement of the operation of enterprises, as well as supporting their agility and market flexibility, while enabling a higher level of data security.

### Conclusion

Today, integrated ERP IT systems are becoming an important element of digital transformation affecting the agility and efficiency of enterprise operations in an increasingly demanding market. The evolution of ERP systems occurring under the influence of dynamic technological development, increasing competition in the IT market and the ever-growing needs of customers, has led to the emergence of systems referred to as Cloud ERP. Cloud ERP is an Enterprise Resource Planning system that has been made available by the provider in a cloud computing environment and is offered as a service to enterprises. Cloud ERP provides enterprises with many benefits (but also risks), which can be considered from strategic, organizational, economic, technological and social dimensions.

According to the opinion of many consulting and advisory firms, the popularity of Cloud ERP systems will increase and gradually replace the traditional model of acquiring and using ERP systems (on-premise). The authors in the article pointed out the potential directions of development of Cloud ERP systems to which they included: verticalization, processivity, integration, automation, mobility, multimedia, intuitiveness, shorter implementation time and the growing popularity of open-source systems. The directions and proposals for evolution outlined above can constitute grounds for discussing the further development of Cloud ERP systems in the digital economy and enhancing its capabilities in the area of enterprise support.

### Literature

- Marnewick, C., and Labuschagne, L. (2005). A conceptual model for enterprise resource planning (ERP). *Information Management & Computer Security*. 13(2), 144-155
- Dmaithan Abdelkarim Almajali, Firas Omar, Abdullah Alsokkar, Ala'a Saeb Alsherideh, Ra'Ed Masa'Deh & Zulkhairi Dahalin (2022), Enterprise Resource Planning Success in Jordan from the Perspective of IT-Business Strategic Alignment, *Cogent Social Sciences*, Volume 8, 2022
- Issar G., Navon L.R., 2016, Enterprise Resource Planning (ERP), [w:] *Operational Excellence. Management for Professionals*, Springer, Cham.
- Weinrich, K. I., & Ahmad, N. (2009). Lessons learned during a decade of ERP experience: a case study. *International Journal of Enterprise Information Systems*, 5(1).
- Nguyen, T.D., Nguyen, T.T., Misra, S. Cloud-based ERP Solution for Modern Education in Vietnam. *International Conference on Future Data and Security Engineering, FDSE(2014)*, pp 234-247
- Luo Hong, Wang Zhongmin, ERP principle, design and implementation. *Electronic Industry Press*, 2020
- Tomasz Turek Damian Dziembek The ERP Process System as a Direction of the Evolution of Integrated Management Information Systems, *Business Informatics* 3(49), 2018
- Berić, D., Sekulić, D., Lolić, T., and Stefanović, D., 2018. Evolution of ERP Systems in SMEs – Past Research, Present Findings and Future Directions. Paper presented at the International Scientific and Expert Conference - TEAM, Novi Sad, Serbia.
- Bhadra, S., Sanyal, M.K., Biswas, B. (2019). Cloud ERP Adoption Pitfalls and Challenges – A Fishikawa Analysis in the Context of the Global Enterprises. In: Mandal, J., Mukhopadhyay, S., Dutta, P., Dasgupta, K. (eds) *Computational Intelligence, Communications, and Business Analytics. CICBA 2018. Communications in Computer and Information Science*, vol 1031. Springer, Singapore.
- Sari Nita Arryani, Hidayanto Achmad Nizar and Handayani Putu Wuri, Toward Catalog of Enterprise Resource Planning (ERP) Implementation Benefits for Measuring ERP Success, *Journal of Human Resources Management Research*, Vol. 2012
- Golarz M, Wykorzystanie systemu klasy ERP w logistyce przedsiębiorstw, *Journal of Modern Management Process*, nr 1(2)/2017
- S. Sadrzadehrafiei, A. G. Chofreh, N. Hosseini, R. Sulaiman: The benefits of enterprise resource planning (ERP) system implementation in dry food packaging industry, *Procedia Technology* 11(2013), s. 225.

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- Susanto A, Meiryani M, Benefits And Challenges Of Enterprises Resources Planning Systems, International Journal of Scientific & Technology Research, Volume 7, Issue 11, November 2018
  - Murphy P, Wood D., Nowoczesna logistyka. Wydanie X, Wydawnictwo Helion, Gliwice 2011, s. 66
  - Waściński T, Zintegrowane systemy zarządzania w procesach logistycznych, Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach, Seria Administracja i Zarządzanie, Nr. 95, 2012 s. 60.
  - Mell, P.; Grance, T. The NIST Definition of Cloud Computing; National Institute of Standards & Technology: Gaithersburg, MA, USA, 2011; p. 2
  - Nguyen, T. D., & Luc, K. V. T. (2018). Information Systems Success: Empirical Evidence on Cloud-based ERP. In T. K. Dang, J. Küng, R. Wagner, N. Thoai, & M. Takizawa (Eds.), Future Data and Security Engineering (Vol. 11251, pp. 471-485). Springer International Publishing
  - Hao Y. and Helo P. Cloud-based Enterprise Resources Planning System (ERP) - A Review of the Literature. In Proceedings of the 16th International Conference on Enterprise Information Systems (ICEIS-2014), SCITEPRESS 2014
  - Kiadehi Elias Fathi, Mohammadi Shahriar, Cloud ERP: Implementation of Enterprise Resource Planning Using Cloud Computing Technology, Journal of Basic and Applied Scientific Research 2(11) p. 11422-11427, 2012
  - De Maria, F., Briano, C., Brandolini, M., Briano, E., Revetria, R., 2011. Market-leader ERPs and cloud computing: a proposed architecture for an efficient and effective synergy. International conference on Applied Computer and Applied Computational Science (10 th WSEAS)
  - Cloud Based ERP Global Market Report 2023, The business Research Company, January 2023.
  - Aulia R, Putri, A N, Raihan M F Ayub M Sulistio J, The Literature Review of Cloud-based Enterprise Resource Planning, Annual Conference on Industrial and System Engineering (ACISE) 2019, IOP Conf. Series: Materials Science and Engineering 598 (2019)
  - Hadidi M, Al-Rashdan M, Hadidi S, Hussein Y.S, Comparison Between Cloud ERP and Traditional ERP, Journal of Critical Reviews, vol. 7, no. 3, 2020 pp. 140-142
  - Dziembek D. System ERP w modelu SaaS w działalności przedsiębiorstw, Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją (PTZP), Opole 2014
  - Panorama Consulting Group, The 2023 ERP Report.
  - BlueWeave Consulting and Research, March 23, 2023 <https://www.globenewswire.com/news-release/2023/03/23/2633407/0/en/Cloud-ERP-Market-Size-More-Than-Doubles-to-Touch-USD-175-Billion-With-the-CAGR-of-15-37-by-2029-BlueWeave-Consulting.html>