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**Article**

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Article

# ERP and Performance of Companies in Romania

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**Abstract:** How does the implementation of ERP solutions influence the financial performance of companies? Using data for 406 of companies from Romania, we assessed the impact of the implementation of ERP solutions on the profitability and productivity of companies. We performed this analysis using companies' financial data for the period between 1999 and 2000. The analysis of the influence of ERP implementation on the two indicators was carried out both from the perspective of users' perception and from the perspective of the evolution over time of these financial indicators. Our results revealed a limited impact of the implementation of ERP systems on profitability and productivity, in line with the expectations of managers.

**Keywords:** ERP; financial performance; profitability; productivity

**JEL Classification:** M29



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## 1. Introduction

Although during the recent COVID-19 crisis and the war in Ukraine companies have encountered great difficulties in terms of supply interruptions or delays in deliveries (Zimon et al. 2021), problems that they have not faced so acutely until now and which they will have to take into account from now on, they are still looking for new methods of improving performance and competitiveness to face the competitive global business environment. The performance of a company can be analyzed by streamlining the transformation of inputs into outputs with an emphasis on consumer requirements and preferences, on innovative technologies, and also on minimizing operational costs and times. Therefore, in order to be efficient, companies aim to improve profit indicators, profitability, and quality by making goods and services at the right place and time, in the right quantity and of the right quality for the right customer, using optimal resources. For this reason, new methods and tools that help optimize the performance of companies have been developed. Six Sigma methodology and Lean production approach are tools with which companies can make better use of system resources. The methodology has been adopted by many companies to “do more with less” (Womack and Jones 1997). The “Lean” approach is based on the elimination of losses and the creation of value (Murman 2002). Optimizing the performance of companies can also be achieved by integrating operational flows into ERP-type systems, thus obtaining increases in financial performance approached from various perspectives (Allen 2008; HassabElnaby et al. 2012; Hunton et al. 2003; Lutfi et al. 2022; Pohludka and Štverková 2019; Ungureanu 2022; Wieder et al. 2006).

Previous studies reveal that firms that adopt ERP systems may achieve significantly higher performance relative to non-adopters (HassabElnaby et al. 2012; Hayes et al. 2001; Hunton et al. 2003; Jayeola et al. 2022; Wier et al. 2007). ERP systems integrate all the databases and workflows in a company and, being modular, allow further development.

Further developments are possible due to the modular functionality of these systems (Ungureanu 2020). Most companies integrate into their business flows simple systems that have in their structure accounting or customer relationship (CRM) modules. Most ERP systems integrate flows in connection with customers, suppliers and employees (Davenport 1998). The most complex information systems are those that integrate production flows, and modules that generate complex data analysis such as Business Intelligence. Through an ERP system, the company's strategy is implemented (Teittinen et al. 2013). The most important benefits of ERP implementation for top management can be the transparency obtained and the control. Business flows must be rigorously configured in ERP so that the implementation produces the expected effects. An inefficient configuration of business flows can cause performance losses (Davenport 2000) because the implementation of ERP is a complex process. An inadequate analysis of business flows and a lack of competence of staff in the testing phase can lead to the failure of the ERP implementation project and can generate irrecoverable costs for the company. All business flows in a company can be configured in an ERP system, so that the company's activity becomes transparent and easily controllable for the management, factors which contribute to taking the best decisions in the shortest time. In addition, an efficient configuration of business flows makes it possible to automate flows that generate an important saving of time, translating into improved productivity.

In this article we aim to analyze how return on assets and productivity are influenced by the implementation of an ERP system, using a unique dataset that comprises information on Romanian companies. Previous studies focused on developing countries reveal that in order to obtain the expected results, ERP implementations require the user's IT system operating skills in all phases of the project (design, implementation and testing) (see e.g., Akkermans and van Helden 2002; Bernroider et al. 2011; Dumitru et al. 2013) and that Romania ranks last out of the 28 EU Member States (DESI-2021) in terms of level of acquiring digital skills. Moreover, ERP is a tool that can help companies improve their performance, but the impact on performance is also determined by the success factors of implementation (Ungureanu et al. 2022), which can decisively influence the results of the implementation.

The results of the study show that the implementation of such systems in Romanian companies does not significantly improve return on assets and productivity. For results that are in line with the expectations of managers and previous studies, see, e.g., Poston and Grabski (2001), who reported no pre- to post-adoption improvement in financial performance for ERP firms.

Finally, the article is structured as follows: Section 2 summarizes the literature review, Section 3 describes the data and methodology used, Section 4 presents the empirical findings and Section 5 presents the final conclusions.

## 2. Literature Review

An ERP system can be defined as an integrated, multidimensional system based on a business model which involves planning, control and optimization (van Slooten and Yap 1999; Uddin et al. 2020). ERP systems help companies achieve their business goals (Aburub 2015). These systems also facilitate the flow of information among all internal functions of a company (Aldossari and Mukhtar 2018). ERP systems can integrate functions in companies such as accounting, procurement, marketing, sales, human resources, finance and production and business intelligence, but also specific functions developed according to the needs of companies. The performance of companies obtained from the implementation of an ERP system can be appreciated from several points of view. Some of the most commonly used financial indicators to assess the performance achieved after implementing an ERP are productivity and return on assets (ROA). Return on assets (ROA) is an indicator that shows the efficiency of the use of assets; therefore, it is a performance indicator followed by most stakeholders. It measures the efficiency from the point of view of the profit obtained, but also best reflects the efficiency of the management team through its

ability to use the company's resources in order to generate performance. Developers of ERP systems promise users an increase in productivity and an improvement in ROA. Therefore, the efficiency of employees is expected to cause an increase in the ratio between revenues and the number of employees and an improvement in the ratio of net result to assets. In the reference literature, however, there is evidence for and against these claims.

There are studies that have demonstrated an improved operational performance for companies that have implemented ERP systems. In addition, benefits have been found in terms of data accuracy and simplification of processes (Beheshti and Beheshti 2010; Mabert et al. 2001; Nicolaou and Bajor 2011).

Performance is a concept that can be defined as the "gain" of the company viewed from several perspectives (economic, financial, social, technical and so forth). From a financial perspective, the performance of companies can also be analyzed with Return on Assets (ROA), through the ability of assets to generate profit or productivity through the company's ability to generate higher revenues relative to the number of employees. Therefore, when a company manages to improve these rates by implementing ERP, we can say that it generates financial performance.

The costs of these ERP systems are relatively high and will grow over time with further developments (Shadi et al. 2019) or maintenance services. But the benefits obtained from the implementation of such systems can be greater and more important than the costs involved.

An ERP can be an advantage for companies looking to differentiate themselves from the competition. Allen (2008) shows that the advantage for companies after ERP implementation is represented by a better and faster performance of service than that of competitors, with activity being better coordinated and more efficient. Thanks to automation through ERP, the company in question increased the productivity of daily calls, which led to increased revenue and profitability. At the same time, the increased efficiency of the process reduced the cost of labor and increased productivity.

Regarding improvement in ROA, there are studies that show that this is possible in the case of companies that implement ERP (Hendricks et al. 2007; Hunton et al. 2003). The results of Poston and Grabski (2001) emphasize an improvement in financial performance, as measured by productivity, in each of the three years after the implementation of an ERP system. Moreover, companies that adopt ERP and, post-implementation, make various upgrades to the application, will achieve a superior performance of ROA compared to those that postpone these upgrades or do not implement them at all (Nicolaou and Bhattacharya 2008).

Galy and Saucedo (2014) demonstrate empirically the cause-effect relationship of managerial actions with financial performance after the implementation of an ERP-type information system. The analyzed regression establishes the fact that advanced information technology applied to business flows directly impacts return on assets. Similarly, Legare (2002) shows that ERP implementation causes an increase in productivity. The time economy obtained in the main activities is also an advantage of implementing ERP (Davenport 2000).

Companies that implement ERP will achieve the desired performance in time, to the extent that all the factors involved adapt to the changes produced by these implementations in the company's work flows. Studies show an improvement in performance two years after ERP implementation (Ross and Vitale 2000; Betts 2001; Al-Mashari et al. 2003; Cosgrove Ware 2003). In addition, companies that improve initial implementations through new ERP developments will perform better than those that do not make new developments (Nicolaou and Bhattacharya 2008). To obtain positive results on performance after an ERP implementation, it is necessary that the business flows in the company be efficiently configured, otherwise the "performance" may be lost (Davenport 2000).

Unexpected effects of loss of performance can also occur by eliminating some roles from the company which are automated after implementing an ERP system, and redistributing employees to other processes. This can generate a decrease in productivity (Arnold et al. 2000).

The existing literature has devoted important attention to the impact of ERP systems adoption on firms's performances in developed countries, with only a few studies focusing on developing or emerging economies (see, e.g., (Soja 2011; Soja and Paliwoda-Pekosz 2013)). However, little is known about the implications of ERP adoption on the performance of Romanian companies. To the best of our knowledge, there are only a few papers that are related to ours, but their focus is different. Barna et al. (2021) analyze the relationship between ERP systems and financial reporting and their results highlight the significant role of ERP systems in terms of improvements in financial and non-financial reporting. Dumitru et al. (2013) investigate how the mutual evolution of both organizations and systems transforms the case of ERP implementation in best practices in management and accounting in an emerging economy. Stanciu and Tinca (2013) assess the significant factors determining the success of an ERP/IT system implementation. Similarly, Albu et al. (2015) investigate how enterprise resource planning systems are implemented and employed in a transition economy. This study aims to fill this gap in the literature.

### 3. Data and Methodology

#### 3.1. Methodology

Testing users' perception of the influence of ERP systems on return on assets (ROA) and on productivity was carried out with a questionnaire distributed in the online environment (social media and email). The respondents were asked to evaluate the influence of ERP implementation on ROA and productivity, using a (1–5) point Likert scale (1, strong disaccord; 2, disaccord; 3, neutral; 4, accord; and 5, strong accord).

The impact of ERP implementation on companies' performance expressed by return on assets (ROA) and productivity was estimated by the following regression equation, using the Ordinary Least Squares regression:

$$Performance_{i,t} = \beta_0 + \beta_1 \times ERP_i + \Phi \times Control\ variable_{i,t} + \varepsilon_{i,t} \quad (1)$$

The performance indicator of the company ( $i$ ) in the year ( $t$ ), the dependent variable, was expressed by return on assets (ROA) and productivity. Return on assets was measured as the ratio of net profit and total assets of the company, and productivity was measured as the ratio of revenue to employees. The  $ERP$  variable indicated that a certain company ( $i$ ) had implemented  $ERP$  during the analyzed period. This variable had the value 1 for companies that had implemented  $ERP$ , and the value 0 for companies that had not implemented  $ERP$ . As control variables, we used the following variables: turnover, fixed assets, equity, revenues, field of activity, listed on BVB, and number of employees.

By the coefficient  $\beta_1$  we indicated the impact of adopting an  $ERP$  system. If the value of this coefficient was positive, this meant an increase in performance determined by the  $ERP$  implementation. If the value of this coefficient was negative, this meant a decrease in performance for companies that had adopted an  $ERP$  system.

Following previous studies (Nichols 2007; Singer and Willett 2003; Skrondal and Rabe-Hesketh 2004) using the difference-in-difference approach, we considered the moment when companies adopted  $ERP$  in order to evaluate the impact of  $ERP$  implementation on their performance:

$$Performance_{i,t} = \beta_0 + \beta_1 \times ERP_i + \beta_2 \times ERP_i \times Time + \Phi \times Control\ variable_{i,t} + \varepsilon_{i,t} \quad (2)$$

In the regression equation, the  $Time$  variable had the value 1 in the post-implementation years, in the case of companies that had implemented  $ERP$ . The  $Time$  variable had the value 0 both for companies that had not implemented  $ERP$ , and for the period before implementation in the case of companies that had implemented  $ERP$ .

The coefficient  $\beta_1$  measured the overall impact of  $ERP$ , by comparing companies that had implemented  $ERP$  with companies that had not implemented  $ERP$ . The  $\beta_2$  coefficient measured the impact of  $ERP$  adoption over time, comparing the period before  $ERP$  adoption with the period after  $ERP$  adoption, only in the case of companies that had adopted  $ERP$ .



Considering the results of previous studies (Al-Mashari et al. 2003; Arnold et al. 2000; Betts 2001; Cosgrove Ware 2003; Davenport 2000; Nicolaou and Bhattacharya 2008; Ross and Vitale 2000) we assumed that there was a positive influence of ERP implementation on the profitability of assets and on the productivity of Romanian companies. The following hypotheses were considered:

**Hypothesis 1 (H1).** *ERP implementation produces an increase in company performance, expressed by ROA.*

**Hypothesis 2 (H2).** *The implementation of ERP produces an increase in the performance of companies, expressed by productivity.*

### 3.2. Data

We collected information on the implementation of ERP systems by companies, the type of modules implemented within ERP, the date of ERP implementation, and data on respondents' perception of the benefits of ERP implementation in companies using a questionnaire distributed in the online environment (LinkedIn, e-mail and other social media networks). The questionnaire was sent to 500 companies from Romania and 406 companies filled out the questionnaires. Furthermore, we merged the dataset on ERP implementation with the financial data from the ORBIS database for the period 1999–2020.

The final database included 397 companies from Romania, out of which 267 companies implemented ERP systems. The minimum number of modules implemented by companies was 1 and the maximum number of modules implemented was 9. Most companies implemented the Accounting module (87.64%), Human Resources module (83.15%), CRM (79.03%), Acquisitions module (59.93%), or Financial module (50.19%). Fewer companies implemented the Production module (26.97%), Project Planning module (24.72%), Registry module (23.60%) and Business Intelligence module (19.85%).

Out of the total number of the companies that implemented an ERP system, 64.79% of them, that is 173 companies, implemented at least the Accounting, Human Resources and CRM modules. This feature could lead us to the conclusion that these companies implemented ERP from an administrative point of view, due to the legislative regulations in Romania that impose the need to operate tax statements in a system that processes them automatically, and were less focused on an eventual increase in performance.

Most of the companies for whom the questionnaire was filled out were privately owned companies (93.45%), and of these, 242 companies had implemented an ERP system and 129 companies had not implemented such a system. As for the publicly owned companies (35 companies), only one company did not implement ERP. The significantly higher percentage of implementation for the public sector can also be explained by the high cost of ERP implementation and by the fact that these publicly owned companies are larger and have easier access to finance.

The answers to the questionnaires were obtained from companies mostly with up to 500 employees (56.68% of the total number of companies analyzed had fewer than 50 employees and 15.37% of the companies fell within the range of 151–500 employees). Most of the companies that did not implement an ERP system had fewer than 50 employees and all the companies with over 150 employees implemented ERP. It is possible that the high cost of ERP implementation was the cause of a lower proportion of implementation by companies with fewer than 150 employees. With regard to the companies that implemented ERP, most of them were companies with revenues greater than two million euros and they recorded an average increase in revenue in the post-implementation period of approximately 20%, compared to the year of ERP implementation, and an increase in revenue of approximately 28% compared to the pre-implementation years.

Regarding the sector of activity of the companies, the highest percentage of companies that implemented ERP were companies belonging to the Production and Trade sectors (over 80%). The situation can be explained by the fact that lately online commerce has

developed considerably, and having an ERP (CRM) system is necessary for recording and organizing data. At the same time, the companies belonging to the field of Production were large companies that could bear the costs of an ERP implementation.

To study the influence of ERP implementation on ROA and productivity we used a database containing information for 397 companies for the period 1999–2020. The descriptive statistics of the variables are shown in Table 1.

**Table 1.** Descriptive statistics of variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
Turnover (thousand Lei)	6089	2795.202	14,146.91	−0.85655	333,500
Number of Employees (no.)	6089	492.6451	2013.714	0	44,917
Equity (thousand Lei)	6089	2514.033	20,220.69	−45,580	528,500
Revenues (thousand Lei)	6089	3031.958	15,011	−0.62989	353,300
ROA (%)	6089	−0.081396	4.008789	−25.061	11.26
Productivity (thousand Lei)	6089	9.05217	45.48931	−0.00043	13,010

Univariate statistical analysis using the *t*-test (presented in Table 2) revealed that companies that had implemented an ERP system registered higher values for both performance indicators and the difference was statistically significant. These results mean that, on average, companies that implemented an ERP system recorded a higher performance compared to companies that did not implement an ERP system for the period analyzed.

**Table 2.** Differences between companies that implemented and those that did not implement ERP systems.

	No ERP	ERP	Difference	Mean
ROA	−0.4372013	0.0390569	−0.4762582	−0.081396
Productivity	6.056007	10.06648	−4.010473 ***	9.05217

Note: \*\*\* indicates statistical significance at 1% level.

Regarding the respondents’ perception of the influence of ERP implementation on the companies’ performance, we obtained the following results:

Hypothesis 1 was not confirmed, according to the perception of the 406 respondents (both those who implemented ERP and those who did not implement ERP) (the weighted average score was 2.85-neutral). The perception of the majority of these respondents, totaling 63.05% of the answers, was neutral regarding the assumed hypothesis (Table 3).

**Table 3.** Results of responses to questionnaire for Hypothesis 1- total respondents who filled in the questionnaire.

Hypothesis 1: ERP Implementation Produces an Increase in Company Performance Expressed by ROA.	
Choices	Responses (Companies Which Implemented ERP and Companies Which Not Implemented)
Accord (4)	58
Strong accord (5)	17
Disaccord (2)	43
Strong disaccord (1)	32
Neutral (3)	256
Total	406

The same results were confirmed by analyzing only the responses of those who implemented ERP and whose perception should be more relevant. The perception of the

majority of these respondents, totaling 49.81% of the responses, was neutral regarding the assumed hypothesis (Table 4) (the weighted average score was 3.02-neutral). Therefore, from the perception of all respondents, Hypothesis 1-The implementation of ERP systems causes an increase in the company’s return on assets (ROA) was not confirmed.

**Table 4.** Results of responses to questionnaire for Hypothesis 1-respondents who implemented ERP and who filled in the questionnaire.

<b>Hypothesis 1: ERP Implementation Produces an Increase in Company Performance Expressed by ROA.</b>	
<b>Choices</b>	<b>Responses (Companies Which Implemented ERP)</b>
Accord (4)	55
Strong accord (5)	16
Disaccord (2)	39
Strong disaccord (1)	23
Neutral (3)	132
<b>Total</b>	<b>265</b>

Hypothesis 2 was not confirmed, according to the perception of the 406 respondents (both those who implemented ERP and those who did not implement ERP). The perception of the majority of these respondents, totaling 51.97% of the responses, was neutral regarding the assumed hypothesis (Table 5). However, analyzing only the responses of those who implemented ERP and who were aware of the cause, the results were the same. The perception of the majority of these respondents, totaling 43.77% of the answers, was favorable toward the assumed hypothesis (Table 6), but the weighted average score was 3.24 (neutral).

**Table 5.** Results of questionnaire responses for Hypothesis 2-total respondents.

<b>Hypothesis 2: The Implementation of ERP Produces an Increase in the Performance of Companies Expressed by Productivity.</b>	
<b>Choices</b>	<b>Responses (Companies Which Implemented ERP and Companies Which Not Implemented)</b>
Accord (4)	96
Strong accord (5)	26
Disaccord (2)	43
Strong disaccord (1)	30
Neutral (3)	211
<b>Total</b>	<b>406</b>

**Table 6.** Results of questionnaire responses for Hypothesis 2-respondents who implemented ERP.

<b>Hypothesis 2: The Implementation of ERP Produces an Increase in the Performance of Companies Expressed by Productivity.</b>	
<b>Choices</b>	<b>Responses (Companies Which Implemented ERP)</b>
Accord (4)	90
Strong accord (5)	26
Disaccord (2)	39
Strong disaccord (1)	21
Neutral (3)	89
<b>Total</b>	<b>265</b>



#### 4. Results

Table 7 shows an analysis of the results of the regression analysis regarding the impact of ERP adoption on the companies' performance expressed through ROA and productivity, for 397 companies in Romania, using the OLS method. Models 1 and 2 present the estimates for each performance indicator: return on assets (ROA) and productivity.

**Table 7.** Results regarding the influence of ERP on performance (ROA and productivity).

	Model 1 ROA	Model 2 Productivity
	b/se	b/se
ERP	0.4892 ** (0.2087)	0.5270 *** (0.1014)
Turnover	0.0001 (0.0000)	0.0059 *** (0.0015)
Fixed assets	0.0000 (0.0000)	−0.0001 *** (0.0000)
Equity	0.0000 (0.0000)	−0.0005 *** (0.0002)
Revenues	−0.0001 * (0.0000)	−0.0039 *** (0.0012)
Domain of activity	−0.0578 * (0.0335)	−0.0274 (0.0310)
BVB listed	−0.0240 (0.0214)	0.6963 * (0.3671)
Number of employees	0.0139 (0.0138)	−0.3547 *** (0.0652)
Cons	−0.3391 ** (0.1603)	1.0191 *** (0.0870)
N	6089	6089
R <sup>2</sup> -adj	0.0030	0.1974

Note: \*\*\*, \*\* and \* indicate statistical significance at the levels of 1%, 5% and 10%, respectively. Standard errors are reported in parentheses.

From the results of the regression analysis, we can see that the implementation of the ERP system had a statistically significant impact on ROA and on Productivity.

The results of the regression analysis revealed that the impact of ERP implementation on ROA was positive and statistically significant. In the case of the first model (Model 1 ROA), the coefficient of determination R<sup>2</sup> showed that the variation of the dependent variable (Return On Assets) was explained in a proportion of 0.30% by the variation of the independent variables ERP, turnover, fixed assets, equity, revenues, domain of activity, BVB listed and number of employees. Therefore, Hypothesis 1 was confirmed; ERP implementation causes a slight increase in ROA, but there are other variables that determine its growth and that were not considered in this model. The value of R<sup>2</sup>-adj was a very small one.

In the case of model 2 (Model 2 Productivity), the impact of ERP implementation on Productivity was statistically significant. The determination coefficient R<sup>2</sup> showed that the variation of the dependent variable (Productivity) was explained at a rate of 19.74% by the variation of the independent variables. Hypothesis 2 was confirmed, but there are other variables that cause its growth and that were not considered in this model. In this case we also had a very small R<sup>2</sup>-adj value.

In the second part of the analysis of the influence of ERP systems implementation on companies' performance expressed through ROA and productivity, we used the difference-in-difference methodology to determine whether the impact of ERP was amplified or diminished by the moment of implementation. The results obtained did not correspond to the reference model. The effects of implementing ERP systems on ROA and productivity of companies in Romania were not confirmed in the estimates made using the difference-in-difference method. The results presented in Table 8 show that the impact of the variable

ERP × TIME is not statistically significant. Our results emphasized that for performance it was important to implement an ERP system and the moment of implementation was not so important. It can be assumed that those companies that implemented an ERP system already had a perspective of improving these indicators in the long term, regardless of whether or not an ERP system was adopted. ERP implementation is a tool that helped companies to coherently integrate business strategy in order to achieve the best results.

**Table 8.** Results regarding the influence of ERP on ROA and productivity of companies considering the moment of implementation.

	Model 1 ROA	Model 2 Productivity
	b/se	b/se
ERP	0.4778 ** (0.2085)	0.5499 *** (0.1092)
ERP X TIME	0.0330 (0.0280)	−0.0662 (0.1331)
Turnover_adj	0.0001 (0.0000)	0.0059 *** (0.0015)
Fixed Assets_adj	0.0000 (0.0000)	−0.0001 *** (0.0000)
Equity_adj	0.0000 (0.0000)	−0.0005 *** (0.0002)
Revenues_adj	−0.0001 (0.0000)	−0.0039 *** (0.0012)
Domain of activity	−0.0581 * (0.0335)	−0.0267 (0.0304)
BVB listed	−0.0268 (0.0220)	0.7018 * (0.3652)
Number of employees	0.0137 (0.0137)	−0.3543 *** (0.0654)
Cons	−0.3382 ** (0.1603)	1.0173 *** (0.0867)
N	6089	6089
R <sup>2</sup> -adj	0.0030	0.1975

Note: \*\*\*, \*\* and \* indicate statistical significance at the levels of 1%, 5% and 10%, respectively. Standard errors are reported in parentheses.

The results of our study that emphasized an increase in performance following the implementation of ERP were also consistent with other studies that determined increases in some performance indicators: an increase in turnover following the implementation of ERP (Ungureanu 2022), increased productivity (Allen 2008; Legare 2002; Poston and Grabski 2001) or an increase in the return on assets (Hunton et al. 2003; Nicolaou and Bhattacharya 2008).

## 5. Conclusions

The study's conclusions show a synchronization of results, both from the perspective of users' perception and from the perspective of financial indicators. ERP implementation has a limited impact on productivity and on the rate of return on assets. Analyzing the indicators depending on the time of implementation, results show that this impact is not amplified by the time of implementation.

It can be assumed that those companies that have implemented an ERP system already had a perspective of improving these indicators in the long term, regardless of whether or not they adopted an ERP system. ERP implementation is a tool that has helped companies to coherently integrate their business strategy in order to achieve the best results and to increase performance.

Regarding the increase of productivity as a result of ERP implementation, the perception of the respondents who implemented ERP strengthens the results obtained, and may be relevant in our study.

The results of the study show that users' perception is synchronized with the evolution of financial indicators, showing a slight improvement of the return on assets and productivity. In a context in which the world is moving towards an era of automation and robotization, such tools as ERP will become part of all business flows, and companies will have to find other tools to help achieve competitive advantages and increased performance.

The analyzed literature reveals positive influences of ERP implementation in the three years after ERP implementation (Poston and Grabski 2001), after the ERP consolidation phase (Nolan and Norton Institute 2000). Our research period covers only the first period of COVID-19, when Romanian companies did not feel the effects in supply interruptions or delays in deliveries so acutely.

Therefore, in order to evaluate the extent to which these influences are maintained even when companies go through a period of crisis such as the period affected by the COVID-19 pandemic and the crisis caused by the war in Ukraine, future research directions should evaluate these influences on companies that implemented ERP in the period 2019–2020. However, our database includes only two companies that implemented ERP in this period.

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## References

- Aburub, Faisal. 2015. Impact of ERP systems usage on organizational agility: An empirical investigation in the banking sector. *Information Technology & People* 28: 570–88.
- Akkermans, Henk, and K. van Helden. 2002. Vicious and virtuous cycles in ERP implementation: A case study of interrelations between critical success factors. *European Journal of Information Systems* 11: 35–46. [CrossRef]
- Albu, Catalin, Nadia Albu, Madalina Dumitru, and Valentin Florentin Dumitru. 2015. The Impact of the Interaction between Context Variables and Enterprise Resource Planning Systems on Organizational Performance: A Case Study from a Transition Economy. *Information Systems Management* 32: 252–64. [CrossRef]
- Aldossari, Showaimy, and Umi Asma Mukhtar. 2018. Enterprise resource planning and business intelligence to enhance organizational performance in private sector of KSA: A preliminary review. In *International Conference of Reliable Information and Communication Technology*. Cham: Springer, pp. 343–52.
- Allen, Tim. 2008. The “secret sauce” that maximizes ROI for ERP. *Strategic Finance* 89: 32–37.
- Al-Mashari, Majed, Abdullah Al-Mudimigh, and Mohamed Zairi. 2003. Enterprise resource planning: A taxonomy of critical factors. *European Journal of Operational Research* 146: 352–64. [CrossRef]
- Arnold, V., James E. Hunton, and S. G. Sutton. 2000. *On the Death and Dying of Originality in the Workplace: A Critical View of Enterprise Resource Planning Systems' Impact on Workers and the Work Environment*. University of South Florida Working Paper. Tampa: University of South Florida.
- Barna, Laura-Eugenia-Lavinia, Bogdan-Stefan Ionescu, and Liliana Ionescu-Feleaga. 2021. The Relationship between the Implementation of ERP Systems and the Financial and Non-Financial Reporting of Organizations. *Sustainability* 13: 11566. [CrossRef]
- Beheshti, Hooshang, and Cyrus M. Beheshti. 2010. Improving productivity and firm performance with enterprise resource planning. *Enterprise Information Systems* 4: 445–72. [CrossRef]
- Bernroider, Edward W. N., Frantisek Sudzina, and Andreja Pucihar. 2011. Contrasting ERP Absorption Between Transition and Developed Economies From Central and Eastern Europe (CEE). *Information Systems Management* 28: 240–57. [CrossRef]
- Betts, Mitch. 2001. Why ERP projects cause panic attacks. *Computerworld* 1: 8.
- Cosgrove Ware, L. 2003. By the numbers: Enterprise systems show results. *CIO Magazine*, November 1.
- Davenport, Thomas H. 1998. Putting the enterprise into the enterprise system. *Harvard Business Review* 76: 121–31. [PubMed]
- Davenport, Thomas H. 2000. *Mission Critical: Realizing the Promise of Enterprise Systems*. Boston: Harvard Business School Press.
- Dumitru, Valentin Florin, Nadia Albu Catalin Albu, and Madalina Dumitru. 2013. ERP Implementation and Organizational Performance. *Anfiteatru Economic* 15: 518–31.
- Galy, Edith, and Mary Jane Saucedo. 2014. Post-implementation practices of ERP systems and their relationship to financial performance. *Information & Management* 51: 310–19.

- HassabElnaby, Hassan R., W. Hwang, and Mark A. Vonderembse. 2012. The impact of ERP implementation on organizational capabilities and firm performance. *Benchmarking: An International Journal* 19: 618–33. [CrossRef]
- Hayes, David, James E. Hunton, and Jacqueline Reck. 2001. Market reaction to ERPS implementation announcements. *Journal of Information System* 15: 3–18. [CrossRef]
- Hendricks, Kevin B., Vinod R. Singhal, and Jeff K. Stratman. 2007. The impact of enterprise systems on corporate performance: A study of ERP, SCM, and CRM system implementations. *Journal of Operations Management* 25: 65–82. [CrossRef]
- Hunton, James, Barbara Lippincott, and Jacqueline L. Reck. 2003. Enterprise resource planning (ERP) systems: Comparing firm performance of adopters and non-adopters. *International Journal of Accounting Information Systems* 4: 165–84. [CrossRef]
- Jayeola, Olakunle, Shafie Sidek, Zulkiflee Abdul-Samad, Nornajihah Nadia Hasbullah, Saiful Anwar, Nguyen Binh An, Vu Thi Nga, Omar Al-Kasasbeh, and Samrat Ray. 2022. The Mediating and Moderating Effects of Top Management Support on the Cloud ERP Implementation–Financial Performance Relationship. *Sustainability* 14: 5688. [CrossRef]
- Legare, Thomas L. 2002. The Role of Organizational factors in realizing ERP benefits. *Information Systems Management* 19: 21–42. [CrossRef]
- Lutfi, Abdalwali, Ahmad Farhan Alshira'h, Malek Hamed Alshirah, Manaf Al-Okaily, Hamza Alqudah, Mohamed Saad, Nahla Ibrahim, and Osama Abdelmaksoud. 2022. Antecedents and Impacts of Enterprise Resource Planning System Adoption among Jordanian SMEs. *Sustainability* 14: 3508. [CrossRef]
- Mabert, Vincent A., Ashok Soni, and M. A. Venkataramanan. 2001. Enterprise resource planning: Common myths versus evolving reality. *Business Horizons* 44: 69–76. [CrossRef]
- Murman, Earll. 2002. *Lean Enterprise Value: Insights from MIT's Lean Aerospace Initiative*. New York: Palgrave.
- Nichols, Austin. 2007. Causal Inference with Observational Data. *STATA Journal* 7: 507–41. Available online: <http://www.stata-journal.com/article.html?article=st0136> (accessed on 22 August 2022). [CrossRef]
- Nicolaou, Andreas I., and Lawrence H. Bajor. 2011. ERP Systems Implementation And Firm Performance. *Review of Business Information Systems (RBIS)* 8: 53–59. [CrossRef]
- Nicolaou, Andreas I., and Somnath Bhattacharya. 2008. Sustainability of ERPS performance outcomes: The role of post-implementation review quality. *International Journal of Accounting Information Systems* 9: 43–60. [CrossRef]
- Nolan and Norton Institute. 2000. *SAP Benchmarking Report 2000*. Melbourne: KPMG.
- Pohludka, Michal, and Hana Štverková. 2019. The Best Practice of CRM Implementation for Small- and Medium-Sized Enterprises. *Administrative Sciences* 9: 22. [CrossRef]
- Poston, Robin, and Severin Grabski. 2001. Financial impacts of enterprise resource planning implementations. *International Journal of Accounting Information Systems* 2: 271–94. [CrossRef]
- Ross, Jeanne W., and Michael R. Vitale. 2000. The ERP revolution: Surviving vs. thriving. *Information Systems Frontiers* 2: 233–41. [CrossRef]
- Shadi, AboAbdo, Aldhoiena Abdulaziz, and Al-Amrib Hashbol. 2019. Implementing Enterprise Resource Planning ERP System in a Large Construction Company in KSA. Paper presented at the CENTERIS-International Conference on Enterprise Information Systems, Heraklion, Greece, May 3–5.
- Singer, Judith D., and John B. Willett. 2003. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York: Oxford University Press. Available online: <http://gseacademic.harvard.edu/~ald/> (accessed on 22 August 2022).
- Skrondal, Anders, and Sophia Rabe-Hesketh. 2004. *Generalized Latent Variable Monitoring: Multilevel, Longitudinal and Structural Equation Models*. Boca Raton: Chapman & Hall/CRC. Available online: <http://www.glam.org/books/> (accessed on 12 August 2020).
- Soja, Piotr. 2011. Examining determinants of enterprise system adoptions in transition economies: Insights from Polish adopters. *Information Systems Management* 28: 192–201. [CrossRef]
- Soja, Piotr, and Grazyna Paliwoda-Pekosz. 2013. Comparing Benefits from Enterprise System Adoption in Transition and Developed Economies: An Ontology-based Approach. *Information Systems Management* 30: 198–217. [CrossRef]
- Stanciu, Victoria, and Andrei Tincea. 2013. ERP Solutions Between Success and Failure. *Accounting and Management Information Systems* 12: 626–49.
- Teittinen, Henri, Jukka Pellinen, and Marko Jarvenpaa. 2013. ERP in action—Challenges and benefits for management control in SME context. *International Journal of Accounting Information Systems* 14: 278–96. [CrossRef]
- Uddin, Md. Aftab, Mohammad Sarwar Alam, Abdullah Al Mamun, Tohid-Uz-Zaman Khan, and Ayesha Akter. 2020. A Study of the Adoption and Implementation of Enterprise Resource Planning (ERP): Identification of Moderators and Mediator. *Journal of Open Innovation: Technology, Market, and Complexity* 6: 2. [CrossRef]
- Ungureanu, Iulia. 2020. ERP Systems and the performance of the companies—a literature review. *European Finance, Business and Regulation EUFIRE* 2020: 101.
- Ungureanu, Iulia. 2022. ERP and financial performance—Case study on Romanian companies. *The Review of Economic and Business Studies* 15: 47–59.
- Ungureanu, Iulia, Oana Catalina Tapurica, Maria Simona Calinescu, and Ioana Iulica Mihai. 2022. ERP implementation in a research-development institute in Romania—perception case study. *Journal of Public Administration, Finance and Law (JOPAFI)*, 241–49. [CrossRef]
- van Slooten, Kees, and Lidwien Yap. 1999. Implementing ERP Information Systems Using SAP. Available online: <https://ris.utwente.nl/ws/portalfiles/portal/268836201/Slooten1999implementing.pdf> (accessed on 22 August 2022).

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- Wieder, Bernhard, Peter Booth, Zoltan P. Matolcsy, and Maria Luise Ossimitz. 2006. The impact of ERP systems on firm and business process performance. *Journal of Enterprise Information Management* 19: 13–29. [[CrossRef](#)]
- Wier, Benson, James Hunton, and Hassan HassabElnaby. 2007. Enterprise resource planning systems and non-financial performance incentives: The joint impact on corporate performance. *International Journal of Accounting Information Systems* 8: 165–90. [[CrossRef](#)]
- Womack, James P., and Daniel T. Jones. 1997. Lean thinking- Banish Waste and Create Wealth in your Corporation. *Journal of the Operational Research Society* 48: 1148. [[CrossRef](#)]
- Zimon, Grzegorz, Vitalina Babenko, Beata Sadowska, Katarzyna Chudy-Laskowska, and Blanka Gosik. 2021. Inventory Management in SMEs Operating in Polish Group Purchasing Organizations during the COVID-19 Pandemic. *Risks* 9: 63. [[CrossRef](#)]