AN ARTIFICIAL NEURAL NETWORK FOR THE ANALYSIS OF SUSTAINABLE ORGANIZATIONAL PROCESSES

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Abstract: *Organizational processes are constantly changing and improving. The globalization of the economy has led to the development of the technologies used and the definition of new organizational system architectures. The research methodology consists of a qualitative and quantitative evaluation. To identify the characteristics of the neural network nodes in the input layer, research was used by questionnaire. After identifying the characteristics of the input layer, the neural network model was designed to improve organizational processes and financial statements. The research results show that AI is increasingly integrated in the decision-making process and in achieving organizational efficiency. The limitations of the research refer to the fact that the research was applied to the Western Region of Romania.*
Key words: *Artificial intelligence, processes, layer, competitiveness, sustainability, machine learning.*

1. INTRODUCTION

Nowadays, companies need to increase their competitive advantage in the market in the conditions of the globalization of the economy. Sustainable development is among the priority activities that organizations implement. Technological advance contributes to the development of the technological progress of companies.

Artificial intelligence (AI) can help companies reduce their *environmental impact* [1]. They can reduce greenhouse gas emissions, the amount of waste, and improve energy efficiency or resources used. AI allows real-time monitoring [2,3]and thus companies can adopt preventive measures and corrective measures to minimize and reduce their environmental resilience[4,5].

Second, AI can contribute to improving *social responsibility*. Social issues can be evaluated to improve transparency, organizational security, risk prevention and a direct impact on the lives of employees [6]. Third, AI can contribute to *improving economic responsibility, efficiency, and productivity*. Tasks and business tasks can be automated considering certain environmental conditions (for example, meteorological conditions), to improve the quality and speed of processes. An example is traffic jams and suggestions for alternative routes. At the same time, AI also contributes to the improvement of the decision-making process and to making more precise decisions (for example for traffic, agriculture, material used or the behavior of students in the learning process). The different sensors used can contribute to monitoring of some indicators used in the decision-making process [1,7].

The present research answers the question: What is the architecture of a framework for evaluating the sustainability of organizational processes? What are the factors that contribute to increasing the competitive advantage? Is the approach of artificial intelligence and sustainability a new direction in the globalization of the economy?

The work is structured into two parts. The first part presents an inventory of specialized literature, and the second part presents the results of the qualitative and quantitative research carried out. The research ends with conclusions and future directions of action.

2. LITERATURE REVIEW

This chapter conducts an evaluation of specialty literature on the main directions addressed by the research. Evaluations of the literature related to AI in sustainability, future directions of sustainability in Industry 4.0 and 5.0 and machine learning in sustainability are presented. The automation of processes and the replacement of some employees using digital transformation develop new business models for companies.

2.1 Artificial intelligence in sustainability

From the perspective of the efficiency of organizational processes, AI can improve the efficiency of resources, materials, energy and can have an impact on the processes in Industry 4.0. The impact can be proven through automation or data integration along the value chain.

Sustainability is a priority for most companies. Companies, especially technology companies, use artificial intelligence to achieve the sustainability goals they have set. For a better understanding and acceleration of the use of AI, this research develops a conceptual framework for the analysis of important organizational processes of an organization.

In research [8], the importance of artificial intelligence in education is presented. The importance of AI for the sustainable development of universities and other types of learning cycle is emphasized. The authors of the research [7] show that AI in achieving sustainability goals is addressed in the industry and is very important. It can be found in improving the efficiency of processes and in the decision-making process.

The rapid progress of technology and the use of sensors in more industries make AI a component of sustainability [9]. This research evaluates in detail the fields of activity agriculture, forestry, and the use of marine resources. Part of the research uses AI and automatic learning tools to approach the thinking of decision-makers in the field of organizational management [9–14]. These papers present the importance of using technology in approaching sustainability.

2.2 Neuronal network in sustainability

The neural network is a method of AI that uses interconnected nodes and neurons in a layered structure that approaches the human brain and that is part of automatic learning, deep learning, and could process data in an inspired way. The neural network is the basis of artificial intelligence (AI) and is used to solve problems difficult for humans to solve according to classical standards because it has the property of self-learning, by improving the processing performance of data as its volume and complexity increases [15] . Neural networks are used by researchers in various academic or commercial scenarios and are subject to continuous and notable activities, which has led to impressive evolution regarding their overall structure, training algorithms, and data management [16].

3. METHODOLOGY

The research methodology consists of a qualitative and quantitative evaluation. To identify the characteristics of the neural network nodes in the input layer, research was used by questionnaire. This questionnaire was applied to companies from the Western Region of Romania. The sample was determined using Raosoft with a margin of error of 5%, confidence level 95%, and a response distribution rate of 90%. Thus, compared to the official data provided, a representative sample of 60 companies was obtained that are part of code classes 62 (Service activities in information technology), 63 (Computer service activities) and 82 (Secretariat activities, support services and other).

This research is a pilot and is part of a university project. The selection of the 60 companies was made based on the following criteria: the type of activity (service activities in information technology, computer service activities, and secretariat activities, support services and other), the level of average or below average digitization appreciated by the company manager and the acceptance of the need for involvement in the consolidation of digital skills.

The questionnaire was applied by email, individually, to each company. The answers were statistically processed. After identifying the characteristics of the nodes of the input layer, the neural network model was designed to obtain the improvement of organizational processes and financial statements. The Likert scale (1-low importance, 5-high importance) was used for the evaluation.

4. RESULTS AND DISCUSSION

This chapter presents the results of the research carried out to identify the model of the implementation of sustainable development within companies.

4.1 Evaluation of companies and identification of sustainability characteristics

Identifying the characteristics of companies is very important for improving the competitive advantage. Cronbach's alpha values were calculated to ensure the reliability of the selected items, Figure 1. The items are accepted because the acceptable value for Cronbach's alpha values is 0.6. In the given situation, the value is greater than 0.6 and selected items are accepted.

Figure 2 shows the respondents' experience in approaching organizational sustainability. More than 43% of the respondents have advanced knowledge about sustainability, while 18% have average knowledge. There are no ratings below average.

Figure 3 presents the results obtained by the organization following the implementation of sustainability principles. These results are divided into 5 categories: improvement of organizational processes, financial statements, efficiency, productivity, and competitive advantage. More than 50% of the respondents appreciated the importance of these results.

Figure 4 shows the appreciation of the 60 respondents regarding the importance of sustainable development in organizations. From the sample interviewed, more than 40 respondents appreciated the above-average importance.

Figure 5 shows the assessment of the level of implementation of sustainability in organizations coordinated by managers. Among

the respondents, 31 fully implemented sustainable development, 7 at an above average level, and 12 implemented the principles of sustainability at an average level. Only 10 respondents appreciate a low level of implementation of sustainability in their organizations. This low involvement may be because these companies have fewer employees and implicitly the capacity for organizational resources is lower. In general, the competitive advantage approach is carried out at the organizational level by all companies, regardless of their size.

#	Variable	Selected Questions					Cronbach's Alpha
1	Improvement of organizational processes	1	3	4	5	6	0.789
2	Financial statements	7	8	10	11	12	0.814
3	Efficiency	9	13	16	17	18	0.843
4	Productivity	14	15	19	20	21	0.768
5	Competitive advantage	22	23	24	25	2	0.834
Average							0.809

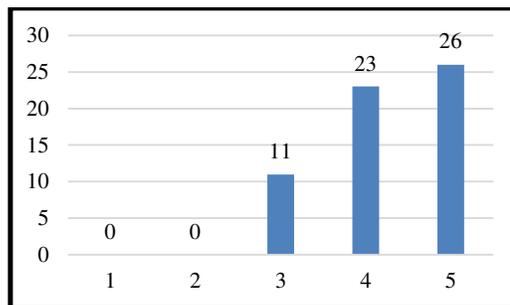**Fig. 1.** Reliability Test.

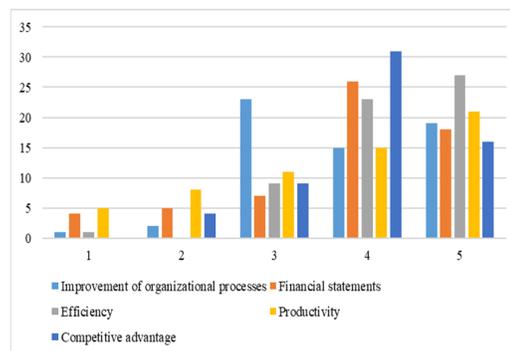**Fig. 2.** Experience in approaching sustainability.

Fig. 3. The results of the sustainable development approach in organizations.
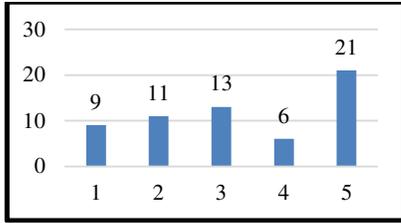
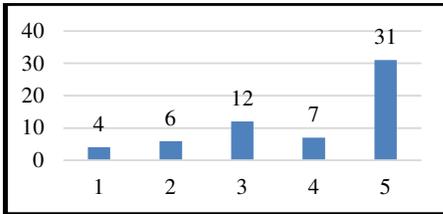**Fig. 4.** The importance of sustainable development in the organization.

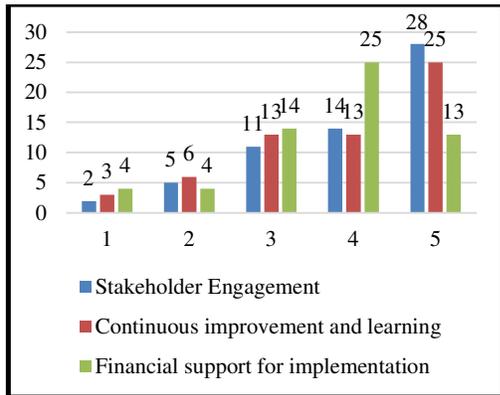**Fig. 5.** The level of approach to sustainable development in organizations.

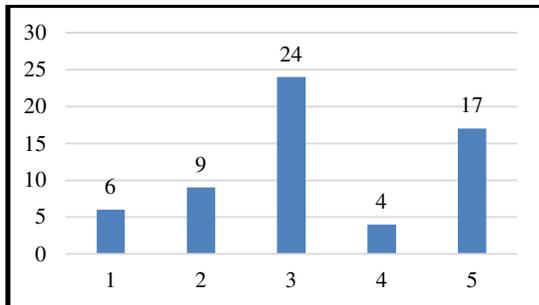**Fig. 6.** Effects of sustainability implementation.

Fig. 7. The level of digital transformation in the organization for the implementation of sustainability

Figure 6 shows the appreciation of some challenges of sustainability implementation. These challenges refer to stakeholder engagement, continuous improvement and learning, and financial support for implementation. Continuous improvement and learning are appreciated by most of the respondents. Stakeholders are involved in the implementation of sustainability and agree to its implementation. Financial support for implementation is very important for sustainable development and is appreciated by at least 60% of the sample respondents.

The level of digital transformation in the organization for the implementation of sustainability is important in improving the level of competitiveness of the company, Figure 7. Among the respondents, 45 appreciated an average or above average level of digital transformation.

An important aspect of this approach is the identification of the important categories of results generated by the nodes of the neural network. Table 1 presents the data regarding the order of priority of the five categories of results from the perspective of the respondents presented in Figure 6. The respondents consider all categories to be important. If we examine the average values, we can see that all the benefits are important, and they are equally distributed.

Table 2 shows the assessments of the technologies used for sustainable development by the respondents. There is a division of appreciation for these types of technologies.

Digital transformation is important to improve the competitive advantage of companies. The importance of valuing different technologies can be observed for the respondents

Table 1

The importance of the results of the implementation of sustainable development in organizations.

		Improvement of organizational processes	Financial statements	Efficiency	Productivity	Competitive advantage
N	Valid	60	60	60	60	60
Mean		4.68	4.24	4.19	4.34	4.79
Median		5.00	5.00	5.00	5.00	5.00

Table 2

The importance of digital transformation for sustainable development	"I do not use it"	"I am indifferent"	"I use it"	Mean
AI (1)	2	3	55	1.78
Deep learning (2)	3	9	48	1.83
Machine learning (3)	5	16	39	1.81
Big data (4)	2	11	47	1.79
Data analytics (5)	1	13	46	1.84
Cloud computing (6)	4	3	53	1.89
Virtual reality (7)	27	21	12	1.74
Cybersecurity (8)	7	15	38	1.86
Internet of things (9)	12	24	24	1.78

Table 3

Multiple regression analysis of the characteristics of sustainable development and dimension of the company.Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.102	0.209		7.567	0
Type of company	.567	.173	.367	3.113	.002
No. of employees	-0.214	0.186	-0.106	-1.145	0.199

Using regression analysis, the link between the characteristics of sustainable development and the companies' characteristics of the interviewed was highlighted, Table 3. The regression analysis shows that there is no statistically significant relationship between the type and extent to which sustainability is addressed in organizations. However, the analysis showed that the number of employees significantly influences the approach to sustainable development as a priority within the company. The relationship shows that the more employees there are in an organization, the more interested it is in addressing organizational sustainability. The significance of this finding can be justified by the increasing involvement of companies in sustainability, and this has become a necessity in the business environment, being approached as a major need in the business relationship.

The results of the market research helped to identify the company's needs, development characteristics, aspects of thinking, and the expected results. The 60 companies interviewed who had a representative person with knowledge of sustainability actively contributed to the outline of the framework and the proposal of the development and learning model.

4.2 The proposed neural model for sustainable development

Developing a neural network for the integration of AI in sustainable development means designing a model that could analyze and interpret a company's sustainability data. Using a three-layer neural network for sustainability tasks is a common architecture for such approaches.

The inherent and non-linear transformations, the interactions between the layers are sometimes complex and make the outputs more delicate to interpret by the interested parties.

The parameters of the model are learnt during training, Figure 8. Once trained, the model will be able to be used on other data sets. The input layer is correlated with sustainability indicators that are precise financial indicators useful to the company. Each node in the input layer corresponds to a feature of the sustainability report. This information is very important for

understanding the health of organizational sustainability. These features in the input layer are considered significant. The input layer relates to the hidden layer to predict useful indicators for financial decisions, efficiency and profitability of the company. The 19 characteristics were identified through research conducted and interviews with the managers of the 60 companies. Table 4 shows the input nodes of the neural network, summing up 19 characteristics. The second column represents the hidden layer of the network, and the last column shows the output of the network for the sustainable development approach in organizations.
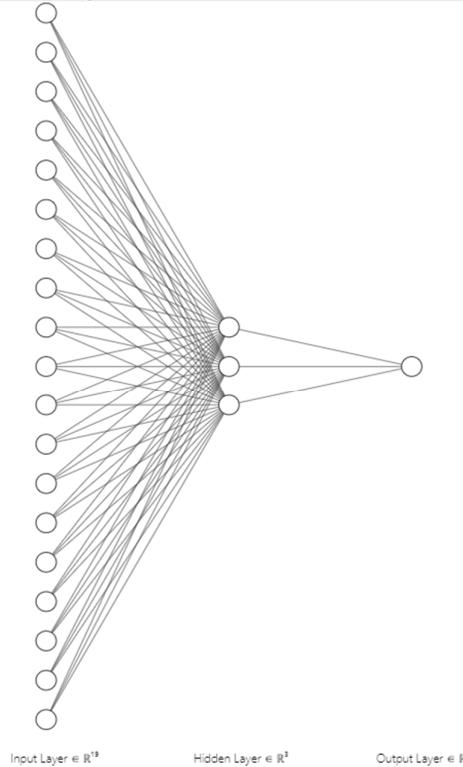

Input Layer $\in \mathbb{R}^{19}$ Hidden Layer $\in \mathbb{R}^{3}$ Output Layer $\in \mathbb{R}^{1}$

Fig. 8. A three-layer artificial neural network model for sustainability.

Table 4

Information of the layers in the proposed neural model for sustainability.

Input Layer	Hidden layer	Output layer
Stakeholder Engagement	Social responsibility	Improvement of organizational processes
Social awareness actions		
Safety at work		
Improving the quality of life		
Value creation		
Strategic priorities		
Net Income	Economical responsibility	Financial statements
Cash		Efficiency
Total shares		Productivity
Revenue growth		
Fixed assets		
Quality control	Technological responsibility	
Renewable energy source usage		
Infrastructure innovation		
Materiality process		
Energy Productivity		
Carbon Neutrality		
Waste Productivity		
Water Productivity		

7. CONCLUSION

Sustainability is still being addressed by organizations. Due to technological evolution, organizational processes are approached using artificial intelligence and its other tools[17, 18]. The answers to the research questions are presented below. *What is the architecture of a framework for evaluating the sustainability of organizational processes?*

The answer to this question is highlighted in present research. The architecture designed based on the respondents' opinions shows that the main characteristics identified in the organizations have an important role in the complete approach.

What are the factors that contribute to increasing the competitive advantage? The factors that contribute to increasing competitiveness are highlighted through the input nodes of the neural network, and they can be an important step in the unitary approach to the concept.

Is the approach of artificial intelligence and sustainability a new direction in the globalization of the economy? The use of artificial intelligence is not new in this endeavor. Most companies' approach sustainability through different technologies. Digital transformation is identified in most companies and is an important step in improving competitive advantage. Training activities are important for improving ergonomic conditions [19, 20].

The limitations of the research refer to the fact that the sample was made up of companies from the Western Region. This research can be done to other regions of the country or at the European level [21, 22].

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O rețea neurală artificială pentru analiza proceselor organizaționale sustenabile

Procesele organizaționale sunt în continuă schimbare și îmbunătățire. Globalizarea economiei a condus la dezvoltarea tehnologiilor utilizate și la definirea unor noi arhitecturi de sisteme organizaționale. Metodologia cercetării constă într-o evaluare calitativă și cantitativă a abordării rețelelor neuronale în educație. S-a utilizat cercetarea prin chestionar pentru a identifica caracteristicile nodurilor rețelei neuronale din stratul de. După identificarea caracteristicilor nodurilor stratului de intrare, modelul rețelei neuronale a fost conceput pentru a obține îmbunătățirea proceselor organizaționale și a situațiilor financiare prin implicarea în dezvoltarea sustenabilă. Rezultatele cercetării arată că inteligența artificială este tot mai mult integrată în procesul de luare a deciziilor și în atingerea eficienței organizaționale. Limitările cercetării se referă la faptul că cercetarea a fost aplicată Regiunii de Vest a României.

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