Business performance in IT. A multivariate regression analysis

Ionela Tofan
"Alexandru Ioan Cuza" University of Iași, Romania
itofan08@yahoo.com
Elena Condrea
"Ovidius" University of Constanta, Faculty of Economic Sciences, Romania
elenacondrea2003@yahoo.com

Abstract

For the analysis of the performance of IT companies in Romania we have opted for a linear regression model in which the dependent variable entitled Result, which can be either profit or loss, was explained through the influence of the following variables: Non-current assets, Current assets, Stocks, Debts under 1 year, Debts over 1 year, Net turnover, Personnel expenditure, Research and development/R&D expenditure, Innovation expenditure. An entire series of positive relationships between the variables chosen is noted as an expression of the presence of a development strategy based both on the growth of the company's turnover and its superior exploitation, and on growth via external sources. In addition to these aspects, the high level of personnel, R&D and innovation expenditure has a dynamic influence on the results of these companies due to the high added value obtained by the overqualified labor.

Key words: business performance, multivariate regression, IT companies, financial indicators, productivity.
J.E.L. classification: M15, M20, M21

1. Introduction

As a rule, a company's performance is analyzed in order to put together a clear picture, with the aim of highlighting the positive and the negative elements that influence *the results*. Based on the results, the company's short-, medium- and long-term strategy is developed. The strategy is the beacon that guides the company's entire activity for the next period and outlines the exact directions to be followed.

Increasing a company's financial performance is a difficult goal to achieve, especially in times of financial crisis, health crisis and armed conflicts between countries, which have characterized the last 3 years. This subject has been widely analyzed within various economic fields, such as accounting, finance and management, and it remains an open topic for the companies which seek to increase turnover, assets, profit and to optimize their results (Mirea et Aivaz, 2016, p. 201; Munteanu et Aivaz, 2017, p. 436; Munteanu, 2021, p. 61).

The IT and telecommunications industry in Romania are an area which is increasingly found on the agenda of public and private entities, especially from the perspective of digitization and development of the digital economy (Tofan et Aivaz, 2022, p. 418). In the early 2000s, this branch of the economy received an impressive boost from policy makers following the decision to exempt directly productive employees from paying income tax on their salaries. This tax relief was the first step towards a strong growth of this sector, which has become increasingly important in the structure of our country's economy.

2. Literature Review

Economists have long emphasized the importance of investing in technology, especially information technology, considered a key driver of economic performance and growth.

As early as 1942, Schumpeter spoke of *creative destruction*, describing the process in which new innovations replace the existing ones that have become obsolete. Over time, similar ideas were put forward and studied by Nelson in 1959, Helpman in 1998, Brynjolfsson and McAfee in 2014.

In 1957, Solow formulated a paradox of ICT productivity, arguing that ICT has no impact and is not associated with improvements in productivity. His argument has been firmly contradicted by subsequent empirical research. Thus, Jason *et al.* in 2003 (p.1) show that at both company and country level, higher investment in IT is associated with higher productivity growth. Recent specialized literature reviews by Polák (2017, p. 38), Cardona *et al.* (2013, p. 4-5) and Brynjolfsson (1993, p. 4) have focused more on the economic impact of ICT.

The effect of IT on a company's performance has been extensively studied at the level of companies, fields and national economy, with most of the initial economic literature supporting the idea that ICT has a considerable and favorable impact on productivity (Niebel, T., 2018, p. 1; Timmer and van Ark, 2003, p. 2-3).

Globally, approximately $500 billion is estimated to be spent annually on building IT infrastructure (Gartner, 2015), and $4.6 trillion is projected to be spent in 2023 (Gartner, 2022). IT spending in emerging economies, such as India, reached approximately $87 billion, recording an annual growth of 9% in 2017 (Gartner, 2017). The large sums invested in technology raise the question of IT's contribution to a company's growth. Although a whole series of studies have addressed the issue of the role played by IT in the advanced economies, official data on the developing economies is largely insufficient or ambiguous (Niebel, 2018, p.1). Perhaps this is one of the reasons why the impact of ICT on sustainable development remains contested, its complexity proving to be an enigma for the researchers (Alataş, 2021, p.2-4).

Technological progress is related to the IT industry and it is believed that it can contribute to structural changes (Acemoglu, 2022 pp. 1-3), and the arrival of emerging technologies can directly replace factors of production (Acemoglu, 2022 p. 1-3).

Pantelis Koutroumpisa *et al.* (2020, p.1), who conducted an analysis of a panel of European companies, considered that the level of capital invested in R&D within ICT companies has a greater effect on revenue compared to the companies not operating in the field of ICT. At the company's level, the results suggest that, surprisingly, smaller and older ICT companies invest more in R&D. Therefore, small but mature companies tend to dominate niche markets and their small size in terms of number of employees allows them to be flexible and adaptable. This helps them respond to technological opportunities so as to develop innovative products and services that lead to performance (Koutroumpisa P. *et al.*, 2020, p.1).

The relationship between a company's performance and its strategy was outlined by Michael Porter (1980, p. 4), who considered that the major determinant factors of generic strategies are the following: suppliers, potential newcomers on the market, buyers, competitors within the industry, and producers of substitutable products. In Porter's view, a generic strategy is composed of three main strategies, namely: *cost leadership strategy, differentiation strategy and concentration/focus strategy*. He argues that it would be advisable for each company or organization to pursue only one of these strategies; otherwise, it risks wasting company resources in a futile attempt to grow the business rapidly and falling short of obtaining performance (Porter M., 1980, p. 35-37).

Over the past 10 years, the Romanian IT&C industry has maintained a steady nominal production growth compared to the national average. The industry has been found to be more resilient to external factors (Stan, 2021, p. 225), recording positive developments even in times of crisis, such as the 2008-2011 economic recession, the 2020 health crisis and the armed conflicts of the last year (ANIS, 2022).

According to ONRC (National Trade Register Office, 2022) and Ministry of Finance data, in 2019, 18,183 companies with the CAEN code belonging to the IT sector were registered in Romania, i.e., *CAEN 62 - information technology service activities*. In 2020 the number of these companies increased by 1,626, reaching 19,809 registered companies. Moreover, the turnover of these companies increased by RON 2.9 billion: from RON 29.5 billion to RON 32.4 billion. The profit recorded by the IT companies increased by 0.8 billion lei: from 3.9 billion lei in 2019 to 4.7 billion

lei in 2020. These data reported in 2021 indicate the upward trend that companies in the Romanian IT sector have been following, reflecting the performance of this sector and its importance for the national economy.

The best performing company in 2021 in the Romanian IT sector is IBM Romania, which approached a turnover of 1 billion lei; more precisely, it recorded a turnover of 984.02 million lei, with 3,291 employees (Ministry of Finance, 2022).

3. Research methodology

In the analysis of the performance of Romanian IT companies we have opted for a linear regression model in which the dependent variable entitled *Result* (which can be profit or loss) was explained by the influence of the following variables: *Non-current assets, Current assets, Stocks, Debts under 1 year, Debts over 1 year, Net turnover, Personnel expenditure, Research and development expenditure, Innovation expenditure*.

The research of the relationship between the *Financial result* and the influencing factors was carried out using the multiple linear regression analysis, which is a generalization of the simple linear regression model, in which the variation of the resultative or endogenous variable results from the simultaneous variation of the factors, following the model of a linear equation (Pintilescu, 2007, p. 180).

This study aims to determine the influencing factors acting on the financial result, a variable which represents an important pillar in the evaluation of a company's performance.

4. Findings

The statistical description of the variables, shown in Table no. 1, was made using the mean and the standard deviation of the variance. N represents the total number of analyzed companies.

Table no. 1 The statistical description of the variables

	Mean	Std. Deviation	N
Result	350551.5634	1754816.56351	1278
Total non-current assets	231449.25	1006568.657	1278
Current assets	1346017.87	7621184.544	1278
Stocks	29560.64	271688.595	1278
Debts under 1 year	684113.42	7464835.412	1278
Debts over 1 year	83180.46	683180.794	1278
Net turnover	2169569.71	10729800.018	1278
Personnel expenditure	1111276.22	7198819.781	1278
R&D expenditure	8775.30	226901.479	1278
Total innovation expenditure	15461.32	484398.654	1278

Source: Author's own processing

In order to check the strength of the connections between each independent variable and the dependent variable (the financial result), we have constructed the correlation matrix shown in Table no. 2. The output provided by the SPSS program shows the Pearson correlation coefficients and the significance (Sig.) for each correlation coefficient. One can see that the correlation coefficients on the main diagonal are equal to 1, since each variable is perfectly correlated with itself.

The correlation coefficients between all independent variables and the dependent variable are significant as the significance level (Sig.) for each correlation coefficient is less than 0.05.

Table no. 2 Pearson correlation

		Result	Total non-current assets	Current assets	Stocks	Debts under 1 year	Debts over 1 year	Net turnover	Personnel expenditure	R&D expenditure	Total Innovation expenditure
Pearson Correlation	Result	1.000	.210	-.016	.416	-.362	.088	.363	.191	.200	.198
	Total non-current assets	.210	1.000	.644	.433	.535	.244	.579	.570	.166	.165
	Current assets	-.016	.644	1.000	.189	.895	.206	.763	.797	.395	.404
	Stocks	.416	.433	.189	1.000	.067	.190	.151	.082	.105	.094
	Debts under 1 year	-.362	.535	.895	.067	1.000	.091	.522	.607	.327	.334
	Debts over 1 year	.088	.244	.206	.190	.091	1.000	.211	.078	.128	.114
	Net turnover	.363	.579	.763	.151	.522	.211	1.000	.955	.214	.220
	Personnel expenditure	.191	.570	.797	.082	.607	.078	.955	1.000	.186	.196
	Research and development expenditure	.200	.166	.395	.105	.327	.128	.214	.186	1.000	.967
	Total Innovation expenditure	.198	.165	.404	.094	.334	.114	.220	.196	.967	1.000
Sig. (1-tailed)	Result	.	<.001	.286	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	Total non-current assets	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
	Current assets	.028	.000	.	.000	.000	.000	.000	.000	.000	.000
	Stocks	.000	.000	.000	.	.008	.000	.000	.002	.000	.000
	Debts under 1 year	.000	.000	.000	.008	.	.001	.000	.000	.000	.000
	Debts over 1 year	.001	.000	.000	.000	.001	.	.000	.003	.000	.000
	Net turnover	.000	.000	.000	.000	.000	.000	.	.000	.000	.000
	Personnel expenditure	.000	.000	.000	.002	.000	.003	.000	.	.000	.000
	Research and development expenditure	.000	.000	.000	.000	.000	.000	.000	.000	.	.000
	Total Innovation expenditure	.000	.000	.000	.000	.000	.000	.000	.000	.000	.

Source: Author's own processing

As expected from the theory, there is a positive correlation between the *Financial result* and the *turnover* (0.363), as an expression of the presence of a development strategy based on the growth of the company's turnover and its superior capitalization. One can say that the best way to maximize profits is to concentrate the managers' efforts on increasing economic efficiency. At the same time, the strong positive influence of non-current and current assets on the result is observed, which indicates the need for expensive infrastructure, the high share of certain licenses, know-how, brands in the company.

The existence of direct connections between the dependent variable and short- or long-term debt reflects on the one hand the financial risk and on the other hand the companies' connections with other units with a view to growing through external sources.

Moreover, personnel, R&D and innovation expenditure exert a positive influence on the *Financial Results*, due to the high added value obtained by this overqualified labor.

At this stage of the analysis, Table no. 4, which shows the SPSS *Model Summary* output of the multiple linear regression, shows that all 8 models are significant as the significance level (Sig.) is less than 0.05 for each model.

Table no. 4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.416[a]	.173	.172	1596475.85599	.173	266.871	1	1276	<.001	
2	.571[b]	.326	.325	1441899.17010	.153	289.248	1	1275	<.001	
3	.823[c]	.677	.676	998635.21305	.351	1384.069	1	1274	<.001	
4	.868[d]	.754	.754	871212.49733	.077	400.921	1	1273	<.001	
5	.881[e]	.776	.775	832521.50855	.022	122.074	1	1272	<.001	
6	.895[f]	.802	.801	782962.77620	.026	167.122	1	1271	<.001	
7	.910[g]	.828	.827	729904.35240	.026	192.500	1	1270	<.001	
8	.916[h]	.839	.838	705605.15162	.011	89.977	1	1269	<.001	1.911

a. Predictors: (Constant), Stocks
b. Predictors: (Constant), Stocks, Debts under 1 year
c. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover
d. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure
e. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure
f. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year
g. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year, Current assets
h. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year, Current assets, Total non-current assets
i. Dependent Variable: Result

Source: Author's own processing

Table no. 5 ANOVA presents the estimates of the two components of the variance (the variance explained by the regression model and the residual variance), the corresponding degrees of freedom and the estimates of the explained and residual variances, the calculated Fisher test value and the significance of the test.

The estimated correlation ratio variables for each model and the corresponding determination ratio in Table no. 4 show the proportion in which the dependent variable is explained by the independent variables.

Table no. 5 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	680183693535981.500	1	680183693535981.500	266.871	<.001[b]
	Residual	3252186062560899.000	1276	2548735158746.786		
	Total	3932369756096880.500	1277			
2	Regression	1281551404754892.000	2	640775702377446.000	308.203	<.001[c]
	Residual	2650818351341988.500	1275	2079073216738.815		
	Total	3932369756096880.500	1277			
3	Regression	2661844860231270.000	3	887281620077090.000	889.708	.000[d]
	Residual	1270524895865610.500	1274	997272288748.517		
	Total	3932369756096880.500	1277			
4	Regression	2966148478753025.500	4	741537119688256.400	976.978	.000[e]
	Residual	966221277343855.100	1273	759011215509.706		
	Total	3932369756096880.500	1277			

5	Regression	3050756652985992.500	5	610151330597198.500	880.332	.000[f]
	Residual	881613103110888.000	1272	693092062194.094		
	Total	3932369756096880.500	1277			
6	Regression	3153207725062546.000	6	525534620843757.700	857.273	.000[g]
	Residual	779162031034334.600	1271	613030708917.651		
	Total	3932369756096880.500	1277			
7	Regression	3255764094252330.000	7	465109156321761.440	873.018	.000[h]
	Residual	676605661844550.600	1270	532760363657.126		
	Total	3932369756096880.500	1277			
8	Regression	3300561774636128.000	8	412570221829516.000	828.656	.000[i]
	Residual	631807981460752.500	1269	497878629992.713		
	Total	3932369756096880.500	1277			

a. Dependent Variable: Result
b. Predictors: (Constant), Stocks
c. Predictors: (Constant), Stocks, Debts under 1 year
d. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover
e. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure
f. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure
g. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year
h. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year, Current assets
i. Predictors: (Constant), Stocks, Debts under 1 year, Net turnover, Total Innovation expenditure, Personnel expenditure, Debts over 1 year, Current assets, Total non-current assets

Source: Author's own processing

The output in Table no. 6 shows the parameters of the multiple regression model which were tested using the Student test, taking into account the estimators obtained through the least squares' method and their distribution law. In SPSS, the decision is made based on the significance of the test: if Sig t <0.05, H0 is rejected at the 0.05 confidence level, and if Sig t >0.05, H0 is accepted.

One can see that all parameters, from all models, are statistically significant and, therefore, the independent variables have a significant partial linear influence on the dependent variable. The SPSS program also performs a test using the classical approach, based on the theoretical and calculated values of the test in the t column. Applying the decision rule gives the same results.

Table no. 6 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	271144.320	44921.521		6.036	<.001
	Stocks	2.686	.164	.416	16.336	<.001
2	(Constant)	329148.137	40715.147		8.084	<.001
	Stocks	2.856	.149	.442	19.189	<.001
	Debts under 1 year	-.092	.005	-.392	-17.007	<.001
3	(Constant)	153898.941	28589.378		5.383	<.001
	Stocks	2.331	.104	.361	22.403	<.001
	Debts under 1 year	-.177	.004	-.752	-40.287	<.001
	Net turnover	.115	.003	.701	37.203	<.001
4	(Constant)	160931.422	24943.936		6.452	<.001
	Stocks	2.205	.091	.341	24.229	<.001
	Debts under 1 year	-.198	.004	-.842	-49.833	<.001
	Net turnover	.112	.003	.685	41.657	<.001

	Total Innovation expenditure	1.073	.054	.296	20.023	<.001
5	(Constant)	128436.208	24016.925		5.348	<.001
	Stocks	1.989	.089	.308	22.311	<.001
	Debts under 1 year	-.176	.004	-.748	-41.022	<.001
	Net turnover	.195	.008	1.193	24.575	<.001
	Total Innovation expenditure	.972	.052	.268	18.679	<.001
	Personnel expenditure	-.139	.013	-.571	-11.049	<.001
6	(Constant)	133087.858	22590.100		5.891	<.001
	Stocks	2.063	.084	.319	24.553	<.001
	Debts under 1 year	-.166	.004	-.706	-40.494	<.001
	Net turnover	.245	.008	1.499	29.148	<.001
	Total Innovation expenditure	.966	.049	.267	19.741	<.001
	Personnel expenditure	-.213	.013	-.874	-16.204	<.001
	Debts over 1 year	-.479	.037	-.186	-12.928	<.001
7	(Constant)	102179.606	21176.754		4.825	<.001
	Stocks	1.742	.082	.270	21.335	<.001
	Debts under 1 year	-.263	.008	-1.118	-33.058	<.001
	Net turnover	.219	.008	1.336	27.070	<.001
	Total Innovation expenditure	.745	.048	.206	15.410	<.001
	Personnel expenditure	-.235	.012	-.966	-19.032	<.001
	Debts over 1 year	-.576	.035	-.224	-16.338	<.001
	Current assets	.149	.011	.647	13.874	<.001
8	(Constant)	79571.034	20610.041		3.861	<.001
	Stocks	1.395	.087	.216	16.035	<.001
	Debts under 1 year	-.269	.008	-1.143	-34.866	<.001
	Net turnover	.216	.008	1.318	27.614	<.001
	Total Innovation expenditure	.793	.047	.219	16.876	<.001
	Personnel expenditure	-.241	.012	-.990	-20.156	<.001
	Debts over 1 year	-.612	.034	-.238	-17.856	<.001
	Current assets	.140	.010	.608	13.433	<.001
	Total non-current assets	.277	.029	.159	9.486	<.001

a. Dependent Variable: Result

Source: Author's own processing

The regression equations for the *Results* variable, obtained from the results in Table no. 6, are as follows:

Model 1: *Results=271144.320+2.686 Stocks*

Model 2: *Results =329148.137+2.856 Stocks -0.092 Debts under 1 year*

Model 3: *Results =153898.941+2.331 Stocks -0.177 Debts under 1 year + 0.115 Net turnover*

Model 4: *Results =160931.422+2.205 Stocks -0.198 Debts under 1 year + 0.112 Net turnover + 1.073 Total Innovation expenditure*

Model 5: *Results =128436.208+1.989 Stocks -0.176 Debts under 1 year + 0.195 Net turnover + 0.972 Total Innovation expenditure + Personnel expenditure*

Model 6: *Results =160931.422+2.205 Stocks -0.198 Debts under 1 year + 0.112 Net turnover + 1.073 Total Innovation expenditure -0.139 Personnel expenditure -0.479 Debts over 1 year*

Model 7: *Results =102179.606+1.742 Stocks -0.263 Debts under 1 year + 0.219 Net turnover + 0.745 Total Innovation expenditure -0.235 Personnel expenditure -0.576 Debts over 1 year +0.149 Current assets*

Model 8: *Results =79571.034+1.395 Stocks -0.269 D Debts under 1 year + 0.216 Net turnover + 0.793 Total Innovation expenditure -0.241 Personnel expenditure -0.612 D Debts over 1 year +0.140 Current assets +0.277 Total non-current assets*

Model 8 contains all the variables introduced in the study. The multiple correlation coefficient (R) for this model is 0.919 and the coefficient of determination (R^2) is 0.839. These values show that 83.9% of the variation *Results* obtained by IT companies can be explained by the factor variables introduced in the model. The remaining, up to 100%, represents the influence of other factors not included in the model.

5. Conclusions

Companies, especially IT companies, are in a constant competition for the most important resource, namely qualified people. This is why these companies need a clear definition of their objectives, including a description of the organization's product, market, main technology areas, so as to reflect the values and priorities of the decision-makers (Rus, M. -I., 2013, p. 942; Rus, M. -I., 2016, p. 187).

The analysis at the level of Romania has shown that the market for information and related activities is particularly complex, with financial results being influenced by an entire series of financial indicators (Aivaz, 2021a, p. 8; Aivaz, 2021b, p.17) which, as seen in the regression models used, determine the level of profit or loss.

This research aimed to determine the influencing factors acting on the *financial result* of Romanian IT companies. Following the analysis, carried out with the help of linear regression model, we can conclude the following: there is a positive correlation between the *Financial Result* and *Turnover*, highlighting the importance given to the increase of turnover by entrepreneurs in order to raise the performance level of their companies. All the variables introduced in the linear regression model were found to have a considerable impact upon the *results* of IT companies.

The importance given to digitization in the past 10 years and its forced implementation in various economic sectors in the last three years - due to the COVID-19 pandemic and the conflict context between Russia and Ukraine – have led to the issuance of supportive internal and external policies and has determined the accelerated growth of the IT sector in the Romanian economy. With the role of the IT sector projected to grow steadily until 2025, further research will be needed to create a connection between the performance of the companies in this sector and their role in the economy.

6. References

- Acemoglu, D.et al, 2022. Radical and Incremental Innovation: The Roles of Firms, Managers, and Innovators*, American Economic Journal: Macroeconomics*, Vol.. 14, no. 3, July 2022, pp. 199-249, Document Type: Article, Available at: < Radical and Incremental Innovation: The Roles of Firms, Managers, and Innovators (mit.edu)>, [Accessed date: 18 November 2022], https://doi.org/10.1257/mac.20170410.
- Aivaz Kamer-Ainur, 2021a**.** The Impact of ICT on Education and Living Standards. Case Study in Constanta County, Romania*. Under the pressure of digitalization: challenges and solutions at organizational and industrial levels, first edition*, pp. 8-16**,** Document Type: Article; Book Chapter, ISBN 979-12-80225-27-6, Filodiritto publisher, Inforomatica srl, via Castiglione, 81, Bologna, 40124, Italy.
- Aivaz Kamer-Ainur**,** 2021b. Correlations Between Infrastructure, Medical Staff and Financial Indicators of Companies Operating in the Field of Health and Social Care Services. The Case of Constanta County, Romania*, Under the pressure of digitalization: challenges and solutions at organizational and industrial levels, first edition*, pp. 17-25**,** Document Type: Article; Book Chapter, ISBN 979-12-80225-27-6, Filodiritto publisher, Inforomatica srl, via Castiglione, 81, Bologna, 40124, Italy

- Alataș. S., 2021. The role of information and communication technologies for environmental sustainability: Evidence from a large panel data analysis, *Journal of Environmental Management*, Volume 293, 1 September 2021, 112889, p. 2-4, Document Type: Article, https://doi.org/10.1016/j.jenvman.2021.112889
- ANIS, 2021. Studiu privind impactul industriei de software și servicii IT în economia României, Available at: <https://media.dcnews.ro/other/202202/anis_rb_studiu-privind-impactul-industriei-swit_final_27234800.pdf> [Accessed 2 December 2022].
- Brynjolfsson, E., 1993. The Productivity Paradox of Information Technology: Review and Assessment. *Communications of the ACM*, Center for Coordination Science, MIT Sloan School of Management, Cambridge, Massachusetts, Available at: <http://ccs.mit.edu/papers/CCSWP130/CCSWP130.html>. [Accessed 20 November 2022]. http://dx.doi.org/10.1145/163298.163309.
- Brynjolfsson, E., & McAfee, A., 2014. *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. Available at: <https://books.google.ro/books?id=PMBUAgAAQBAJ&printsec=frontcover&hl=ro&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false>, Document type: Book, ISBN 978-0-393-35064-7, WW Norton & Co, New York, [Accessed 20 November 2022].
- Cardona, M. et al., 2013. ICT and productivity: conclusions from the empirical literature, Document Type: Article, *Inf. Econ. Policy*, Volume 25, Issue 3, September 2013, p. 109-125, http://dx.doi.org/10.1016/j.infoecopol.2012.12.002
- Dedrick, J., Gurbaxani, V., & Kraemer, KL., 2003. *Information technology and economic performance: A critical review of the empirical evidence,* ACM Computing SurveysVolume 35, Issue1 March 2003 p. 1–28, https://doi.org/10.1145/641865.641866, Available at: <https://www.researchgate.net/publication/220566643_Information_technology_and_economic_performance_A_critical_review_of_the_empirical_evidence>.
- Gartner Inc., 2015. *Hype Cycle for Emerging Technologies*, Available at:<https://www.gartner.com/smarterwithgartner/whats-new-in-gartners-hype-cycle-for-emerging-technologies-2015>, [Accessed 20 November 2022].
- Gartner Inc., 2022, *Outlook for the Global IT Market* During Gartner IT Symposium/Xpo 2022, October 17-20, Orlando, Available at: <https://www.gartner.com/en/newsroom/press-releases/2022-06-14-gartner-forecasts-worldwide-it-spending-to-grow-3-percent-in-2022>, [Accessed 20 November 2022].
- Gartner Inc. 2017, *IT Trends and Spending Outlook for India* during Gartner Symposium/ITxpo 2017, November 13-16, Goa, India, https://www.gartner.com/en/newsroom/press-releases/2021-12-01-india-it-spending-forecast-2022, [Accessed 20 November 2022].
- Helpman, E, 1998. *General Purpose Technologies and Economic Growth*, Place of publication: p. 1-14. Publisher Massachussets Institute of Technology, Available at: <https://books.google.ro/books?printsec=frontcover&vid=LCCN98011842&redir_esc=y#v=onepage&q&f=false, ISBN 0262082632>, [Accessed 22 November 2022].
- Koutroumpisa, P. et al, 2020. *Small is big in ICT: The impact of R&D on productivity, in Telecommunications Policy,* Volume 44, Issue 1,2020,101833, ISSN 0308-5961, DOI: https://doi.org/10.1016/j.telpol.2019.101833.
- Ministry of Finance, 2022. Available at: https://mfinante.gov.ro/info-pj-selectie-nume-si-judet, [Accessed 20 November 2022].
- Mirea, M., Aivaz, K. A. 2016. *Analyzing "the workforce cost" and "the net nominal earnings" in the main economic activities, by principal component analysis*, in BASIQ INTERNATIONAL CONFERENCE: NEW TRENDS IN SUSTAINABLE BUSINESS AND CONSUMPTION 2016, Book Series: Proceedings of BASIQ, p. 201-209, Published: 2016, Document Type: Proceedings Paper, ISSN: 2457-483X.
- Munteanu Florea, I., Aivaz, K.A., 2017. Factorial correspondences in the tourism services provided tothe population in Romania. Proceedings of BASIQ International Conference on New Trends in Sustainable Business and Consumption. Graz, Austria, 31 May-3 June 2017. Bucharest: ASE, p. 436-444.
- Munteanu, I. F. , 2021. Comparative Analysis on Financial Performance and Sustainable Incentives in the Construction Sector. Evidence from the Coastal Area of Romania. *Annals of the University Dunarea de Jos of Galati: Fascicle: I, Economics & Applied Informatics*, 27(1), p. 61-67. https://doi.org/10.35219/eai15840409168.
- Nelson, R., 1959. The simple economics of basic scientific research, *Journal of Political Economy*, Vol. 67, No.3 (Jun. 1959), p. 297-306, published by The University of Chicago Press.

- Niebel, T., 2018. ICT and economic growth – Comparing developing, emerging and developed countries, *Centre for European Economic Research (ZEW*), Published in World Development, vol. 104, issue C, p. 197-211. https://doi.org/10.1016/j.worlddev.2017.11.024.
- National Trade Registered Office, 2022, https://www.onrc.ro/index.php/en/statistics.
- Polák, P., 2017. The productivity paradox: A meta-analysis, *Information Economics and Policy*, Elsevier, vol. 38(C), p. 38-54, DOI: 10.1016/j.infoecopol.2016.11.003.
- Porter, M. E., 1980. *Competitive strategy: Techniques for analyzing industries and competition,* New York, Free Press, (Republished with a new introduction, 1998.)
- Pintilescu, C., 2007. *Analiză statistică multivariată*, Editura Universității Al. Ioan Cuza, Iași.
- Rus, M. -I., 2013. "The Knowledge Triangle" in a Knowledge-Based Society, *Annals of Faculty of Economics*, Oradea, vol 1 (1), p. 942-947, [online] Available at: https://econpapers.repec.org/scripts/redir.pf?u=http%3A%2F%2Fanale.steconomiceuoradea.ro%2Fvolume%2F2013%2Fn1%2F099.pdf;h=repec:ora:journl:v:1:y:2013:i:1:p:942-947
- Rus, M. -I., 2016. The impact of financing the research and development activities worldwide. Comparative studies, *Discourse as a form of Multiculturalism in Literature and Comunication*, p. 187-192, Editura Arhipelag XXI.
- Shumpeter, J., 1942. *Creative destruction. Capitalism. Socialism. Democracy*, New York: Harper & Row, 381 pp.; Third edition, 1950.
- Solow, R.M, 1957. *Tehnical change and the aggregate production function*- The Revue for Economics and Statistics, 39 (3), p. 312-320.
- Stan, M. I., 2019. Issues concerning the dynamics of labor productivity ay the level of the companies in Constanta County operating in the Construction sector befor and after Covid-19 pandemic, *Technium Social Sciences Journa*l, vol 25, p. 225-241, https://doi.org/10.47577/tssj.v25i1.5095
- Timmer, M.P., Ypma, G., and van Ark, B., 2003. *IT in the European Union: driving productivity divergence?*, No 200363, GGDC Research Memorandum GD-67, Groningen Growth and Development Centre, University of Groningen, Available at: <https://www.researchgate.net/publication/4765400_IT_in_the_European_Union_Driving_Productivity_Divergence>, [Accessed 18 November 2022].
- Tofan, I., Aivaz K. A., 2022. *The use of computers and the Internet- effects on employee productivity in Romania, Technium Social Sciences Journal*, Vol. 32 (June 2022): A new decade for social changes, p. 418-429, https://doi.org/10.47577/tssj.v32i1.