THE DIGITAL TRANSFORMATIONS AMPLIFIED BY THE NOVEL CORONAVIRUS ARE POSITIVELY IMPACTING THE TRANSITION TO GREEN ECONOMY? CASE STUDY OF ENTITIES LISTED AT BSE

Oana BOGDAN[1], Valentin BURCĂ[2], Larisa IVAŞCU[3]

Rezumat. *Pentru a putea să îşi desfăşoare activitatea şi să respecte în acelaşi timp măsurile de restricţie impuse de guvernele lumii cu scopul de a limita răspândirea noului coronavirus, entităţile economice şi-au testat capacitatea de rezilienţă şi au fost nevoite să se adapteze şi să utilizeze tot mai mult tehnologia digitală. Fie că erau pregătite sau nu în acest scop, se pare că pandemia cauzată de noul coronavirus a amplificat procesul de digitalizare. În acest context, scopul lucrării noastre este de a identifica dacă transformările digitale au impactat şi durabilitatea şi tranziţia către o economie verde. Eşantionul nostru este format din entităţile listate la BVB ce au publicat rapoartele anuale în perioada 2019-2021. Astfel, cu ajutorul programului NVivo, am extras cuvintele cheie ce se regăsesc în European Green Deal. Apoi, cu ajutorul programului RapidMiner am putut analiza rapoartele anuale publicate în cei trei ani pentru a identifica, în baza cuvintelor cheie selectate, iniţiativele verzi întreprinse de entităţile ce formează eşantionul nostru. Rezultatele reflectă faptul că, în timpuri pandemice, rapoartele anuale prezintă informaţia tot mai succint, iar rezultatele financiare mai slabe sunt cosmetizate prin focusarea pe aspectele pozitive întreprinse, precum eforturile demarate în sfera dezvoltării durabile.*

Abstract. *In order to be able to carry out their activity and at the same time comply with the restriction measures imposed by the governments of the world with the aim of limiting the spread of the novel coronavirus, economic entities tested their resilience and adaptability, using much more the digital technology. Whether they were prepared for this purpose or not, it seems that the pandemic caused by the novel coronavirus has amplified the digitization process. In this context, the purpose of our study is to identify whether digital transformations have impacted sustainability and the transition to a green economy. Our sample consists of the entities listed at the Bucharest Stock Exchange (BSE) that published their annual reports in the period 2019-2021. Thus, with the help of the NVivo program, we extracted the keywords found in the European Green Deal. Then, with the help of the RapidMiner program, we were able to analyze the annual reports published in the three years to identify, based on the selected keywords, the green initiatives undertaken by the entities from our sample. The results reflect the fact that, in*

[1] Assist.prof., Faculty of Economics and Business Administration, West University of Timisoara, Timisoara, Romania (e-mail: oana.bogdan@e-uvt.ro)
[2] Assist.prof., Faculty of Economics and Business Administration, West University of Timisoara, Timisoara, Romania (valentin.burca@e-uvt.ro)
[3] Prof.habil.Ph.D.Eng., Politehnica University of Timisoara, Romania, Associate Member of the Academy of Romanian Scientists (larisa.ivascu@upt.ro)

pandemic times, annual reports present information more and more succinctly, and weaker financial results are embellished by focusing on the positive aspects undertaken, such as the efforts started in the sphere of sustainable development.

1. Introduction

The non-financial reporting of entities tends to become a tool more and more importantly, financial information no longer being the only criterion in substantiating investment decisions. Thus, non-financial reporting reflects the social impact and transparency of companies, being at the same time a mean of promotion and communication with the external environment. However, in order for the sustainability report not to present only the positive elements, and the negative ones to be cosmeticized, the field of CSR was reformed by the Directive 95/2014/EU which imposed the reporting obligation and conditions.

However, it seems that it is quite difficult to transmit the weaker results in the public environment, especially in the context of a health crisis that has affected the economic environment to a very large extent. The pandemic caused by the „novel coronavirus" forced the entities to look for solutions to carry out their activity, while respecting, at the same time, the imposed restriction measures necessary to limit the spread of COVID-19.

Thus, the crisis accelerated processes that had been started for a long time, but which progressed at a slower pace, such as automation and digitization. The recent studies [1] undertaken highlighted the fact that the main impediments in the implementation of digital technologies to improve and facilitate the transition to a green economy were represented by the lack of knowledge and understanding of the processes but also by the culture organizational, reluctant to change. Extensive analyzes carried out [2] highlighted the fact that corporate digital transformation has a greater effect on innovation in the green economy sphere within large firms. However, in order to adapt to the new „normal", most companies, not just the big ones, were forced to reorient themselves and adopt solutions to work remotely, thus amplifying the digitization process. But this process was not an easy one, it involved substantial costs both in terms of logistics and in terms of training human resources. Practice has shown us, however, that in pandemic times, the elaborated reports tend to present the information more succinctly and in a more ambiguous tone [3] and the weaker results to be embellished by focusing on the positive aspects undertaken [4]. But is sustainability a topic of interest even in times of crisis, used in order to mask weaker financial results? Are companies able to facilitate, even in this context, the transition to a circular economy? Has the pandemic crisis and the acceleration of the digitization process had a positive impact in the sphere of sustainable development?

The purpose of our research is to bring some new perspectives on the efforts made to achieve sustainable development in a pandemic context, based on a sample of entities listed on the Bucharest Stock Exchange that published their annual reports in the period 2019-2021. We aim to identify whether digital transformations have also impacted the transition to a green economy. Thus, our article comes with additional perspectives in the scientific literature and brings additions through the analysis that demonstrates the increasing trend, over time, of the relevance of keywords directly or indirectly associated with green economy initiatives, considering the context of the recent crisis generated by the new coronavirus. This period represented a turning point in the evolution of the awareness of the management of economic entities regarding the need to reform business models which, in addition to the economic or corporate governance aspects, must also take into account human capital but also the measures undertaken in the sphere of environmental protection [5].

This paper is structured as follows: Section 2 presents the literature review and hypothesis development; Section 3 presents the research methodology, Section 4 discusses the results obtained, and Section 5 summarizes the main findings, conclusions and avenues for future research directions.

2. Literature review

The concepts of green economy, environmental protection, sustainable development and digital transformation have become topics of great interest, especially due to the fact that, currently, the way in which resources are used is not a sustainable one, being in fact a model that exerts great pressure on the planet's resources.

The transition to a green, circular economy, which focuses on design, innovation and ecological investments, is thus necessary. The economic activities carried out ensure the well-being of the population and contribute to the reduction of poverty, but they pollute the environment. In addition, climate change and global warming are reasons that reflect the need to take urgent measures to counter them. However, the pandemic generated by the novel coronavirus has shown us that humanity is capable of adapting and taking immediate measures. An example in this case is the growing trend of digitization during the pandemic period. Due to the restrictive measures imposed to limit the spread of the COVID-19 virus, the vast majority of activities have been transferred into the online environment, digitization being a necessity of the new "normal".

In what form, however, can the acceleration of digitization influence the transition to a green economy and the achievement of long-term sustainable development? Certain researchers [6] demonstrate that both the state and companies must support the transition to a green economy through digital innovations and efficient management of renewable energy. The same conclusion

was reached by another study [5] which highlights that digital transformation can improve the level of innovation in the green economy sphere by alleviating financing constraints and attracting government subsidies. But all these benefits are not without challenges and costs. Another researcher [7] highlights the fact that the adoption and integration of new digital technologies in the infrastructure of society represent the biggest challenges faced by companies in this context where digitization was forced by the emergence of the new coronavirus.

All of this has required companies to invest significant time, money and capabilities to ensure their resilience in times of economic uncertainty. An important aspect is also the way in which managers present the results obtained in a pandemic context. The research conducted by [8] reveals that managers prefer to convey a positive signal by framing a generalized speech that does not highlight negative aspects or poorer performance. The question is, in this context, are economic entities still thinking about sustainable development or they are just struggling to overcome difficult times?

On the one hand, there are studies that highlight the fact that economic entities have begun to adopt new strategies and digital technologies to adapt to the pandemic period [9], [10] or to transfer the activity to a remote system in order to continue their business. Also, there are studies that demonstrate that entities have paid more attention to innovation and risk management, especially with regard to the supply chain and the portfolio of products sold in the retail area [11-13].

Conversely, on the other hand, there is a gap in the literature regarding how digital transformations can improve the transition to a green economy. In this context, the objective of our research is to bring additional perspectives to the scientific literature by analyzing the annual reports published by the entities listed on the BSE in the period 2019-2021 in order to identify, first of all, based on the selected keywords, the green initiatives undertaken by entities [12-15]. We then aim to identify, to what extent digital transformations have been the promoter of the green initiatives of the entities included in the sample. In carrying out the research, we used the TF-IDF indicator, with the aim of highlighting how important a word is in a document, respectively the annual reports published in the three years under analysis.

3. Research methodology

Our research methodology is similar to the one carried out by [3], being focused on the analysis of the frequency of keywords used in the period between 2019 and 2021. Our sample consists of companies listed on the Romanian capital market, respectively the Bucharest Stock Exchange (BSE). The basis of the analysis was made up of the annual reports that were manually downloaded from the BSE website, 126 observations being included in the analysis.

To achieve our research objective, we entered the European Green Deal into the Nvivo program, from which we extracted the most used 500 words. From these we selected the terms regarding digital technologies and the green economy and with the help of the TF-IDF indicator we ranked the relevance of the keywords associated with the list of words that we consider to be related to the green initiatives undertaken by the economic entities included in the sample.

4. Results and discussions
4.1. Keywords related to the green economy
In Figure no.1 we represent the relevance of the keywords associated with the list of words that we consider to be related to the green initiatives undertaken by the economic entities included in the analyzed sample of annual reports.
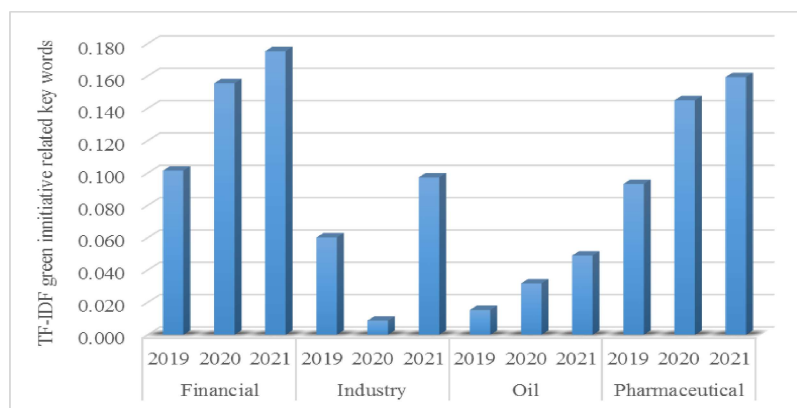

Fig. 1. Representation of relevant keywords extracted from annual reports
Source: authors projection after RapidMiner

The TF-IDF values reveal a greater presence of keywords associated with the statements included in the analyzed annual reports that address issues indirectly related to green initiatives to which economic entities in the financial field pay attention. They are followed by economic entities from the pharmaceutical area, at a short distance. These results are not unexpected, considering the pressure that the banking system exerts on the policies of economic entities, by including in the banking criteria some aspects related to environmental performance. At the same time, in the pharmaceutical industry, the specifics of operational activities raise numerous environmental issues, which is why entities operating in this area want to send as positive signals as possible regarding internal policies that encourage environmental protection and facilitate green economy initiatives. Last but not least, we notice an increasing evolution over time of the relevance of keywords directly or indirectly associated with green economy initiatives, given the context of the recent crisis generated by the COVID-19 pandemic. This period represented a turning point in the evolution of

the awareness of the management of economic entities regarding the need to reformulate business models, which must take into account, not only the economic aspects, or those of corporate governance, but also those related to of human capital and those of environmental protection, respectively.

On the other hand, we observe a low level of relevance of keywords associated with green economy initiatives in the case of the analyzed reports in the case of economic entities operating in the industrial field and in the field of oil and gas extraction, respectively. The differences are particularly notable for entities operating in the field of oil and gas extraction, although in the case of this category of entities we expected to obtain the most usage of keywords associated with green economy initiatives. At least at the level of a circumstantial textual analysis, it seems that these entities are less concerned with environmental protection measures, pretending the transition to a circular economy through a component focused more on the efficiency of operations by reducing operational costs and, respectively, the sizing attention of the human resource.

Table 1. Keywords associated with green economy initiatives found in annual reports

Cluster 1	TD-IF	Cluster 2	TD-IF	Cluster 3	TD-IF	Cluster 4	TD-IF
Fossil	0.5268	Depletion	0.1415	Ecologic	0.0638	Recycle	0.0326
Bioenergy	0.3386	Disposable	0.1364	Climate	0.0599	Emissions	0.0320
Efficiency	0.2570	Pollution	0.1354	Consumption	0.0597	Renewable	0.0275
Preservation	0.2424	Biodiversity	0.1296	Depollution	0.0546	Restauration	0.0209
Land	0.2272	Resilient	0.1147	Deforestation	0.0528	Dewatering	0.0190
decarbonization	0.2057	Hazards	0.1100	Inefficiency	0.0522	Organic	0.0169
Forests	0.1949	Wastes	0.1000	Clean	0.0508	Carbon	0.0157
Biotechnology	0.1906	Degradation	0.0920	Reforestation	0.0501	Energy	0.0154
Intensively	0.1573	Adaptable	0.0658	biodegradable	0.0344	policy makers	0.0147
Development	0.1523	Reduction	0.0645	Returnable	0.0337	Flexibility	0.0115

Source: Authors projection after RapidMiner

Noteworthy in Table 1 is the fact that the most common words used in the annual reports refer to concerns regarding energy and, respectively, the natural resources available to each economic entity. The V recovery of national economies has raised major challenges in the recovery of supply chains, including in terms of meeting energy demand with significantly reduced supply amid the consumer-level effects of the COVID-19 pandemic. Under these conditions, the economic entities sought as much as possible solutions to reduce the already significantly increased purchase costs, by streamlining operational processes and, respectively, identifying alternative energy solutions, precisely to ensure a sustainable intensive economic growth in the medium and long term. However, it

seems that at the level of economic entities there is a concern regarding the need to reduce the degree of pollution, a reduction of waste and a reduction of the degree of environmental degradation, by adopting strategies and corporate policies of resilience. However, these declarative positions through the annual reports are not found in reality, as long as the public authorities do not come to the support of economic entities by providing incentives in this direction, especially if the transition to a green economy usually involves significant investments.

4.2. LDA analysis of topics

In this section we reveal the results obtained through the comparative analysis of several extraction scenarios of the most relevant topics addressed in the analyzed annual reports, with the help of the LDA method described in the research methodology section. From Figure 2 it appears that the optimal level of extracted topics would be approximately 81, considering that the minimum level of the Propensity indicator is in this case 1171.3. Given that the size of the annual reports is very large, this number of topics is justified, thus obtaining topics as independent as possible from each other.
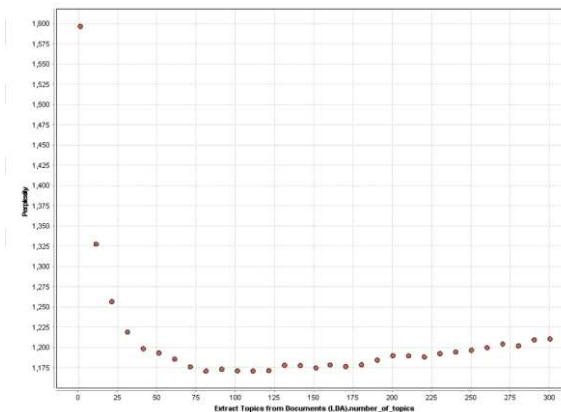

Fig. 2. Representation of the optimal number of extracted topics
Source: authors projection with RapidMiner

In Table 2 we summarize the descriptive elements of the 81 topics extracted in the case of the analyzed annual reports. Based on these data, we can see that this optimal level of extracted topics does not lead to well-delimited topics, given the low level of exclusivity.

Table 2. LDA statistics of extracted topics

Sector	Year	Coherence	Exclusivity	Entropy	Token	Words per sentence
Finance	2019	-42.794	0.135	1.693	5,491	6.672
	2020	-42.524	0.139	1.811	6,039	6.685
	2021	-41.972	0.138	1.772	6,443	6.690

Gas&Oil	2019	-52.777	0.214	1.441	5,934	6.955
	2020	-53.670	0.212	1.342	7,718	6.898
	2021	-50.663	0.194	1.381	7,397	6.822
Industry	2019	-79.303	0.182	2.128	4,026	6.978
	2020	-78.801	0.183	2.065	4,491	7.027
	2021	-76.956	0.183	2.081	4,287	7.033
Pharma	2019	-31.500	0.335	0.887	1,475	7.160
	2020	-34.832	0.357	0.897	1,269	7.107
	2021	-32.634	0.342	0.904	1,320	7.099

Source: authors projection with RapidMiner

However, we notice a higher level of exclusivity in the case of economic entities active in the pharmaceutical industry, explained by the specificity of the field and a much higher level of regulation of the degree of corporate transparency.

Table 3. Summary of topics extracted in relation to the list of words regarding green initiatives

Group	Topic	Keywords from the list reviewed	Keywords topic extracted
Finance	Directors' opinion	policy, energy	fund, property, director, shareholders, management, policy, financial, energy, remuneration, law
Finance	Financial audit & valuation	Policy	shares, shareholders, value, regulation, financial, audit, board, meeting, price, dividend
Finance	Results financial analysis	emissions	financial, value, assets, account, company, shareholders, profit, credit, consolidated, risk
Gas&Oil	Contracting & regulation	energy, policy, emissions	mandatory, chief, differences, oil, assets, company, source, contract, storage, distribution
Gas&Oil	Invoicing & regulation	energy, policy	prevalence, differences, inspection, energy, resolution, financial, reevaluation, recognize, requirements, products
Gas&Oil	Distribution, regulation & liabilities	energy, lands	group, distribution, electricity, ANRE, income, reporting, services, financial, liabilities, conformity
Industry	Sustainable economic development	development, consumption, policy	directors, department, environmental, development, maintenance, consumption, financial, workers, risk, provisions
Industry	Financial analysis	lands, energy, emissions	company, value, financial, report, interests, rate, taxes, consolidated, equity, directors
Industry	Development & performance management	development, disposals	group, consolidated, process, development, indicators, components, products, installations, requirements, integrated

Pharma	Results financial analysis	policy, lands	amendments, recognize, profit, losses, obligations, commercial, corporate, compare, expenses, policy
Pharma	Financial audit	policy, lands	financial, administrators, audit, according, policies, meetings, assets, shares, capital, result
Pharma	Accounting policies	policy, disposals	financial, depreciation, loss, according, company, reporting, changes, policy, exercise, material

Group	Topic	% of topic extracted	Tokens extracted per sector	% of all words in topics extracted
Finance	Directors' opinion	3.74%		0.061%
Finance	Financial audit & valuation	2.01%	409,011	0.022%
Finance	Results financial analysis	1.14%		0.019%
Gas&Oil	Contracting & regulation	3.52%		0.062%
Gas&Oil	Invoicing & regulation	2.30%	437,218	0.058%
Gas&Oil	Distribution, regulation & liabilities	3.58%		0.057%
Industry	Sustainable economic development	5.38%		0.100%
Industry	Financial analysis	7.20%	269,278	0.085%
Industry	Development & performance management	3.17%		0.080%
Pharma	Results financial analysis	3.71%		0.041%
Pharma	Financial audit	3.01%	180,837	0.039%
Pharma	Accounting policies	2.67%		0.038%

Source: Author's point of view using LDA & Rapid Miner

At the same time, we highlight that in the case of these economic entities, a higher degree of coherence is also relevant between the most common words found at the level of each topic extracted through the analysis of the annual reports included in the sample, considering the higher level of the Coherence indicator. However, this value is small, which is why we appreciate that the vocabulary used in outlining each topic is not strongly differentiated from one topic to another, which is why we believe that annual reports present rather general information and less relevant for investors and other stakeholders. On the other hand, the low level of the Entropy indicator suggests that these economic entities focus on a smaller number of addressed topics, which also leads to a higher level of coherence and robustness of the annual report.

4.3. Analysis of topics related to the green economy

In Table 3 we summarize the main issues addressed in the analyzed annual reports, which are outlined including the use of words included in the list of keywords that suggest corporate green economy initiatives.

In Table 4 we reveal information regarding the number of topics extracted at the level of each activity sector analyzed. We observe from these results that the relatively high number of extracted topics creates an extremely diversified management approach in the preparation of annual reports.

These reports deal with different aspects specific to each economic entity, without following a reporting pattern.

Table 4. Number of distinct topics extracted

Area	2019	2020	2021	Grand Total	Common topics	%
Finance	10	11	11	**32**	4	*12.50%*
Gas & Oil	9	9	9	**27**	4	*14.81%*
Industry	17	17	17	**51**	13	*7.84%*
Pharma	4	4	4	**12**	1	*33.33%*
Grand Total	**40**	**41**	**41**	**122**		

Source: authors projection with RapidMiner

Based on the results summarized in Table 3, we notice that the extracted topics that are described including words specific to the definition of the green economy, do not mainly address the issues intensively debated in the specialized literature corresponding to this type of economy. Broadly speaking, these aspects focus more on the presentation of the financial perspective of the activity of the analyzed economic entities, or on the importance of aligning financial processes with legal requirements, including those for compensating energy prices, with implications for revenue recognition and the impact on financial results corporate finals. At the same time, the contracting process proves to be essential in the specific reports of economic entities in the area of gas and oil extraction and distribution.

The exception is the industrial field, which reveals in the annual reports the role of sustainable growth, based on protecting the environment. However, this approach is rather focused on optimizing material consumption and, respectively, the yield of the means of production, which have direct implications on the final corporate results.

5. Conclusions

The pandemic generated by the COVID-19 virus tested the economic entities, which had to adapt to the new conditions in order to be able to carry out

their activity in the new "normal". They have tested their resilience and embraced new digital technologies that have allowed them to survive in times of great economic uncertainty.

Through the research undertaken on the entities listed on the Bucharest Stock Exchange that published their annual reports in the 2019-2021 period, we set out to identify whether digital transformations also impacted sustainable development and the transition to a green economy. The results reflect the fact that, in pandemic times, the annual reports present the information more and more succinctly and the TF-IDF indicator used in the analysis reveals a greater presence of keywords associated with the clarifications included in the analyzed annual reports that address issues indirectly related to the green initiatives to which the economic entities pay attention to them. The results obtained also reflect an increasing evolution over time of the relevance of keywords directly or indirectly associated with green economy initiatives, considering the context of the recent crisis generated by the COVID-19 pandemic. This period represented a turning point in the evolution of the awareness of the management of economic entities regarding the need to reformulate business models, which must take into account, not only the economic aspects, or those of corporate governance, but also those related to human capital and those of environmental protection, respectively. Our research is limited to entities listed on the BSE, but future studies can complement our research by including other entities listed on different capital markets in the sample.

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