Mihail Busu *Editor*

Digital Economy and the Green Revolution

16th International Conference
on Business Excellence, ICBE 2022,
Bucharest, Romania, March 24–26, 2022

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Contents

Quantitative Analysis of the Romanian Private Security Market. A Machine Learning Approach

Alexandru-Costin Băroiu

Abstract Market segmentation and analysis have benefited greatly from advancements in Machine Learning. Supervised and unsupervised learning techniques have been applied with great success in market analysis. This paper proposes such an approach that aims to first introduce a new dataset and identify the groups in which the market is segmented, by applying k-means++ clustering, and then to develop a well performing classifier that would correctly identify future companies and place them in the previously identified clusters for a disregarded industry, the Romanian private security market. First, a clustering algorithm is applied to group the companies into clusters. Then, the results are analyzed and findings are discussed about the market segmentation. 6 distinct groups are identified and the main factors that differentiate the companies are number of employees and turnover. Second, multiple classification algorithms are trained and benchmarked in order to find the best performing model. Due to the nature of the data, which is heavily imbalanced, sampling algorithms and weights adjustments are applied in order to improve model performance. Lastly, the best combination of classification algorithm and sampling technique is presented for the given data. The best performing model is a Multi-Layer Perceptron network, with an average F-score of 71.8. The best performing technique used to counter imbalanced data is ADASYN, with an average F-score of 69.9. The best performing combination and the best result overall is achieved by the Multi-Layer Perceptron in tandem with Random Oversampling, with an F-score of 83.3.

Keywords Market segmentation · Market analysis · Machine learning

1 Introduction

Even though it isn't a novel approach, Machine Learning (ML) has gained increased popularity for the past decade when it comes to applications in business related fields. Regressions models have long been used to make predictions, especially in financial

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markets, and classification algorithms have been applied to a plethora of fields, such as business intelligence.

Another application of ML widely used is clustering, applied when there is latent knowledge in data that needs to be extracted. One such example is market segmentation. This field has been approached at large, with research raging from tourism to real estate. The prospect of grouping businesses or consumers and gain a better understanding of what motivates them has proven to be a very lucrative area of interest.

This paper proposes such an approach for the Romanian private security market. Various press articles have been published on this subject, often as a critique to its highly controversial nature. The industry has often associated with corruption, political affiliation and tax evasion. As such, this market could prove to be a very lucrative one when it comes to conducting business analysis and to developing a better understanding of how Romanian companies operate in a still emerging capitalist market. However, no research has been conducted for this market and its potential for knowledge has not yet been tapped. A first endeavor will be presented in this paper, which will cluster the Romanian private security companies and then will build a classifier that can quickly identify future companies and place them in their respective class.

2 Literature Review

2.1 Clustering

Clustering is the grouping of heterogeneous data into more homogenous groups. There are different types of algorithms: based on the process of cluster forming, agglomerative or partitioning clustering, and based on the organization of the data, centroid-based, density-based, distribution-based and hierarchical-clustering. An exhaustive list of clustering algorithms was formed by Xu and Tian [1].

Clustering is of interest for this paper due to its large adoption in related research, analyzing the business dynamics through the means of grouping. One example of clustering is when it is used to gain insights from companies in the hospitality and tourism sector. Tourism is an active research field for clustering, where it is often used to group customers and get a better understanding of their behavior [2, 3].

Another research field that leans on clustering is real estate, where market segmentation and analysis are essential. It has been used to analyze the impact of policies on the real estate sector or to group listings to gain latent knowledge [4]. Research in financial markets has also used clustering to improve prediction quality [5].

As previously stated, clustering is widely used in research. Mainly, it is applied to market segmentation. Still, comprehensive guidelines for developing robust Business to Business (B2B) market segments are sparse, with few frameworks being present [6]. Hurdles in B2B market segmentation are the vast majority of the market

segmentation literature deals with consumer markets [7], industrial marketers have been slower to adopt market segmentation beyond mere traditional industry segments [8] and information searching and purchasing in B2B contexts are more formalized than in consumer (B2C) contexts [9].

The clustering algorithm that will be implemented is k-means, with the k-means++ variation for clusters initialization [10]. K-means aims to partition n observations into k clusters, with observation belonging to the cluster with the nearest. K-means clustering minimizes within-cluster variances, or squared Euclidean distances [11]. K-means++ was shown to offer excellent time complexity and good cluster purity [12]. It is an algorithm for choosing the initial values for the *k*-means clustering algorithm.

2.2 *Classification*

Classification is a ML technique that enables algorithms to observe instances and correctly place them in a certain class. Classification is part of the supervised learning branch of ML and it has been widely applied in research. For example, sentiment analysis is a popular research field where classification is the main task of the algorithms used. Labeled data, texts accompanied by a certain sentiment, is processed by a model that enables it to later recognize the sentiment of new texts.

One interesting approach of using ML classification is the framework for analyzing financial behavior using machine learning classification of personality through handwriting analysis. The paper details the evaluation of handwriting features for one of the Big Five Personality Traits. The 7 features that the results yielded were evaluated with machine learning techniques. The author found that individuals who scored high on extraversion were likely to overspend and to invest in risky financial products [13].

Some of the most popular classification algorithms are Support Vector Machine (SVM), DecisionTrees (DT) and K Nearest Neighbors (kNN). A SVM seeks to minimize the upper threshold of its classifications [14]. It achieves this by transforming training examples from their original dimension space to another space, with a greater number of dimensions, where a linear separation is approximated by a hyper plane [15]. The SVM seeks to minimize the margin of the classification hyper plane during the training stage. Kernel functions enable the transformation from the space of original dimensions to the space in which classifications are done [16].

DT involve subdivision of the data into subsets separated by the values of the input variables until the basic classification unit is obtained. One of the most popular DT is the Random Forest (RF) algorithm. The algorithm is based on the combination of the consensual classifications of the most accurate trees into a single one [17]. The combination of decision trees in the RF technique can be used in regressions or classifications.

For kNN, the k in the k-nearest neighbor is a positive integer. The input will consist of the nearest k training examples in classification within a field. In this form, the

result is class membership. This would recognize a new entity among its k closest to the class most familiar neighbors. If k = 1 then the object is assigned to the class of the single nearest neighbor.

Another classification approach that has gained popularity for the past half-decade is the use of neural networks. Neural networks model biological processes [18]. The basic unit of these networks, the neuron or perceptron, emulates the human equivalent, with dendrites for receiving input variables to emit an output value [19], which can serve as input for other neurons. The layers of basic processing units of the neural networks are interconnected, attributing weights for each connection [20], which are adjusted in the learning process of the network [21]. The first training phase optimizes not only the interconnections between the layers of neurons but also the parameters of the transfer functions between one layer and another, thus minimizing the errors. Finally, the last layer of the neural network is responsible for summing all the signals from the previous layer into just one output signal, the network's response to certain input data [5].

2.3 Imbalanced Data

One hurdle that classification algorithms may encounter is the imbalanced class distribution in a dataset. This means that, for example, for a binary classification algorithm the positive class has 90% of the observations while the negative class has only 10% of the observations. Such a model could have a classification accuracy of 92%, which seems to be an excellent performance. But, for this case, a random classifier would net an accuracy of 90%, the minimum achievable. As such, accuracy is no longer a great assessment of model performance. The preferred metric for benchmarking in this case is f-score, the harmonic mean between precision and recall. This metric pays more attention to mislabeled examples and, as such, offers a better evaluation for competing models.

In the case of imbalanced data, there are a few techniques that have been developed and studied that can improve model performance. The ones implemented in this paper are: RandomOverSampler (ROS), RandomUnderSampler (RUS), Synthetic Minority Over-sampling Technique (SMOTE), Adaptive Synthetic (ADASYN) sampling approach and class and sample weights.

ROS oversamples the minority class or classes by randomly picking samples with replacement. RUS undersample the majority class or classes by randomly picking samples with or without replacement.

SMOTE is an oversampling approach in which the minority class is oversampled by creating synthetic examples rather than by oversampling with replacement. Therefore, the minority class is oversampled by taking each minority class sample and introducing synthetic examples along the line segments, by joining any or all of the k minority class nearest neighbors. Neighbors from the k nearest neighbors are randomly chosen, depending on the amount of oversampling required [22].

ADASYN uses a weighted distribution for different minority class examples according to their level of difficulty in learning, where more synthetic data is generated for minority class examples that are harder to learn compared to those minority examples that are easier to learn [23].

Class weights are used to make the classifier pay more attention to certain classes, while sample weights are used to make the classifier pay more attention to certain samples.

Therefore, from the literature previously presented and the knowledge in the field, two research questions are postulated:

1. *Is the Romanian private security market mature?*
2. *What is the best solution to apply on the resulting market grouping to achieve the best classification results?*

3 Methodology

The research consists of a quantitative analysis, conducted on data from secondary sources. The pipeline is as follows: data preprocessing, unsupervised learning, clustering, to label the data and then applying supervised learning, classification, on the newly labeled data.

3.1 Data

The dataset is obtained from external sources, courtesy of www.securitateinromania.ro. It is an aggregate of the short balance sheet from the 2019 reported fiscal year (researched period is 01.01.2019–31.12.2019) of all the Romanian private security companies, registered under CAEN code 8082. The total number of companies and entries in the dataset is 1.504. From the attributes present in the dataset for each company, only the following are used to conduct the research: no. of employees, turnover, net profit, profit margin and turnover/employee. Feature engineering was performed on the dataset, adding a new column: net profit/employee.

3.2 Preprocessing

Before applying the clustering algorithm, data preprocessing is required. Firstly, rows containing Nan values will be removed. This leaves the dataset with 1.076 companies, removing 428 in the process. An important second step is normalizing the data. Z-normalization is applied, resulting in attributes with mean 0 and standard deviation 1.

3.3   Clustering

Before clustering the data, a preliminary analysis can be made. The correlation between the different attributes of the dataset can be observed in Fig. 1.

It can be noted that no strong correlations are present in the data, the strongest one being of 0.4. Nevertheless, relations are present, especially between turnover, no. of employees and net profit, which all are positively correlated. A negative correlation occurs between the net profit/employee and turnover/employee. Because there is no high correlation value present in the data, above 0.8, all attributes will be kept in the analysis.

K-means is a partitioning algorithm that requires the number of clusters as an input. The elbow method will be used to determine the optimal number of clusters.

From analyzing Fig. 2, 6 was chosen as the optimal number, because that is the place where the elbow point occurs. Following this step, k-means clustering is performed. In order to plot the clusters, PCA analysis is required to reduce the dimensionality of the data to only two dimensions. The result is presented in Fig. 3.

Multiple observations can be made. Firstly, the presence of an outlier cluster can be noted, cluster 3, which consists of a single data point. Secondly, it can be noted that cluster 2 contains a lot of highly dense points. Cluster 1 is the most dispersed, while clusters 4, 5 and 6 are well defined but in close proximity to majority class, cluster 2, especially cluster 6.
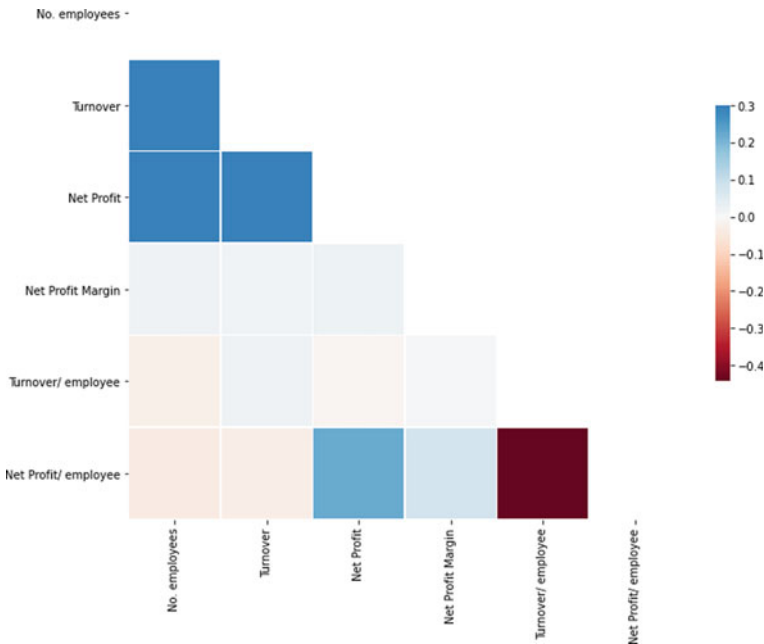
Fig. 1   Dataset correlation
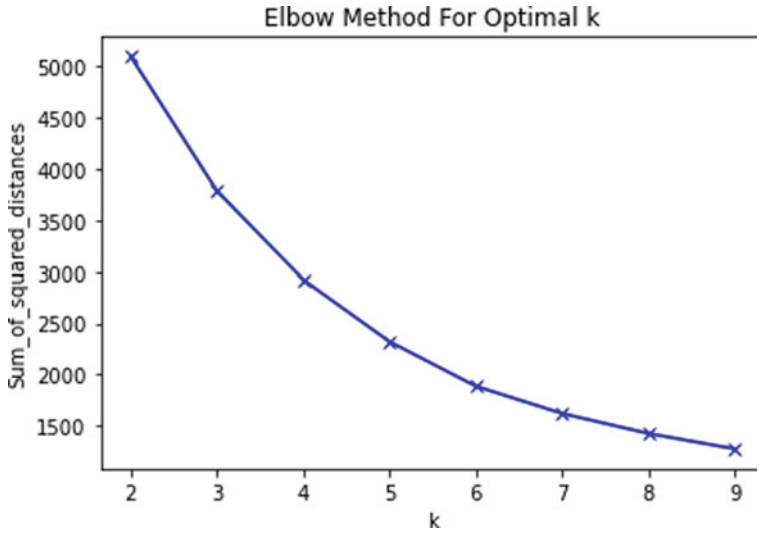
Fig. 2 Elbow method

Fig. 3 K-means clustering plot (PCA = 2)
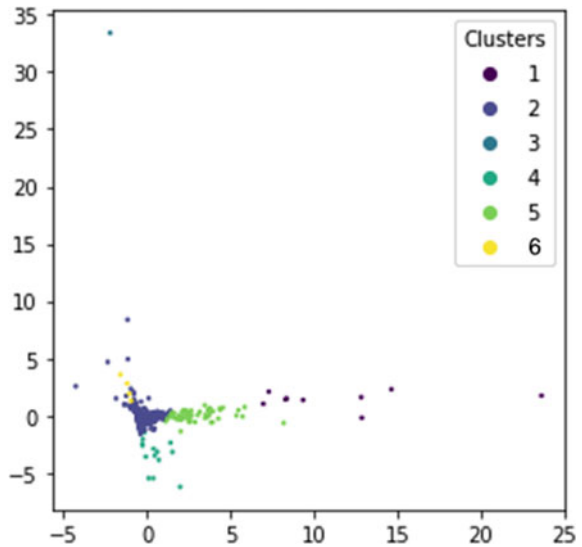
A more informative, 3D, representation of the clustering result can be observed in Fig. 4.

Additional clustering metrics that can be presented are maximum distance between two clusters, 38.67 between clusters 3 and 6, minimum distance, 3.14 between clusters 2 and 5, and average distance between clusters, 20.23.
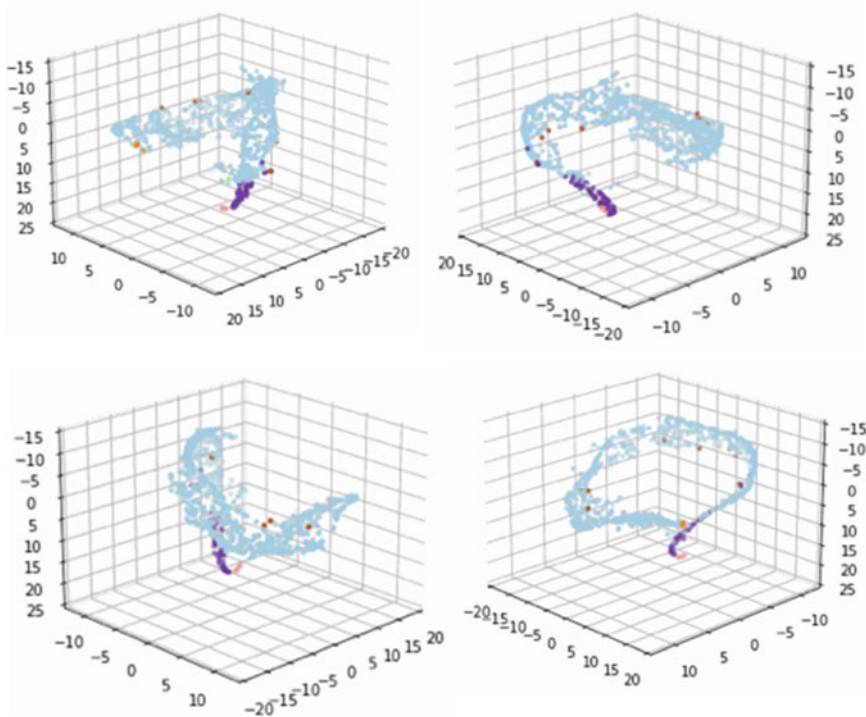
Fig. 4. 3D representation of the k-means clustering

Next, feature importance will be analyzed. Feature importance identifies the importance of the attributes when the clustering algorithm partitions the data. Values on the X axis represent the feature importance score.

It can be observed from Fig. 5 that the most important features when partitioning the data are turnover and no. of employees, followed by net profit.

Analyzing the characteristics of the clusters will offer better insights into the profile of the companies. Figure 6 offers a plethora of information regarding the clusters. First, companies in cluster 2, the majority cluster, have the highest turnover/employee while having the lowest net profit/employee. These are relative small companies with few employees, given the high turnover/employee ratio that struggle to net a profit or even operate at a small loss. This being the majority class could be a sign of concern for the market. Cluster 3 is composed of the biggest players on the market, market leaders, with the greatest number of employees, turnover and net profit. Overachievers can be found in cluster 6, companies that manage to net a large profit with a small number of employees. These companies could be innovators or the "apartment" businesses often found in Romania. Further analysis is required. Companies in cluster 4 struggle to stay in business, highlighted by their high negative net profit margin. Market followers can be found in clusters 5 and 1, companies that manage a balanced business that assures their continued existence on the market.
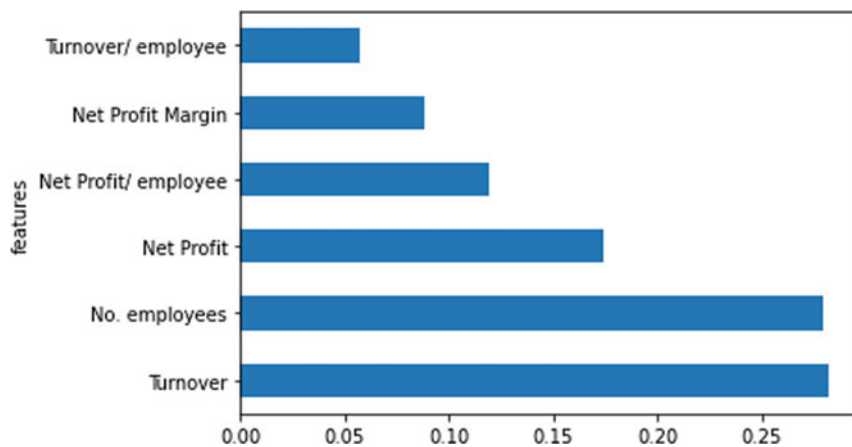
Fig. 5 Feature importance
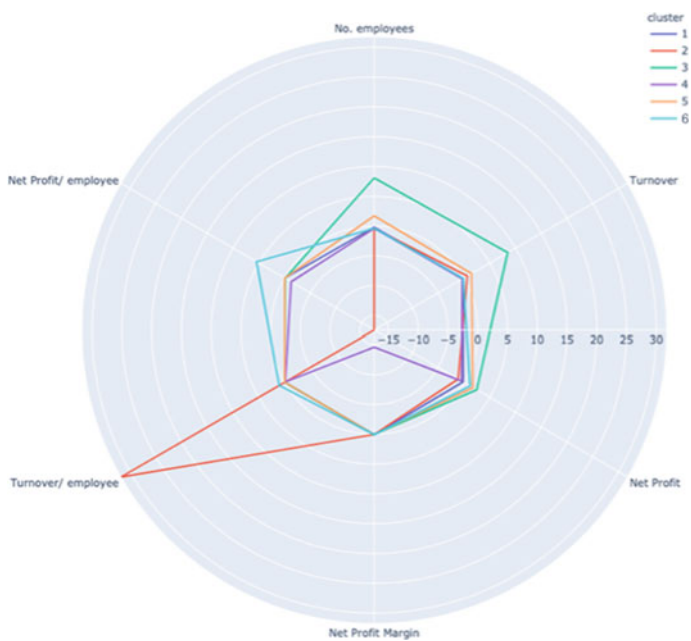
Fig. 6. Clusters line plot
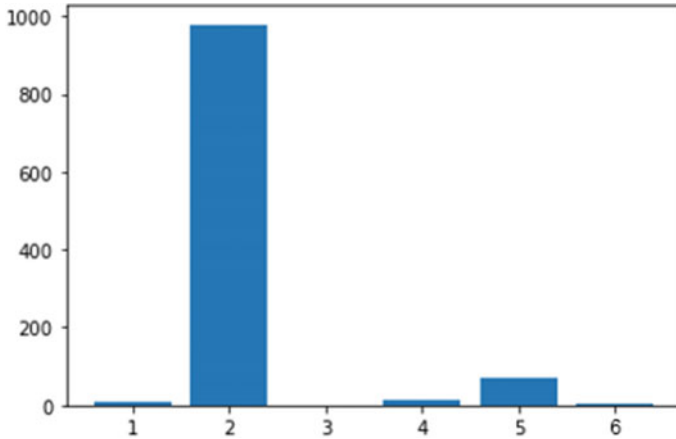
Fig. 7 Data class distribution

3.4 Classification

As previously stated, the labeled data obtained from clustering will be used to train classifiers that will be able to correctly identify new companies and place them in the according class.

Multiple classifiers will be trained and benchmarked. The classification algorithms will be machine learning based, SVM, DecisionTrees and KNN, and deep learning based, neural networks (NN).

For the classification task the dataset is split into a training and a test set, with a 70/30 split. Before training, a representation of the data is required in order to understand the distribution of the classes. Class 2 is the majority class, with 979 observations (98% of total). Class 5 is the second most represented, with 69 observations (41%), followed by class 4 (14, 1.3%), class 1 (9, 0.83%), class 6 (4, 0.37%) and, lastly, class 3 (1, 0.09%). Figure 7 illustrates these results.

It is clear that the dataset is imbalanced, with 90% of the observations in a single class. Therefore, imbalance tackling techniques, such as oversampling, undersampling and weights, will be required. First, classifiers will be trained without taking into the account the imbalance, then the data will be processed and the classifiers will be trained again. The results will then be presented and compared, in order to determine the best solution for this task.

4 Results and Discussion

As previously stated, the classifiers will first be trained on the imbalanced dataset, without applying any correction. This will also establish a baseline of the performance. The macro-scores will be reported for each model (accuracy, precision, recall, f-score). Results achieved at this step are presented in Table 1.

The models used to classify the data are Decision Tree, Support Vector Machine, K Nearest Neighbors and a Neural Network, which can be observed in Fig. 8.

Analyzing performance results from Table 1, it can be noted why accuracy isn't a great measure for imbalanced datasets. The smallest value achieved is 96% (DecisionTree), which is a great value for a balanced dataset. This is not the case here. The minimum accuracy score achievable is 90%, the representation of the majority class. A better metric to evaluate the performance of the models is f-score. F-score is the harmonic mean of precision and recall and shows the performance of the model when it comes to identifying all the members of a certain class and correctly classifying the identified members. Going forward, only f-score will be reported for the performance of the models.

It can be seen that the neural network achieves the best results (f-score of 82.6) followed by the SVM (66), DT (63.1) and KNN (45.1). The neural network is able to better understand the relationships present in the imbalanced data and to correctly classify the members of each class, a task that proves too complex for classic,

Table 1 Model performance for the imbalanced dataset

Model	Accuracy	Precision	Recall	F-score
Decision tree	96	62.6	63.7	63.1
SVM classifier	99.1	65.4	66.6	66
KNN	97.2	48.8	42.4	45.1
NN	**99.1**	**83.2**	**82**	**82.6**

```
Layer (type)                 Output Shape              Param #
=================================================================
dense_53 (Dense)             (None, 500)               3500

dense_54 (Dense)             (None, 100)               50100

dense_55 (Dense)             (None, 50)                5050

dense_56 (Dense)             (None, 6)                 306
=================================================================
Total params: 58,956
Trainable params: 58,956
Non-trainable params: 0
```

Fig. 8 Neural network model summary

simpler models. In order to better understand the performance and results of the NN, the confusion matrix will be presented. It provides information in regards to the classification output and it helps in identifying mislabeled data.

By analyzing Fig. 9, it can be seen that the NN is unable to correctly label the single member of class 3, which was obviously an impossible task for this model, seeing how class 3 wasn't present in training. Regarding classes seen in training, the NN mislabels two members of class 4 in class 2, the only misfire of the model. As such, it can be concluded that the NN achieves great results for the task at hand.

Following the results on the imbalanced dataset, the results on the balanced datasets will be presented. Multiple techniques were used for balancing the dataset: RandomOverSampler (ROS), SMOTE, ADASYN, RandomUnderSampler (RUS), balanced class weights and sample weights. The RandomOverSampler, when used alone, was implemented with sampling_strategy = 'auto' in order to oversample all the under-represented classes. For SMOTE, ADASYN and RandomUnderSampler, a pipeline was established. For SMOTE and ADASYN, ROS was first applied for the minority class, and then the other techniques. For RUS, ROS was applied for the minority classes followed by RUS for the majority class. Weights were used for class and sample, separately. Results are presented in Table 2.

Firstly, it can be noted that the NN achieves the best performance across the board, with an average f-score of 71.8. Regardless, this is an evaluation of the imbalance battling techniques and not so much of the classification models. It can be seen that ADASYN nets the best result, with an average f-score for the models of 69.9. DecisionTrees is the worst performing model, with an average f-score of 37.7, and
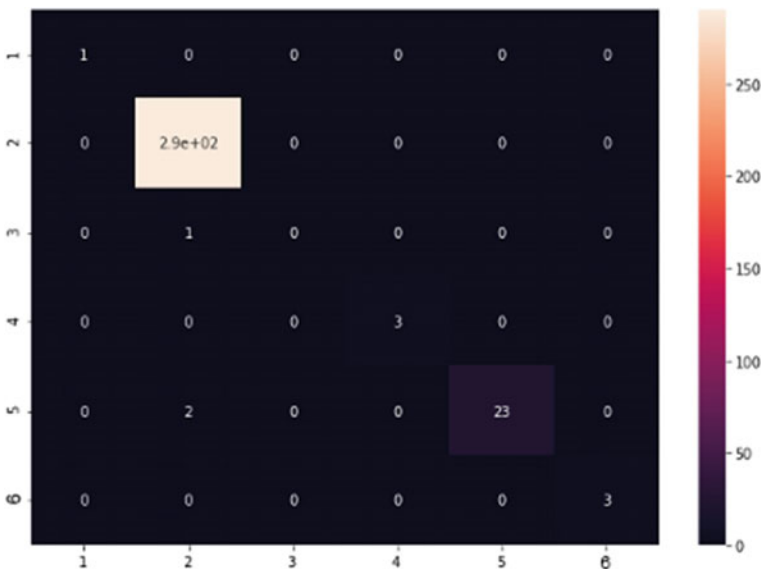
Fig. 9 Neural network classifier confusion matrix

Table 2 Classification models performance for the balanced dataset

Model	ROS	SMOTE	ADASYN	ROS + RUS	Class	Sample	Average
DecisionTrees	33.4	33.4	49.2	0.1	63.1	46.9	37.7
SVM classifier	65.0	65.6	65.3	16.5	66.0	17.6	49.3
KNN	65.3	65.6	82.3	16.5	45.1	45.1	53.3
NN	**83.3**	**82.9**	**82.9**	**33.2**	**82.6**	**65.9**	**71.8**
Average	61.8	61.9	**69.9**	16.6	64.2	43.9	53.0

ROS + RUS is the worst performing balancing implementation, with an average f-score of 16.6. The lowest performance is achieved by DecisionTree when applying ROS + RUS balancing, f-score of 0.1, while the best performance is achieved by the NN when applying ROS, f-score of 83.3.

Comparing the results of the balanced dataset with those of the imbalanced dataset, it can be seen that improvements are achieved by the NN and KNN, with a f-score difference between the best performing instances of 0.7 (ROS) for the NN and 37.2, greatest increase, for the KNN (ADASYN). No improvements have been observed for the other models, with DT and SVM achieving their imbalanced performance when applying Class Weights (f-score of 63.1 and 66, respectively).

The only balancing technique that generated results for this dataset is ADASYN, improving the average original, imbalanced, f-score of 64.2 by 5.7. The other techniques netted better results for KNN and the NN, while decreasing the performance of DT.

Firstly, the segmentation of the Romanian security market can be discussed. The data was partitioned into 6 clusters, each defining a type of company activating on the market: leaders, followers, struggling companies, innovators/shell companies and a plethora of small companies that barely manage to turn a profit.

Secondly, the performance of the classification models can be discussed. The NN managed to achieve the best results, for both the imbalanced and balanced datasets. The NN manages to better understand the latent knowledge in the dataset, enabling it to make better classification predictions. The best balancing technique of the ones implemented was ADASYN, the only one that improved performance over the imbalanced set.

5   Conclusion

In closing, both research questions have been answered. First, the Romanian private security market presents the characteristics of a mature market. There are a small number of large, well established, and profitable companies, a characteristic of a mature market. Additionally, most companies present tend to be smaller, struggling ones, pointing to the difficulty of penetrating the market. However, some question marks remain, especially with the overachieving companies identified, which could

point to a plethora of directions given the past that this market has in Romania. For the second research question, the best solution for this new dataset has been identified, namely the MLP in tandem with ROS, which achieved the best results. This classification task is essential to track the evolution of the market, of both existing companies or new entries.

For future work, more sophisticated classification models can be implemented, in tandem with different sampling algorithms, to net better classification results. In regards with the market analysis, more in-depth data could be collected, to gain a better understating of each company, or a qualitative study could be conducted among the management of these companies, to go beyond the data presently available.

It can be concluded that a greater understating of the Romanian security market was achieved, along with the development of a competent company classifier for this industry. This paper has introduced a new dataset, by clustering publicly available data, and has analyzed the maturity of a neglected market, the Romanian private security industry. Then, multiple classification algorithms were trained and benchmarked to find the best solution that could serve in the future to attribute new companies to the identified groups or to regroup the already identified companies in new fiscal years. This works serves as a starting point for future research that can be conducted on the selected market and that could help find new insights in a under researched but economically impactful segment of the Romanian economy.

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China's Drive for Technological Leadership in Artificial Intelligence. Key Policies and Government-Industry Integration

Adrian Bazavan and Catalin-Emilian Huidumac-Petrescu

Abstract The world has shifted to the digital economy and data has become one of the most valuable commodities. As internet applications have made data collection seamless, artificial intelligence systems bring significant productivity gains by revolutionising the way data is processed and transformed into added-value. Artificial intelligence has a deep impact over our industrial and production means, supply chains and consumer patterns, as well as over education, mass-media, governance, and national security. Therefore, artificial intelligence development has become a priority of strategic importance to most nations. China, within the last decades, has advanced from a labour-intensive and low-cost manufacturing base to an increasingly sophisticated economy that is able to deliver high added-value goods and services to the world markets. In this transition, China is now openly aiming to become an innovation powerhouse that holds the global edge in crucial technologies. Given the fertile grounds laid by China's market scale, high digital penetration rates and massive pool of consumers, but also the government's interest in deploying social governance systems and increasing military capabilities, artificial intelligence became a top policy priority that is reflected at all levels. Within the evolutionary framework of Learning Models and drawing upon a data collected from public policy documents, specialised commercial databases and qualitative interviews conducted on the ground, this paper will examine the main characteristics of China's AI development policy, highlighting the role played by the central and local governments within the AI ecosystem and the complex interactions with tech companies, universities and talent. At the same time, it aims to address several pertaining misconceptions in existing literature about China's AI landscape and finally, on this basis, propose a set of key recommendations to the European Union regarding AI development.

Keywords China · Artificial intelligence · Innovation policy · Industry-government integration · Talent attraction

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1 Introduction

Humanity has evolved from the agricultural economy to the industrial economy and more recently, to the digital economy. Nowadays, some of the world's biggest companies are not selling to consumers physical goods, services nor software, as the use of their products is free of charge (Android Operating System and Google products, Facebook, messaging applications, Baidu products etc.). Instead, as we are now in a new stage of development when knowledge is the most valuable commodity, their business model is based on collecting, processing and transaction information. Applications of all sorts are harvesting immense quantities of data from users around the world. However, in order to transform raw data into business usable information and thus create added value, data must be processed efficiently and fast.

Traditionally, collecting data about humans was difficult and expensive, sometimes requiring methods such as street and telephone surveys. Nowadays, with the use of social platforms, e-commerce and so many mobile applications, the volume of ready-to-collect data is immense. The challenge however becomes to structure, label and categorise it, tasks that frequently require human specialised assistance. Traditional computer systems are manually programmed for pre-defined tasks, or in other words, receive human-coded rules, based on which they can process data inputs to get output answers. Due to the complexity and ever-evolving nature of data, this frequently proves to be insufficient. In contrast, artificial intelligence systems receive both input data and output answers, alongside a generalised strategy for learning, being able to produce the processing rules. Without further programming, AI systems can automatically adapt self-learned rules to new sets of data and produce original answers (Barton et al. 2017). To some extent, they act like humans that can constantly improve, but in contrast, have the capacity to process much larger strings of data. Artificial intelligence, or the idea that computers can perform functions associated with the human-mind, has indeed gone from far-fetched speculation to contemporary reality. As compared to humans, AI systems have the advantage of being able to instantly access and process any source of information, from anywhere and anytime.

Questions about what AI is, what applications it has in the present and its future ways of development cut across politics, economy, law and ethics. From a technological perspective, AI is a broad term covering machine learning, neural networks, cognitive computing, language processing and others. It constitutes a paradigmatic shift in processing data as it enables a computer to observe its environment or use a large set of representative data, learn and take intelligent action or propose decisions for which it has not been explicitly programmed (Craglia et al. 2018). However, AI is not yet capable of generalised intelligence or common sense and cannot translate experiences from one type of task to another, requiring specialised (human) expertise for every single new domain of use.

AI can be deployed across many industry sectors, generating productivity gains and additional insights in domains where established analytical techniques are

already depleted. Much like the steam engine or electricity in the past, AI is a general-purpose technology with the potential to profoundly transform, directly or indirectly, many aspects of our societies and economies (European Political Strategy Centre 2018). Here are just a few examples of AI's commercial use: image recognition and classification; asset valuation, market analysis and risk assessment (banking and finance); clustering sets of consumer segments based on individual data; personalised marketing, prices and promotions; optimization of outcomes such as generating routes with the best combinations of time and fuel (logistics and road traffic); generating novel data based on previous training (create new music or art of the same style with an input piece); personalised health-care and diagnosis; detection of anomalies and predictive maintenance (extending the life-span of machines); speech recognition (customer service management) and autonomous driving (McKinsey&Company 2017). AI is also highly effective for automated hacking, personalised disinformation campaigns, targeted propaganda, social manipulation and invasive automated surveillance. Therefore, the deployment of AI is and should be bound by constraints due to concerns and evolving regulatory framework around pertaining issues such as human rights, individual freedoms, privacy and personal data protection (Chui et al. 2018).

Having these in mind, AI has become a key driver for enhancing productivity and competitiveness, but also an area of strategic importance, as it is crucial for preserving, or advancing, a nation's security and values (Acharya and Dunn 2022). The United States of America (USA), traditional leader in ICT and digital technologies, still holds the initiative in AI development, judging by the complexity of its ecosystem, the number and global reach of its AI companies, the venture capital scene and available pool of talent. Several Asian nations are following closely, starting with China, followed by Japan, Singapore (Government of Singapore 2017), South Korea (Zastrow 2016) and of course, India (European Political Strategy Centre 2018). According to Chinese sources, while strategy and policy documents in China, US and Japan strive to accelerate the integration of AI within the real economy, as well as with defence and national security, the European Union's policy making is rather concentrating on mitigating the ethical and moral risks of AI, rather than the development itself (Tsinghua University Research Centre for Chinese Technology Policies 2018). However, currently within the EU as well, the focus is swiftly changing towards technology development, as recently both the European Union and some of its Member States have stepped up investment and deployed supportive policies around the development of AI.

China, after four decades of economic transformations, envisions becoming a world leader of innovation. Economic growth's low-hanging fruits have been depleted and a model based on low-value production is no longer feasible. Currently, the nation is the world's largest exporter and its shares in global markets continue to rise. That is not because the economy would expand its low-cost manufacturing base, as manufacturing is actually moving out to countries in South-East Asia and Africa. On the contrary, China is moving up the value chain through innovation, shifting its exports to high-value added products (Zhang and Zhou 2015) or from products to services whatsoever. China is therefore very supportive of innovation

at all social and political levels, the word "innovation" becoming a leitmotif across policy documents as well as across commercial strategy guidelines. And amongst innovation areas, artificial intelligence and AI-related industries have steadily moved to the centre stage of China's policy making and economic reform (Creemers 2018).

In November 2017, Eric Schmidt, then CEO of Alphabet, brought attention to the relevance of China on the AI scene with the statement "By 2020, they will have caught up. By 2025, they will be better than us. By 2030, they will dominate the industries of AI" (Arenal et al. 2020). Having in mind that the country is soon to become the world's largest spender on R&D (OECD 2019), its burgeoning venture capital ecosystem, the scale of its internet corporate giants and the pool of AI engineering talent, adding to the ambitious policy targets set by the government, China is set to play an increasingly important role on the global AI scene (Allison et al. 2021).

This paper aims to map the main characteristics of China's AI ecosystem development, drawing attention to the complex role played by the government including an overview of the most relevant policy documents, emerging methods of funding in public–private partnership, AI ecosystem market scale and talent retention strategies. Against this background, within the analytical framework of innovation and economic growth, the final section will draw several policy recommendations for the EU regarding AI development.

2 Literature Review

This section will start with the most influential perspectives about the nature of innovation, its connection to economic development and the mechanisms that enable innovation to occur and spread in a developing economy. On that basis, it will review the most relevant studies and data on China's AI ecosystem development and will highlight the gaps in existing literature.

2.1 *Theoretical Framework*

The Learning Model, proposed by evolutionary economists such as Dosi (1997) and Metcalfe (1998) to explain innovation, is the most useful to describe China's AI ecosystem. Accordingly, innovation is acquired by firms through a gradual process of developing and accumulating existing capabilities, making use of their available resources and opportunities. The learning sequence starts with low-end manufacture. Climbing reversed product cycles, firms incrementally acquire new designs and skills that enable them to improve their processes, products and marketing, eventually reaching the top of the production chain. Evolution includes "variety creation [..], replication including imitation [..] and selection [that reduce variety in the economic system and discourages the inefficient or ineffective utilisation of resources]" (Malerba and Nelson 2012). The concept of "leapfrogging" will also

prove to be useful during the analysis. This view emphasises the advantage of the latecomer who has the opportunity to skip costly stages of research, to learn and make direct use of the innovation breakthroughs already available (Lu 2000).

2.2　Funding

One of the most cited databases for information regarding China's AI investments in terms of volume, distribution of sources and destination by sectors belongs to Tsinghua University's Research Centre for Chinese Technology Policies. Accordingly, from 2013 to 2018 Q1 China accounted for 60% of world investments in AI, being by far the industry's financial leader, while the US accounted for just 29% (Xue 2018). In 2017, the global scale of AI financing would have reached USD 39.5 billion, out of which China accounted for USD 27.7 billion (70%)—mostly in Beijing and through series A investments. Therefore, in recent years investment in China's AI industry has grown significantly both in nominal value and relative terms as compared to the global total.

2.3　Market Scale

China has the largest market in the world in terms of PPP, ahead of the US and India (IMF 2018). Li, Y. argues that such a scale offers unique possibilities for both domestic and international firms to experiment and find niches for their new products and ideas. As such, the market acts as a complex multi-layered arena of interaction between Chinese companies, foreign firms and government (2017). In June 2018, there were 4,925 companies around the world that have AI at the core of their operations, out of which mainland China was hosting 1,011 and accounted for 21% of global share, ranking second after the US which hosted 2,028 companies or 41% of global share (Tsinghua University—Research Centre for Chinese Technology Policies 2018). Third spot is occupied by the United Kingdom (7%), followed by Canada and India. Among these companies, as of Sep. 2018 China had 14 "unicorns", valued at USD 40.5 billion in total (China Money Network, in World Economic Forum 2018) (Fig. 1).

Databases show Beijing as being by far China's leading cluster in terms of market scale, talents and investment (Development Solutions Europe Ltd. 2018). It is also the first city in the world by the total number of AI companies (395, or 40% of national total) (Tsinghua University—Research Centre for Chinese Technology Policies 2018). In China, it hosts more than half of the AI-related State Key Laboratories and major research bases and is also home to tech giant Baidu, as well as to Zhongguancun District, considered to be China's Silicon Valley. Shanghai is the second AI hub in China and 4th in the world by the number of companies (224).
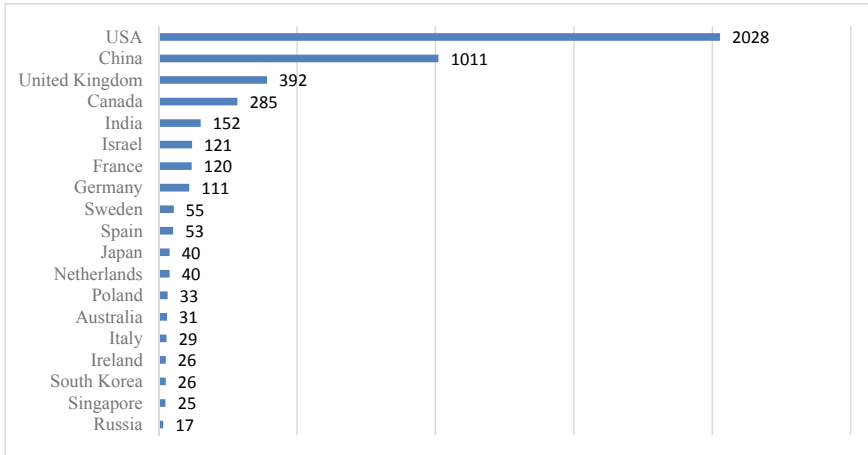
Fig. 1 Number of AI companies by hosting countries. *Source* Tsinghua University—Research Centre for Chinese Technology Policies, 清华大学中国科技政策研究中心 Report on the Development of Artificial Intelligence in China 2018 (中国人工智能发展报告2018)

Together with Beijing, Shanghai is also a leader for chips and semiconductors development, which are crucial to support AI applications. Hangzhou is an important hub for AI companies and hosts Alibaba's headquarters. The municipality partners with Alibaba in order to build an integrated intelligent traffic system. Jiangsu Province leads the development of AI hard infrastructure, internet of things (IoF) and cloud computing. It also develops the Jiangsu Brain Plan and the Jiangsu Brain-inspired AI Industry Alliance. In turn, Fujian specialises in IoF, big data, innovation platforms and intellectual property rights, while Guizhou is the new hub for big data.

3 Methodology

Using the framework of Learning Models and "Leapfrogging", this exploratory research aims to provide a contextual macro understanding of the mechanisms and processes that drive China's AI push, by examining the role of the government and public policies, private–public partnership and integration, the advantages brought by the market scale, as well as talent retention programmes as a driver of domestic innovation. The current paper does not aim to measure the scope of performance of AI innovation in China, nor its extent, which would require a different set of input and output quantitative measures. It limits its scope to China at national level, but draws attention to the significant differences amongst provinces and cities. The paper also highlights the frequent misconception in existing literature of viewing China as a monolithic bloc, as private actors and entities are also powerful shapers of the AI landscape (Ding 2018).

Firstly, a review was performed of available relevant academic literature regarding China's innovation policy in general and AI in particular, in English, French and Chinese. Secondly, data regarding market and funding indicators was received from specialised commercial databases with restricted access.

Following, the author conducted qualitative and quantitative research of public policy documents that contain references to the following terms: "artificial intelligence", "machine learning", "deep learning" and "automation". The research was performed at central government level, provincial and local governments, as well as at central party level, local branches and related organisations. Political statements were also reviewed from official press releases.

Finally, qualitative data is also extracted from 12 informal interviews conducted with 4 Chinese officials, 4 top management-level executives in tech companies and 4 leading academic figures in fields related to AI. The interviews were conducted in Chinese and granted anonymity.

Whenever possible, to increase reliability, data has been cross-verified from several sources and using different collecting methods.

4 Results and Discussions

4.1 Policy Making

Innovation has long been considered critical for China's economic development by top leadership. Chairman Deng Xiaoping designated science and technology (S&T) as the 'first productive force' in 1978,[1] whereas the concept of 'revitalising the nation through S&T has become widely used since 1995.[2] Currently, innovation is the first amongst 5 big principles for development which shall lead China to build a moderately prosperous society in all aspects: innovation, coordination, green, open, and shared development (Ministry of Foreign Affairs of PRC 2016). The importance given to S&T is reflected by the massive increase in research and development (R&D) expenditure during the last decades, both in nominal value and as a percentage of GDP. And AI takes an increasingly preeminent role amongst S&T sectors. This section will overview the mixture of policies and roles performed by the Chinese government in relation to AI development. However, it is important to highlight that China's AI policy is not monolithic. Instead, it is formed of a complex network of central and regional, provincial and municipal policies, at different levels of development and support, connected or dissipated.

In May 2015, the State Council released *Made in China 2025*, a framework aimed at transforming China into an advanced manufacturing powerhouse within the following decade, drawing inspiration from the German *Industrie 4.0*. The main

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[1] 3rd Plenary Session of the 11th CPC Central Committee of the Communist Party of China, 18 Dec. 1978.

[2] Introducer at the National Science Conference, 1995.

emphasis of the policy falls on smart manufacturing. It also targets the integrated development of information and cyber technologies, production automation and new industrial internet applications, with the general aim to improve precision manufacturing and agile manufacturing capabilities. While AI is not mentioned as such, AI-enabling technologies are a core emphasis of *Made in China 2025.*

In March 2016, following the entry into the Thirteenth Five-year Plan on National Economic and Social Development (2016–2020), The Ministry of Industry and Information Technology with the National Development and Reform Commission and the Ministry of Science and Technologies launched The *13th Five-Year Plan for Developing National Strategic and Emerging Industries* together with the *'Internet+' Artificial Intelligence Three-year Action Plan. China Artificial Intelligence White Paper* followed to provide guidelines for R&D specifically for AI.

In February 2017, *Artificial Intelligence 2.0* was designated as a mega-project, alongside fifteen other technologies deemed crucial (China Academy of Engineering [中国工程院院刊] 2017). The main outcome of the document was to award AI development substantial additional funding.

In July 2017, the State Council released The *Plan for the Development of New Generation Artificial Intelligence* (2017), as the key document laying the foundations of China's AI industry. The document defines AI clearly as a national-strategic level priority, and emphasises the target areas to be given all-around support by 2030. The goal is responding to the complicated national security and international competition situation, in order to ensure that China maintains the strategic initiative in AI development and thus (1) builds a competitive edge, (2) stimulates the development of new industries, and (3) improves national security (Development Solutions Europe Ltd. 2018) (Tsinghua University—Research Centre for Chinese Technology Policies 2018). The plan envisions three important milestones:

- 2020: Catching up with the most advanced AI powers

By 2020, China's AI industry is about to close the gap on most advanced AI technologies and their applications. Some domestic companies were foreseen to make significant breakthroughs and thus become internationally competitive. AI should have become an important economic growth net contributor, with a gross-output exceeding RMB 150 billion (USD 22.5 billion) for the core AI industry and RMB 1 trillion (USD 150.8 billion) for AI-related industries.

- 2025: Becoming one of the world leaders

By 2025, major breakthroughs would be made in fundamental AI theory, while in a set of priority technologies and their applications China would become the leader. AI technologies should be deployed widely in the market in fields such as intelligent manufacturing, healthcare, smart cities, agriculture and defence. At the same time, the basic legal framework would be defined, including standards, safety, supervision, etc. The gross-output would exceed RMB 400 billion (USD 60.3 billion) for the core AI industry and RMB 5 trillion (USD 750.0 billion) for AI-related industries.

- 2030: Achieving primacy

By 2030, China aims to become the world's leader for AI theory, technologies and applications. China would host world-class innovation clusters and AI would become deeply integrated within production chains, as well as within social governance and defence systems. The gross-output will exceed RMB 1 trillion (USD 150.8 billion) for the core AI industry and RMB 10 trillion (USD 1.5 trillion) for AI-related industries.

4.2 Industry-Government Integration

In November 2017, the Ministry of Science and Technology launched the Association for the New Generation of Artificial Intelligence Development Planning Promotion. Part of this effort included the establishment of four artificial intelligence open innovation platforms, each led by technology giants Baidu, Alibaba Group, Tencent Holdings and iFlyTek respectively:

- Baidu's Autonomous Driving National AI Open Innovation Platform;
- Aliyun's (Alibaba cloud) City Brain (Urban Cognition) National AI Open Innovation Platform;
- Tencent's Medical Imaging National Open Innovation Platform; and
- iFlyTek's Intelligent Voice National AI Open Innovation Platform.

In addition to public funding, the open innovation platforms awarded private companies unprecedented access to public infrastructure and data, marking a cornerstone in industry-government integration.

In terms of funding, the government tunnels public money to private venture funds that are allowed to invest according to market principles through the Government Guided Funds (GGF). GGFs are backed by public money but management and decision-making is delegated to private stakeholders.

As far as academia is concerned, AI tech companies develop joint programs with universities. While companies receive access to the talent pool, alongside public research infrastructure, universities tap into company's resources, get closer connected to market needs and enable their students to find immediate employment.

Finally, it is important to note that the public–private distinction is not clear-cut in China. In those areas of specific interest, the state might own itself, directly or indirectly, important shares of companies, or possess other types of dependency relations (Li 2017). The state might also intervene strongly with protective measures in markets where domestic firms are less competitive and more vulnerable against foreign companies. In turn, this raises significant concerns amongst foreign companies regarding fair competition and the lack of an equal-playing field. Actually, in order to protect domestic companies, China blocks the services of American companies such as Facebook, Alphabet and Twitter. That brings adverse effects within China's domestic market as well, as protecting state-chosen giants harms the chances of emergence and success of new companies that have the potential to stir innovation.

4.3 Market Scale

AI have a voracious appetite for data, both in terms of volume and variety. It can be productive only if a threshold of data volume is reached. In primary stages, both AI and other traditional technologies increase their performance concomitantly with the increase in size of data sets. However, after a point, other technologies tend to plateau, whereas AI using deep neural networks continues to increase performance unlimitedly.

AI companies in China have a significant advantage as they can tap into a huge emerging consumer market, tech-savvy and highly-enthusiast on using new technologies. However, the sheer scale of China's internal market, the huge number of Chinese internet users and their potential to generate data cannot be seen as superior to the USA's market. While the USA internal market is smaller, American companies are not limited to it and have global reach. With a presence on most markets around the world (with the notable exception of China), US tech companies not only have access to more data, but also data that is more diversified. The idea that data is easier to be collected in China due to lax privacy regulations, is not valid anymore. In recent years there has been a strong push for regulation regarding data privacy and the Chinese government took strong actions to limit the capabilities of Chinese tech giants, to an extent that could not be foreseen in market economies. Moreover, Chinese consumers have been always more reluctant and attentive to the personal data they voluntarily provide to internet applications, as compared to their peers in Western societies. For instance, there is no email, messaging or social media application where Chinese citizens usually currently use their real name or photo unless it is compulsory.

Currently, Chinese companies are fighting to internationalise but so far results are limited. Bytedance, the owner of TikTok, set an important precedent as the first ever Chinese company that succeeds to act as a global competitor to US tech giants on AI-based services.

4.4 Talent

Given China's economic transformation and ambition to climb supply chains towards higher-value industries, the demand for highly skilled workers and top-notch scientists has continuously increased. In the case of AI more specifically, there is a stringent need for world-class AI engineers. In this area, the USA has a large advantage as a top destination for the brightest minds around the world that China needs to compete with. Employing foreign talents does not only help improve S&T and thus power long-term economic growth, but also contributes to strengthening the commercial relations between Chinese tech companies and the rest of the world (International Labour Organisation 2017). Therefore, in recent decades, attracting researchers trained abroad has consistently formed a key part of China's S&T policy.

The country has established a series of programmes to attract foreign researchers, such as the Thousand Talents Programme. However, despite sustained efforts, the policy's results are mixed.

Foreign researchers are considered those non-Chinese citizens who are PhDs students, post-doctoral fellows or holders of higher academic titles that come to China to work in universities, research institutes or enterprises, being employed specifically for research activities. It is important to note that most talent programs are mixed, targeting both Chinese and non-Chinese citizens, as well as both researchers and other categories of overseas talents.

Governments in China at all levels have been energetically building initiatives for attracting overseas talents, whether returning Chinese or foreign-citizens, particularly those who have studied or worked at the most prestigious universities and companies overseas and who can demonstrate outstanding achievements. These policies included centrally-led schemes like the "Thousand Talent Programme", The Chinese Academy of Science's Hundred Talents Program, regional programs and public–private endeavours. They are usually designed to provide researchers with start-up packages or continuous funding equivalent to what they could expect in Western countries. Beyond the central government, provincial and city-level governments also usually replicate national schemes that can be earned cumulatively by the same individual/team, in addition to national funding.

As a result, the number of foreign Ph.D. holders that venture to Chinese public research institutions or tech companies increased every year, in search of access to generous funding and state-of-the art research facilities, opportunities to get involved in national "big" projects and a vibrant scientific community that is increasingly professional. However, China's talent programmes have a mixed track record as so far the overall number of foreign researchers coming to China is rather low and retention (if China really aims for that) is even lower. A multitude of factors play a role including the fact including difficult cultural and social integration, academic freedom limitations, low internationalisation profile of Chinese universities and companies etc.

5 Conclusion

This paper presents the story of how a developing, manufacturing-based economy can learn, accumulate capabilities and move towards an innovative, competitive and technology-driven growth model in a top-notch industry—artificial intelligence.

The nation is one of the largest spenders for A&I development in the world. While some databases put China on top of the list, methodologies and actual means of calculating AI public and private investment vary significantly. But it is a certainty that the Chinese government and China-based companies increasingly have the capacity to allocate large funding to fundamental AI development. While usually R&D financing in China is largely carried by the private sector and the government supports with fiscal incentives, the case of AI is different, as a top policy priority. Therefore, despite

an already mature ecosystem and strong companies in the industry, the government contributed extensively to R&D funding. It does so through a multitude of direct and indirect channels, including direct funding for R&D in public institutes, delegating public resources to private venture capital funds through the Government Guided Funds and establishing overseas talent attraction programs that benefit both universities and domestic corporations.

In recent years, China has made strenuous efforts to attract foreign researchers and top-notch AI engineers. However, due to a mix of cultural, administrative and systemic reasons, China has not yet become a preferred emigration destination for foreign talents and the actual number of highly qualified foreign talents recruited remains disappointingly low, not to mention the retention rate. However, China's talent strategy should not be seen as a public, monolithic, completely top-down approach. The private sector is also very relevant, or sometimes more relevant. The most "natural" and probably the most common way for research talents to come (or return) to China is the commercial path. There are more and more Chinese companies with competitive salaries and state-of-the-art research facilities that employ foreign researchers without applying for governmental assistance. The same is the case for public universities. While there is no authoritative statistics on foreign researchers coming by commercial ways, there are a few iconic examples such as Andrew Ng, former head of Google Brain who transferred to Baidu and Qi Lu, former executive vice president of Microsoft, who has moved to become Baidu's CEO. Therefore, the structure and competitiveness of the private sector contributes greatly to China's capacity to attract and retain talents.

Overall, China's AI industry is developing fast, benefiting from public support. It has also brought its first successful wins on markets overseas. However, China still lacks a critical mass of tech champions that have the capacity, scale and attractiveness to compete with American giants on an equal footing. Nevertheless, China's AI faces vulnerabilities in crucial hardware such as semiconductors (Arenal et al. 2020).

Although we can draw many lessons from China's story, its model cannot be replicated in a different context. China finds itself in different contexts, pertaining to its political establishment, cultural background, market scale and consumer behaviour.

As far as the European Union is concerned, it leads an important and healthy debate about ethics and potential dangers of AI. While the EU should push even harder to properly address worrying privacy issues and ethical concerns, in a potential insufficient focus on technology development, it is deemed to lack the means to actually benefit economically, protect its citizens and set the global standards in the AI revolution. Currently, there is limited funding and policy support for technology development in comparison to global peers, and few steps are made in the direction of bringing domestic EU technology and AI services on the global stage. The fact that the EU lacks its own large internet companies, leaving all its data under the monopoly of non-EU tech companies, does not only inhibit domestic innovations but it also makes it increasingly difficult for the EU to achieve its goal of protecting citizens' security and mitigate AI risks.

In the context of rapid technological breakthroughs in China, USA and the rest of the world, the EU has already set innovation in general and AI in particular as a top

policy priority and deployed a variety of strategies and measures, at different levels, to foster domestic technological progress. While ultimately innovation is driven by the market, the European Commission and Member States should intensify their efforts to become effective facilitators, platform-creators and strategic planners of the AI innovation system. This report proposes 10 policy directions for the EU which include but are not limited to allocating increasing resources for research while targeting certain strategic areas that are omitted by the market, designing AI innovation-friendly policies and improving institutional efficiency, promoting technological European independence, stimulating acquisition of foreign technology, attracting talents and others:

(1) Prioritise AI development in S&T policy-making;
(2) Adhere to an integrated European approach by pooling together Member States' resources;
(3) Increase public funding for AI R&D and AI-oriented venture capital;
(4) Stimulate AI market scale and output, including through public procurement;
(5) Allow and support the emergence of domestic tech champions with global reach;
(6) Design talent retention and attraction programs, with generous funding;
(7) Encourage experimentation and public–private integration;
(8) Encourage university-industry joint ventures;
(9) Designate AI as a key component of common security and defence planning;
(10) Designate a limited number of AI clusters within the EU that receive all-around support.

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Qualitative Analysis: Expert Views on Healthcare Systems of Russia and Romania

Vladimir Bulatnikov and Cristinel Constantin

Abstract The desired and designed need of qualitative extraction of healthcare experts' opinions in situation of medicine in Russia and Romania tend this article to be focused on the complications as observed countries have relatively poor healthcare quality index among European countries. With that information gained we are allowed to held a future quantitative analysis to observe the representative sample's feelings and thoughts which are valuable for the research as society here plays a role of a so-called "hidden customer" for mandatory insurance-based healthcare countries which Russia and Romania are nowadays, even if patients don't pay directly for the service. The outcome of this study is a table of short, closed categories of hypotheses which are to point out weaknesses required that have to be improved. In this article we touched such dialogs with experts as the main problems of healthcare systems in the analyzed countries, financing of healthcare in Russia and Romania, common managerial practices in Russia and Romania, social issues in each country's healthcare, marketing strategies and innovations. This qualitative analysis article extracts the results from experts' opinions and in the end of each section shows the percentage of the sample to find the hypotheses for the future quantitative marketing research.

Keywords Russian healthcare · Romanian healthcare · Qualitative analysis · Expert views · Marketing research

1 Introduction

Recall that since 1989 and 1991, Romania and Russia, respectively, came out of the social camp (Kirov 2017), these countries have started to play in the commercial market, where commercial organizations also exist. This led to an imbalance: the Semashko system introduced in Russia and Romania couldn't be applied in such

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circumstances (Kirillov and Putincev 2012). Which in turn led to such a phenomenon as staff turnover and part-time work, as one of the experts pointed out. However, they note that the growth of competition in the market of medical services is an incentive to carry out work more qualitatively for public institutions (Mamedova et al. 2014). This topic was raised due to the fact that Russia and Romania are quite young countries in the capitalist market system, for them this phenomenon is largely an unforeseen factor, which led to an imbalance of the parties (Kirillov and Putintsev 2015). In Russia there is a low dynamics of life expectancy in birth, it was spotted and claimed as moderate, almost linear. High amount of deaths and modest birth rate—this is what prevails inside Russia in 21 century (Banin 2012).

In the article we mention such professional expert's medical explanation shorting's such as: HIF (Health Insurance Fund)—being applicable for countries which use insurance system is related to finance medical care for citizens which confidences on the main functions of the fund: equalization of the conditions for the activities of territorial funds of compulsory medical insurance to ensure the financing of programs, finances of targeted programs, control over the targeted use of financial resources of the system. CHI (Compulsory Health Insurance)—being applicable only for Russian healthcare system it creates the so-called protective umbrella for this post-communist country to sustain the difficulties of this young capitalistic system and gives Russians "free" medical care equally, fast and to everyone with a help of finances collected throughout the taxes charged on a permanent basis. UHI (Universal Health Insurance)—applicable only for Romanian healthcare system. It was a result of major reforms launched in 1989 in Romania, the centralized system of tax-funded healthcare was replaced by a decentralized system of medical and social insurance, in which health insurance funds conclude contracts with medical institutions. Behind different titles CHI and UHI in reality are parallel, as we pointed out throughout the outputs of the expects' opinions—finance difficulties are connected to them and they pointed out ways of improving it or switching to other models, such as budget system coming from communist era.

The current article answers the following 4 research questions: Q1. What are the main problems of healthcare systems in observed countries? Q2. The situation in financing of healthcare in observed countries? Q3. What is the social situation in each country's healthcare? Q4. Which marketing strategies and innovations could be implemented? In order to reach the research goal, we proposed to find answers to the following research objectives: O1. To find existing main problems of healthcare systems; O2. To obtain information about the financing of healthcare; O3. To obtain information about social issues in each country's healthcare; O4. To find information about marketing strategies and innovations. First object asked experts about what can be improved in healthcare, as one of the trending problems is the question about harmonization of the two competitive models of medical institutions: budget-funded and commercial ones; second object focused on the funding of healthcare in Russia and Romania, as two countries have quite common problems questions didn't differ much; third object is about social network, here we looked closer on statistics and pointed on 4 weaknesses as: mortality and what to do with that, unavailable medical

services, staffing problem and doctor-patient relationship; forth object—marketing-wide points were carried out: innovative solutions that have been implemented in healthcare systems.

2 Literature Review

The "volume of financing for the industry" is needed so to have qualified standards of medical healthcare with most focus in rural areas of the huge country (Gamidov 2010). For that reason also needed to have efficient spending of industry funds as well as reducing bad ingredients consumption, so that Russian healthcare system can be at least somewhat better and ready for observations of more specific problems. Looking from the point of view of economics on healthcare is insufficient, it's better to look more from management issues perspective and smart management in healthcare even far more frequently so that social aspects will grow higher with quality (Duganov and Kalashnikov 2011).

If we look from Romania's point of view we can mention author writing that people gradually use and benefit more from healthcare if they pay less for the medical insurance than those who have to pay much more according to their salary coefficients or buying extra heath insurances for high costs—they invite hospitals quite rarely if not even less than that. If we take into account the major difference in size of these two groups then this leads to the fact that the profitable coefficient of the country's healthcare is degrading each year while this mentioned problem is not solved. It is needed to find viable solutions to increase the budget (Besciu 2014). In these conditions, any decision–maker in the Romanian health system should be concerned about identifying extra financial resources and making optimal use of current restricted resources (Antón and Onofrei 2012).

The "sixth technological order," which emerged in the second half of the twentieth century and has since extended throughout the world, is drastically altering the character and structure of society and revealing major contrasts from the industrial civilization that dominated previous centuries (Kurkina and Kolmykova 2013). Therefore better medical staff is needed to keep up with the times so that implementing improved and updated competitive academic education programs and knowledge transfer is required in vast majority of countries to be able to enter the new technological order countrywide (Kuhlmann et al. 2018).

In this regard, most nations' healthcare systems are currently undergoing a shift in priority, from cost-cutting for medical treatment to creating and executing the most efficient resource allocation strategies with smart management in medical sphere (Avksent'eva and Omel'yanovskij 2010). This evolution of healthcare management could be considered a progress toward the approaching of healthcare system from a marketing perspective that "puts the patient at the center". In this regard, medical measures are intended to detect and meet the patient's requirements through high-quality service (Duganov and Kalashnikov 2011). "Interactive medical marketing based on innovation" is the ideal way for detecting new possibilities at a certain

moment, stimulating healthcare consumption, and implementing solutions that can transform the business model in medical organizations over time. Entrepreneurs are more likely to invest in new goods and technology when the rate of return in existing sectors is reduced. During long-term economic crises, the focus shifts from generating profits to limiting relative risk. Product innovations are more common during the "long-wave depression period" (Ioniță and Cioc 2014).

3 Methodology

The research provided in this article is an empirical qualitative research based on a series of structured individual interviews with participants—experts in healthcare systems. We provided 32 in-depth interviews with 19 Russian experts in medicine and 13 Romanian experts (Fig. 1).

The sample structure consists of: medical personnel—17, entrepreneurs of private clinics—7, scientists—5, professors—3. People involved in this interview work in hospitals, medical organizations of private and governmental type, universities and healthcare committees. Part of them in quantity of 8 are quite wise by experience, it can be proved with their medical degree. The rest 24 interviewees are of managerial and medical personnel, which means some of their experience is applicable with marketing research held in this sphere.

The interview guide is relying on structured individual method. Total number of qualitative questions for experts—15; each individual question requested the expert to answer between not less than 1 min and no more than 3 min; interviews were held in October of 2021 year and 17 were conducted using online platform; there are 15 face-to-face dialogs which were recorded locally; interviews length was up to 18 min. The interviews' outcomes are organized around the major themes that emerged from a thematic analysis of the data. We concentrated opinions and simplified them with 4 content analyses. Thematic analysis was performed (Clarke and Braun 2014). The interviews' semantic analysis was coupled with a latent analysis (Landauer et al. 1998). We derived semantic analysis before each category to clarify a latent analysis.
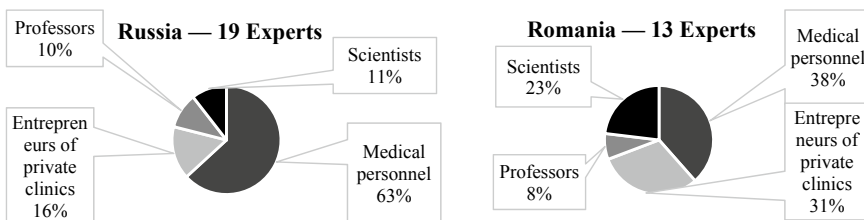
Fig. 1 Number of Russian and Romanian experts in healthcare by profession. *Source* Authors' own research

4 Results and Discussions

4.1 Main Problems of Russian and Romanian Healthcare Systems (O1)

After reviewing the records for main problems, we combined experts' arguments together in 4 categories of problems, which are considered below.

4.1.1 Financing of Healthcare as One of the Main Problems

The main found problem of Russian healthcare is funding. As a result, many doctors go to private clinics because they see that the salary there is higher, usually 2 times, and this despite the fact that the schedule is flexible. Finally, low salaries of medical personnel in public health institutions aren't noticed.

> The huge gap in Russia's healthcare system is funding. Russia spends just 3% of its GDP on healthcare, while in developed countries 8–12%—Russian expert.

> We should contribute all citizens to the health system, not just those who work, and keep behind non-worker—Romanian expert.

The other result of underfunding was spotted in Romania—obsolete tangible assets: buildings and equipment, infrastructure. Since funding is the first priority for improving healthcare, judging by the number of interviewers' responses, we held a category of questions about financing in one of the next chapters of the article.

4.1.2 Management in Healthcare as One of the Main Problems

Russian situation—it is aggravated by the fact that healthcare has been transferred to the powers of regions whose budgets vary greatly and which sometimes set their own rules. Russia is losing hospitals on the periphery due to the lack of awareness of the ministry and committees. But the main trend was spotted with the growing rate of commercial in all kinds of healthcare.

> There is such a nuance as the growth of commercial clinics. In the growth of paid medicine, the authorities don't see anything wrong: it's believed that the patient should have an alternative—Russian expert.

For Romania it's as the biggest problem interviewees mentioned is that, there's not enough attention to primary care (family medicine) and to prevention programs.

> Family medicine should see the patient in his 18 years' while pediatrics should see the patient and do the immunizations and childcare—Romanian expert.

Managerial stuff itself is degrading for 2 countries—hospital management is weak, there's a need of hiring managers on the basis of performance, not political or familiar base.

4.1.3 Commercialization and Competition in Healthcare is Problematic

Experts focused most on doctors and patients were forced to go to the private sector. Staff turnover is a major problem in healthcare when competition is emerging. Romanian expert noticed that a control of private medical activity is needed as it grows up without any adjustments from the government.

> It's necessary to legislatively allow the creation of new commercial clinics, only in places where an acute shortage of medical personnel exists—Russian expert.

As the vast majority experts state—the main trend should be to update the legislation in connection with the extensive emergence of private clinics. To make it unprofitable to violate the law. Harmonization through public–private partnership is a concern.

> We need the cooperation of public and private organizations in order to obtain the health of the population on mutually beneficial terms—Russian expert.

> The abolition of the private subscription system and the introduction of the private health insurance system. Direct settlement of medical service to the state and to the private is also a concern—Romanian expert.

It's also necessary to change the laws to equalize competition, financing as one of the main criterions of competition, harmonization through public–private partnership.

4.1.4 Problems with Quality of Medical Services in Russia and Romania

Both country's experts expressed the opinion that, namely, the characteristics of the quality of services suffer in the whole country and don't allow healthcare to be combined with ones that have a sufficiently high level of healthcare.

> Low quality of services offered by budgetary institutions in Russia is a known fact. I had an observation with that in previous years—Russian expert.

> Quality of medical-auxiliary personnel—from doctors, nurses to therapists, physiotherapists, caregivers, stretchers are the main problem—Romanian expert.

This is the quality of services offered in medical institutions, weak quality training which reflects in poor knowledge of the doctors, provision with sufficient and well-trained medical and care staff. So, training doctors in specialized universities are suggested, also with patient and caregivers and with other members of medical team.

Starting from literature review and experts' opinions, the first hypothesis of the article is as follows: "Financing and management are the main problems in both countries healthcare system". Below is the percentage of experts responding (Table 1).

Table 1 Horizontal analysis on the problems of country's healthcare systems

Country	Percentage of Experts responses			
Russia	Bad financing 53%	Bad management 24%	Bad commerce 14%	Bad quality 9%
Romania	Bad financing 38%	Bad management 23%	Commerce 13%	Bad quality 26%

Source Authors' own research

4.2　Finances in Healthcare in Russia and Romania: Ways of Payments (O2)

On this issue, the experts divided into categories: experts who identified the compulsory medical insurance system that plays a positive role in the healthcare system and those who responded it as playing a negative role.

4.2.1　Experts Identified Compulsory Insurance System as Positive

As experts mentioned—CHI is a prop for the capitalist system to organize all the same social healthcare. Compulsory medical insurance is the only funding system that is able to provide free medical care in a capitalist society. Private clinics are gradually concluding contracts with the compulsory medical insurance fund in order to increase the client base.

> CHI treat everyone from little too large. Everyone makes a contribution, so low-income segments society can receive a complex service—Russian expert.

> Provided that health contribution is paid by everyone, and the amounts raised are fully reinvested in the health system—compulsory insurance is justified. Insurance companies have to be fair with clear conditions—Romanian expert.

From Romanian experience it's imperative for the proper functioning. It's justified for providing a minimum of funds necessary for all people in need of medical services. The assessment must start from real, not desired or imagined situation of the country—first of all, the share of vulnerable society.

4.2.2　Experts Who Highlighted CHI/UHI System as Ineffective

An insurance company is a private intermediary. They bypass issues in terms of business and making money, the lack of transparency of the use of the asset is obvious here. Here the lack of funds for the treatment of really sick patients exists.

> Insurance private organizations liquidation creating direct payments for CHI and financing country's healthcare will give more than 3–4% GDP—Russian expert.

Table 2 Horizontal analysis of ways financing in both countries' healthcare

Country	Percentage of Experts responses		
Russia	No changes needed 73%	Remove insurance 13.50%	Move to budget 13.50%
Romania	No changes needed 92%		Remove 8%

Source Authors' own research

> Disadvantage here is that being many consumers and few payers, it's intensely consuming money from the budget, so no money is enough for modernizations or for quality services, only quantity is offered—Romanian expert.

Starting from literature review and experts' opinions on topic above the hypothesis for mentioned above horizontal analysis is as follows: "Compulsory medical insurance is a source of underfunding". Below is the percentage of experts responding (Table 2).

4.3 Social Situation in Russian and Romanian Healthcare (O3)

To have a better idea of social situation, we used the method of excluding vague expert comments. Thus, this category contains concentrated views that most affect the problem. It consists of 4 subcategories: premature deaths, services patients can't receive, personnel problem, doctor-patient relationship.

4.3.1 Leading Position in Premature Deaths

Firstly, premature deaths start from the ambulance being slow—bad roads, facilities of the emergency rooms and finish with bad time management of the doctor at his place. There isn't enough time that is allowed to receive and treat patients in a right way. Average doctor uses more on writing the diagnoses rather than taking care of the patient.

> Hospitals that are on the highway must have in their staff doctors traumatologist and surgeon, to provide emergency care on the spot—Russian expert.

Secondly, it's the lack of a full medical examination of the population. This leads to illiteracy of some patients, who come at the last moment, and nothing can be done to them. Monitoring by the family doctor is also a case in prevention premature deaths.

> Doctors are removed, they can't be replaced by a computer tomograph, or, magnetic resonance or some other iron—Romanian expert.

Thirdly, is an insufficient funding. In public institutions, the qualification of a doctor is usually lower than in commercial ones, which affects the incorrect treatment of the patient and leads to unexpected death. Underfunding doesn't allow any increase in the number of doctors, nurses, devices.

4.3.2 Services That Patients Can't Receive Right Away

Some experts claim rural zone in Russia as the prevailing threat not examined properly with doctors, especially in circumstances of a huge territory.

> Primary healthcare in rural areas is unavailable. Outpatient specialty assistance is a tough point if you rely only on UHI—Russian expert.

The main trend is that services that go beyond the sponsorship of compulsory medical insurance are currently unavailable in both countries. Complex instrumental research is unavailable for most parts of Russia.

> High-tech, complex instrumental research, oncology, and help with orphan diseases are often unavailable with CHI. You have to pay extra if you want help or you go to the private, so you'll be treated as intended—Romanian expert.

Laboratory tests are not easily accessible and somewhat expensive in Romania. As a rule, oncology and help with orphan diseases are a problem. High-tech medical care has problems with the flow going through. Finally, high-cost services, many patients are forced to pay for the usual receptions and examinations. In face of Covid-19 experts expressed intensive care unit's failure.

4.3.3 Shortage of Medical Personnel

It's necessary that the result of every treatment with a doctor, the patient felt immediately during the session. It's essential to increase the time of reception by doctors of patients by exemption that exact doctor from unnecessary paperwork.

> One of the ways to solve this problem is to free the doctor from unnecessary paperwork, which will free up time for direct patient visits—Russian expert.

> The personnel problem, first of all, hits the villages and towns of the country. You can't even make calculations here; statistics are not kept—Romanian expert.

Secondly, villages half lost personnel for the past 10 years, and today this leads to the dissolution of such institutions as a consequence.

4.3.4 Issues with Doctor-Patient Relationship

Between Russian healthcare professionals the problems were pointed out as follows: automate the time to describe the medical history; implement a system of reviews

Table 3 Horizontal analysis of social relationships in Russia and Romania

Country	Percentage of Experts responses			
Russia	Early mortality 32%	Unavailability 28%	Lack of medical staff 20%	Doc-Patient problem 20%
Romania	Early mortality 20%	Unavailability of services 30%	Lack of medical staff 30%	Doc-Patient problem 20%

Source Authors' own research

with reference to the name of the doctor; the issue of cultural development of the population and training.

> This is a question of training personnel, and the whole culture of the society in Russian Federation—Russian expert.

Romanian medicine experts debated on the problem of self-education of a doctor. It can be reached through more efficient education, through communication courses for staff.

> Correct explanation and information of the patient about the disease, options, side effects, possible complications—all this is needed—Romanian expert.

Communication, and increased length of time during consultations, controls also related to this subtopic. Correct explanation and information of the patient about the disease, options, side effects, possible complications. Doctors have must be available for their patients and health professionals should have enough time in order to so-called "fill" the problem of each patient.

Starting from literature review and experts' opinions on topic above the hypothesis for mentioned above horizontal analysis is as follows: "There is a strong need of qualified medical staff and better relationships with patients". Below is the percentage of responding (Table 3).

4.4 Implementation of Marketing and Management Strategies (O4)

4.4.1 Healthcare Price Changes Consideration

A vast majority of experts expressed their feelings that patients don't agree to pay anything and take healthcare as for granted.

> Main types of medical care should be provided free of charge—Russian expert.

Patient's view is that the state should give them everything for free, that "health is the most important". The medical subscription system offered by the employer, it doesn't cost the patient, but creates a malfunction in the system.

> Medical subscription offered by the employer, it doesn't cost the patient, but creates a malfunction. The company deducts from the tax, but in the end all the patient loses: lower

salary, frequently not all private medical services are covered by the subscription, from the salary stops and CAS—Romanian expert.

The company deducts from the tax, but all patients lose: lower salary, frequently not all private medical services are covered, the salary drops significantly with national health insurance. The price of the average service to be smart and dynamic. Mostly it should be formed by the population's solvency rates as well as with few other popular factors. Fixed prices should be dynamic, depending on the patient's salary.

4.4.2　Healthcare Lacks Innovation in Distribution

Innovation requires to distribute patient flows. The implementation of the ability to automatically record medical history should be considered. Information systems for corroborating information that can facilitate diagnosis.

> Most things to be done remotely due to pandemic. Unified medical information and analytical systems, it connects hospital with clinic—Russian expert.
>
> Introduction of the interpersonal communication course in the first year of college is a first thing to be focused on—Romanian expert.

Health education of on growing flow of patients into one big city hospital is needed for increasing the perception of the population in their new trend of good mental health. Thereby innovative suggestion comes automatically providing tools for a healthy lifestyle, prophylaxis. This can be done, as a lot of youth medical experts debated, with artificial intelligence.

4.4.3　Retention of a Patient in a Budgetary Healthcare Institution

Between Russian experts' opinions here focused on internal problems of the hospitals. Medical hospitals have to improve quality, not do business on this, on the medical field.

> State hospitals are sorely lacking in conducting market research to probe the patient in returning again and again—Russian expert.
>
> Eliminating annoying, humiliating and counterproductive expectations. After waiting 2 hours at a doctor's door, the patient perceives him as a public enemy. An empathetic, compassionate behavior of the medical staff, but not condescending and demeaner. Eradicating the bribe climate—Romanian expert.

Good conditions in the hospital are the solution here. Psychological work with the hospital staff is needed. Free medical services, proximity of the institution to the place of residence. State institutions should provide services so that the equipment is on its innovative level. Below is the percentage of experts responding (Table 4).

Starting from literature review and experts' opinions on topic above the hypothesis for mentioned above horizontal analysis is as follows: "The main marketing strategies should focus on price, innovations and patient satisfaction".

Table 4 Horizontal analysis of Russian and Romanian healthcare management

Country	Percentage of Experts responses		
Russia	Price changes needed 37.50%	Innovations needed 31.25%	Expand patient's interest 31.25%
Romania	Price changes needed 20%	Innovations needed 27%	Expand patient's interest 53%

Source Authors' own research

5 Conclusion

As of a conclusion for this article, thankfully experts' opinions are quite similar one to another with Russian and Romanian healthcare outputs. The major difference here is with only some percentages which we considered in each table. The biggest major difference between Russian and Romanian healthcare found in this qualitative research article was another attitude of Romanians to its compulsory medical insurance, even more—they don't want returning to budget healthcare system as it was during the socialist camp. The opposite in Russia—one half of experts and literature sources were found that they tend to have good experiences during USSR era, some of them directly told to move back again, some were fondly remembered the old days. Speaking of other significant observations, we found the difference in attitude of how Russians think of modern investigations in future management system of medicine—they want it all the way, but in Romanians in opposite want more qualified medical stuff in their institutions which simply means that education in Russia is still on its own way, but in the meantime Russia lacks of modern features. Anyway, listed differences don't play a role in future investigation of this research as its very minor to the main direction we found in this research which is quite interesting. Speaking of main problems in Russian and Romanian healthcare we can see exactly the same situation: bad financing, bad management, the coming of commercial institutions and lack of quality all the way. As you can see it's not only a marketing problem of previous years in terms of healthcare of Russia and Romania but also a vast amount of other problems as follows: competition in healthcare needs improvements: law change and equaled financing; compulsory medical insurance is a source of underfunding; modern management and qualified staff are the inevitability of renovations in healthcare; There is a strong need of qualified medical staff and better relationships with patients; The main marketing strategies should focus on price, innovations and patient satisfaction. That clearly identify the problem of the 2 observed systems at all main levels. Which is why these countries gaining a relatively low healthcare index between European countries. Below are the tables with each section's directions to study in future work. The Russian and Romanian expert's opinions are divided and calculated with its percentage. This information obtained by the interviews can be representative in many ways to extract priceful qualitative type of information needed to prove or deny any hypotheses of our marketing research in the field but specially to substantiate on empirical bases hypotheses for future quantitative research.

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A Bibliometric and Visualization Analysis of Community and Entrepreneurship Research

Khanh Hung Doan

Abstract The relationship between community and entrepreneurship is a topic that has long been studied in the field of business administration. In more detail, these studies both establish that community and entrepreneurship are interrelated and are significant for the development of any country and any locality. This paper's aim is to review previous community and entrepreneurship studies based on the bibliometric method. Furthermore, an overview of the studies of the relationship between community and entrepreneurship was provided. The study was based on 847 publications obtained from the Scopus database (including articles, conference proceedings, and books or book chapters). The analyzes were performed by using tools of VOSviewer software and Citespace software, and the analysis is done on several levels. In addition, assessments and analyzes of time, the field of study, keywords are provided. From the results of the research, it is possible to mention that the relationship between community and entrepreneurship is close. Besides, the objectives such as community sustainable development, social enterprise, and community entrepreneurship development are also interested in the research between community and entrepreneurship. The obtained results contribute to a better understanding of this research area. In addition, this study promotes potential research on community and entrepreneurship currently and in the future.

Keywords Entrepreneurship · Enterprise · Community · Bibliometric method · VOSviewer · Citespace

1 Introduction

Nowadays, there are many studies on entrepreneurship and community. However, currently, many studies mainly assess entrepreneurship, build entrepreneurial ideas, and the relationship between entrepreneurship and local socio-economic development, etc. There is little research on the relationship between community and

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entrepreneurship. It is an essential theme, but it is a relatively neglected topic (Lyons et al. 2012). In fact, the relationship between community and entrepreneurship is a complex issue that cannot be easily identified or understood. It is a partnership that must afford mutual benefit to its sides. Before it can take place, the nature and needs of those prospective partners must be clearly elaborated and appreciated (Lyons et al. 2012). Martinez et al. (2011) suggested that entrepreneurship research had not paid sufficient attention to the community in which entrepreneurship is carried out. Furthermore, Coase and Wang (2011) and Lyons et al. (2012) also suggested that the relationship between entrepreneurs and community could be the next frontier for entrepreneurship researchers.

Studying this problem directly, a lot of researchers have mentioned the relationship between community and entrepreneurship, such as: Lyons et al. (2012) have shown that have a relationship between community and entrepreneurship: mutualistic, commensalistic, or parasitic. In addition, Lyons et al. (2012) showed the role of the community in entrepreneurship, such as: community culture, social capital, community entrepreneurship, etc. Moreover, in recent research, there has been an emphasis on the idea that both community and individual influence one's vision of and access to opportunities (Fortunato and Alter 2011). Many studies show a relation between community culture and entrepreneurship. The research of Chrisman et al. (2002) took the approach that culture will influence how entrepreneurs affect the environment, which in turn affects the strategic choices made by entrepreneurs and the rate of success of those ventures. Huggins and Thompson (2012) showed dimensions of socio-spatial culture relating to levels of dynamic entrepreneurship within local economies. Furthermore, some studies show the role of the community in providing capital for entrepreneurship, for example, Hui et al. (2014) identified community efforts to support crowdfunding work. The research of Giudic et al. (2012) identified crowdfunding which seems to play an increasingly important role in the financing of entrepreneurial projects. However, these researches have not fully assessed the role of the community in entrepreneurship.

Besides the positive effects, communities can have a negative impact on the success of enterprises and entrepreneurship (Lyons et al. 2012). In particular, the lack of motivation to create new entrepreneurs in the community will harm the sustainability of entrepreneurial activities and entrepreneurship development, which will also have a negative impact on the community (because entrepreneurship is correlated with economic growth) (Lyons et al. 2012). In summary, the nature and role of any relevant community as a factor influencing the entrepreneurship process is an issue that needs to be carefully considered in the research and evaluation of entrepreneurship (Hindle and Moroz 2010).

In general, many studies mention the importance of the community to entrepreneurship. In plus, that is making recommendations and policies for local entrepreneurship development. However, these studies are general only. Many scholars have mentioned the role and contribution of the community to stimulating entrepreneurship based on exploiting each aspect of the community. However, there is no general study on the role of the community and its contribution to stimulating entrepreneurship.

This paper aims to systematically review the existing literature to clarify current research on the relationship between community and entrepreneurship and gain a clearer view of the approach and characteristics of the community between these two objects. From there, there were discovered patterns explaining the development or change over time of entrepreneurship and community research. Besides, the informational visualization presented in this paper demonstrates the research achievements in this field. The theoretical review also provides a basic theoretical framework to lay the groundwork for potential future research. The paper ends with conclusions. Furthermore, this part presents research characteristics of the relationship between community and entrepreneurship and makes suggestions for future research directions.

The article is structured in four parts. The first part provides a literature review that highlights some of the issues related to the relationship between community and entrepreneurship. At the same time, the research results of this part show the importance of research between the community and entrepreneurship. The second part introduces the document research method used in the article. The third part includes research results and analysis results from the collected databases. The final part discusses the results of the paper and gives a summary of limitations and potential directions for future research.

2　Literature Review

Interdependence between Community and Entrepreneurship

Currently, a profound change in the strategy of community economic development in the past decades is the appearance of entrepreneurship (Gruidl and Markley 2014), new business models such as business innovation models (Bellini et al. 2019), business through digital platforms (Ruggieri et al. 2018), etc. Nowadays, community developers realize that entrepreneurship is essential to the vitality and development of a local economy (Collins et al. 2016). In addition, Gruidl and Markley (2014) determined that entrepreneurship is driving economic growth and job creation worldwide. Since then, the development of entrepreneurship has shown an increasingly important role for the locality. It is considered an emerging strategy that contributes to the community and local development. However, in reality, the development of entrepreneurship is also influenced and impacted by many factors. In fact, any change of nature, accidental or intentional, can affect enterprises and organizations (Păunescu et al. 2018a). In more detail, the enterprise is a socio-cultural phenomenon. The establishment and operation (the success or failure) of the enterprises are linked and it depends on the environment where the enterprise is operating (Păunescu et al. 2018a, b; Priede-Bergamini et al. 2019; Păunescu and Mátyus 2020; Păunescu and Molnar 2020). Therefore, the environment, which can stimulate or promote the enterprise activities, is an essential factor in determining the conditions under which the enterprise will operate. Shane (2003) explained that the phenomenon of entrepreneurship

cannot be explained either by environmental forces or by individual factors in the absence of the other. This view has been built upon the academic scholarship of social scientists (Fortunato and Alter 2015). They observe that culture, state and local policies, social and infrastructure, and even the degree of social interaction profoundly influence entrepreneurship (Fortunato and Alter 2015). Anderson and Giberson (2003) pointed out the strong relationship between process and location for entrepreneurship. Entrepreneurship behavior and intentions will differ in different environments, circumstances, and times (Ambad and Damit 2016; Maresch et al. 2016). Hindle and Moroz (2010) also identified community as a consideration that affects all forms of entrepreneurship.

Currently, there are studies by some researchers confirmed that entrepreneurship has a close relationship with the community, based on the community to develop, pursuing the goals and common interests of both community and entrepreneurship (Anderson 1999; Peredo 2001; Lyons et al. 2012; Stanford et al. 2021). Many aspects and characteristics of the community have a strong influence on any business and entrepreneurship, although other agents (individuals, groups, organizations) are the main character of the operation business (Hindle and Moroz 2010). On the other hand, Korsching and Allen (2004) saw entrepreneurship from a perspective broader than community development. They see community support as a catalyst for business projects (Korsching and Allen 2004). Communities provide essential services aimed at supporting startups (Darwish and Van Dyk 2018) by adopting various measures and subsidies (Prijon 2012). Therefore, it can be seen that entrepreneurship and community have an essential relationship with each other (Lyons et al. 2012; JMIGE 2021; Stanford et al. 2021).

However, community and entrepreneurship is complex relationship, not easily defined and understood (Lyons et al. 2012; JMIGE 2021). It is a partnership that must be mutually beneficial for its parties (Lyons et al. 2012). Therefore, before such a relationship can happen, the nature and needs of potential partners must be built and assessed (Lyons et al. 2012). In recent startup studies, there has been an emphasis on the idea that both the community and individual startups influence a vision and access to opportunities (Fortunato and Alter 2011). Additionally, there was a part in the entrepreneurship sector with one side focused on the individual entrepreneur, and the rest focus on the external forces influencing the entrepreneurship phenomenon (Shane 2003; Naushad et al. 2018). Fortunato and Alter (2015) argued that the collaboration between individuals and communities contributes to promoting and developing creativity, innovation, and growth. From there, it brings positive results for all individuals and communities (Fortunato and Alter 2015). Communities support entrepreneurship by creating culturally backed relationships to share opportunity information, collaborate for the benefit of the community or the region, and create an ecosystem that helps enterprises (Julien 2007; Fortunato and Alter 2011). In addition, communities (or community ecosystems) that support entrepreneurs and entrepreneurship are not just at the functional level (for example, access to capital through banks, local taxes, and land use books, availability of reasonable financing options) but also at the relational level (Wilkinson 1991). From there, the community

contributes to improving an environment that supports entrepreneurship and startup (Wilkinson 1991; Lyons et al. 2012; Stanford et al. 2021).

In their own research, Lyons et al. (2012) have shown many factors that promote interaction between the community and entrepreneurship that are: Local people's awareness of entrepreneurship and support for local businesses; Culture and types of institutional support; The role of the entrepreneur in effective community development; Activity allocation of business activities of the enterprise; Type of business of the enterprise. Research by Reynolds et al. (2000) identified factors that determine the interaction between entrepreneurship and community related to entrepreneurial framework conditions. Entrepreneurial framework conditions that Reynolds et al. (2000) suggested include entrepreneurship opportunity, entrepreneurial capacity, social legitimacy, and finance and information technology. These conditions have a direct impact on the level of entrepreneurship activity. Furthermore, these conditions depend on the individual entrepreneur and the community (Reynolds et al. 2000). Moreover, based on the relationship and role of the community with entrepreneurship, Gruidl and Markley (2014) developed a suggestion mechanism to play a role in stimulating the entrepreneurship of the community as well as with the aim of examining what the community is currently doing to promote entrepreneurship. Besides, this mechanism is also intended to understand how communities currently support entrepreneurs (Gruidl and Markley 2014). Gruidl and Markley (2014) determined that it is unlikely that a community will score well across all categories, but this tool can suggest what they are doing well and areas where the community can improve. Therefore, the leaders of the community need to find ways to expand the number of start-up enterprises in the community and create cultural entrepreneurship and entrepreneurial motivation among community residents (Gruidl and Markley 2014). In particular, the main premise of these programs is to support the community in focusing on the needs and wants of entrepreneurs if they want to be successful (Gruidl and Markley 2014).

3 Methodology

3.1 Aim of the Research

The aim of the research is to provide an overview and trends of recent research on entrepreneurship and the community. From there, the common related issues in community and entrepreneurship research can be identified. Besides, the research results will contribute and promote potential research in this field in the coming time.

3.2 Research Methodologies

In this paper, the bibliometric analysis method is the chosen research method for implementation. This bibliometric method is a method widely used in many different studies. The main purpose of this method is to identify important aspects and factors in previous studies. In addition, the results of the study also contribute to identifying future research trends based on the phrases mentioned in the bibliography (in this study, the objectives are community and entrepreneurship). More specifically, the bibliometric analysis will analyze and evaluate scientific research based on statistical methods and tools in a particular field, as well as identify relevant information to the specified research object. According to Yu et al. (2016), currently, the bibliometric method is frequently used to investigate the latest research status and trends on a particular topic, including the number of articles, geography, journal distribution, subject area, authors, and institutions, academic collation, and article citations. Therefore, the bibliometric method has been used extensively to provide a quantitative analysis of written publications or academic literature in recent years (Cicea 2020; Angarita-Zapata et al. 2021; Elihami 2021; Faruk et al. 2021; Martinho 2021; Su et al. 2021; McNicholas et al. 2022; Wei and Deng 2022). In this paper, by the bibliometric method, the information related to the relationship between community and entrepreneurship researches will be explored.

3.3 Data Collection

Nowadays, there are many databases with scientific knowledge. These databases are recognized by many organizations, individuals, scientists as well as worldwide. Among those databases, two scientific databases stand out, Scopus and Web of Sciences. These are the two databases with the largest and most reputable documents in the world. Firstly, Scopus is a database of more than 70 million scientific documents, provided by Elsevier. Secondly, Web of Sciences is the world's largest database of more than 100 million scientific documents, provided by Clarivate Analytics (Cicea and Marinescu 2021; Paperpile 2021). Because most of the results and scientific documents are cited in both of the above databases, to avoid redundancy in the analysis results, the research selects only one database to extract data from. Based on the search engine of both databases, the Scopus database is selected because the search results obtained with selected keywords in the Scopus database (938 publications) give more results than in the Web of Science database (703 publications). Besides, many scholars also use the Scopus database to analyze because of its simple interface and fast analysis (Cicea and Marinescu 2021; Trinh and Cicea 2021). Therefore, this study continues to use the Scopus database to conduct data collection.

To collect data in the Scopus database, the search engine of the Scopus database is used to conduct a simple search with the following keywords: 'Community', 'Communities', 'Entrepreneurship', 'Enterprise', 'Enterprises'. Keywords are searched with the title of the publications contained in the Scopus database. The data extraction date is December 30, 2021. A total of 938 publications were found. From the publications found, the research proceeds to select documents suitable for the research purpose. The first step is to remove publications published in 2022, which are scheduled to be published. The research choose publications published before 2022. In the second step, the documents that are Articles, Book Chapters, and Conference Proceedings are selected. Finally, the publications that are not in English are removed. The number of publications remaining is 847. After data filtering, a total of 847 publications were used for analysis compared to a total of 938 publications found initially.

3.4   Data Analysis

After the database has been collected from the Scopus database, in the next step, the research conducts an analysis of the content related to the research objectives of community and entrepreneurship. The analyzes were performed using the data provided by the Scopus database through the Scopus database engine, VOSViewer 1.6.17 software (van Eck and Waltman 2010), and Citespace software (Chen 2006). The analysis considered several aspects, including the subject area and distribution of scientific research, the time of publication, and the keywords terminology of the databases collected.

Besides, to ensure the validity of the research, the Scopus database was one of the reputable research databases that were reviewed (Soosay and Hyland 2015; Trinh and Cicea 2021). The systematic literature review process is explained in detail to ensure the reliability of the study. In addition, the inclusion and exclusion criteria were based on the options given in the Scopus database. The research did not use their criteria for inclusion in the exclusion list. Thus, this ensures the reliability of the database collected.

4   Results and Discussions

Based on the above data collection results, a total of 847 documents related to community and entrepreneurship were used for post-screening analysis. These results are collected based on the Scopus database. In this section, an overview of the studies to date will clarify research of the relationship between communities and entrepreneurship.

Fig. 1 Publications by types (%). *Source* Author's own research results, using Scopus database
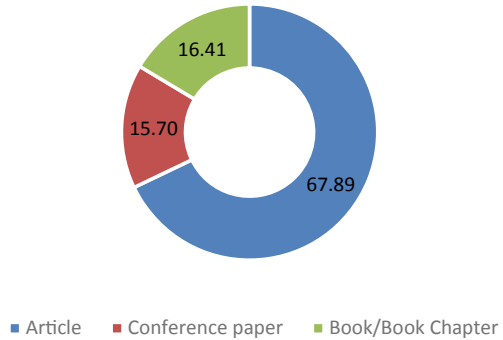
4.1 Analysis by Type of the Publications

The distribution of documents related to entrepreneurship and community is shown in Fig. 1. This result is based on statistical results from the Scopus database for keywords related to entrepreneurship and community in the title of the publications. The results show an unequal distribution among the document types. Based on the chart, the most common type of document is Article (67.89%, corresponding to 575 publications), followed by Books and Book chapters (16.41%, corresponding to 139 publications), and finally the Conferences Paper (with 15.70%, corresponding to 133 publications). These three types of documents account for 90.30% of the total number of initial search document results (including other types of documents such as reviews, notes, etc.). It proves that the documents included in the analysis are appropriate and highly accurate.

4.2 Analysis by Subject Area of the Publications

The distribution of the database of 847 publications by subject area is presented in Table 1. In more detail, the results in Table 1 provide the top 10 subject areas with the highest number of publications. It should be noted here that, in the Scopus database, a document can be in many different fields, depending on the scientific area and the journal in which it is published. Specifically, according to the results in Table 1, the number of publications in the fields of Business, Management and Accounting accounted for the biggest number (361 documents, 42.62% of all documents), followed by Social Sciences with 353 documents (41.68% of all documents). The next areas are Economics, Econometrics and Finance, Computer Science, etc.

Table 1 Top 10 subject area of publications

Ranking	Subject area	Number	Percent (%)
1	Business, Management and Accounting	361	42.62
2	Social Sciences	353	41.68
3	Economics, Econometrics and Finance	220	25.97
4	Computer Science	111	13.11
5	Environmental Science	89	10.51
6	Engineering	78	9.21
7	Arts and Humanities	62	7.32
8	Medicine	46	5.43
9	Agricultural and Biological Sciences	43	5.08
10	Decision Sciences	38	4.49

Source Author's own research results, using Scopus database

4.3 Analysis by Publication Time

Figure 2 shows the distribution over time in the number of articles published. From Fig. 2, there is an existence an increase in the number of published articles related to entrepreneurship and community. The first published paper related to community and entrepreneurship was in 1953. By the end of 2021, there were 92 corresponding publications. Looking at Fig. 2 of the increase in publications, the results consider that the expansion in publications is related to economic and social fluctuations. During the period from 1953 to 2000, there were 1 to 5 scientific articles per year (with the highest number in 1990 with seven publications). From 2001 there was a boom in the number of publications. The number of publications reached the highest value in 2021, with 92 documents. In the period 2010–2021, there were 646 publications published, accounting for 76.27% of the number of publications from 1953 to 2021. From 2010 to 2021, 54 articles are published on average per year. Undoubtedly, the boom in the number of scientific articles registered after 2010 is due to the growing interest of researchers in this field. This increase is suitable with the change of the global economy and society.

4.4 Analysis by Geography of the Publications

Regarding the geographical distribution, it can be said to be very diverse. According to statistical results, there are 104 countries and territories that have researched on community and entrepreneurship. Countries with at least ten publications (articles, yearbooks, book chapters) addressing the issue are presented in Table 2. A total of 21 countries and territories have 10 or more publications. The results show that the United States has the highest number of publications with 207 documents (24.44%
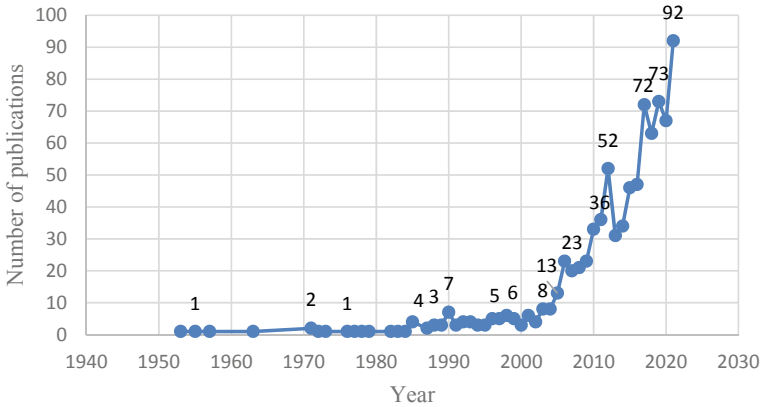
Fig. 2 Documents by year. *Source* Author's own research results, using Scopus database

of all documents), followed by the United Kingdom (130 documents, 15.35% of all documents) and Australia (69 documents, 8.15% of all documents). It is not surprising that these countries have a high number of publications because these are developed economies and have a lot of research on business and community activities. Besides, for the number of citations for each country, the United States still accounts for the largest number of citations with 3474 citations, followed by the United Kingdom and Canada with 2313 citations and 1451 citations, respectively. Currently, Asian countries are also emerging as countries and regions with a lot of research into community and entrepreneurship. Countries such as Thailand, China, and Indonesia occupy the 5th, 6th, and 7th positions, respectively, in terms of the number of studies.

Conducting an assessment of publication times by country, the results in Table 2 and Fig. 3 show the average publications year in detail. The results show that the countries with the most recent research on community and entrepreneurship focus mainly on countries and territories in Asia and Africa. The emerging research is from countries (such as Thailand, Indonesia, South Africa, and Nigeria). It shows a tendency to move research towards community and entrepreneurship studies from European and American countries to Asian and African countries.

4.5 Keywords and Co-keywords Analysis

The first part of this analysis was performed using VOSViewer software (Version 1.6.13) (van Eck and Waltman 2010). This software can create a list of keywords, authors, citations, etc., and determine the correlation or suggested association between keywords. Using VOSviewer software, the research has selected the minimum number of occurrences of a keyword as five (threshold). There are 57

Table 2 Countries have documents more than 10 publications

Ranking	Country/Territory	Number of documents	Percent (%)	Citations	APY
1	United State	207	24.44	3473	2012
2	United Kingdom	130	15.35	2313	2012
3	Australia	69	8.15	836	2014
4	Canada	55	6.49	1451	2012
5	Thailand	51	6.02	111	2017
6	China	50	5.90	161	2014
7	Indonesia	41	4.84	125	2017
8	Germany	28	3.31	298	2013
9	Netherlands	24	2.83	202	2015
10	Malaysia	22	2.60	46	2016
11	India	20	2.36	136	2016
12	New Zealands	20	2.36	303	2014
13	Italy	18	2.13	124	2014
14	South Africa	17	2.01	100	2017
15	Spain	16	1.89	147	2014
16	Sweden	15	1.77	302	2011
17	Japan	12	1.42	48	2015
18	Nigeria	11	1.30	59	2016
19	Mexico	10	1.18	55	2016
20	Portugal	10	1.18	71	2014
21	France	10	1.18	91	2013

Note APY: Average publications year
Source Author's own research results, using Scopus database and VOSviewer
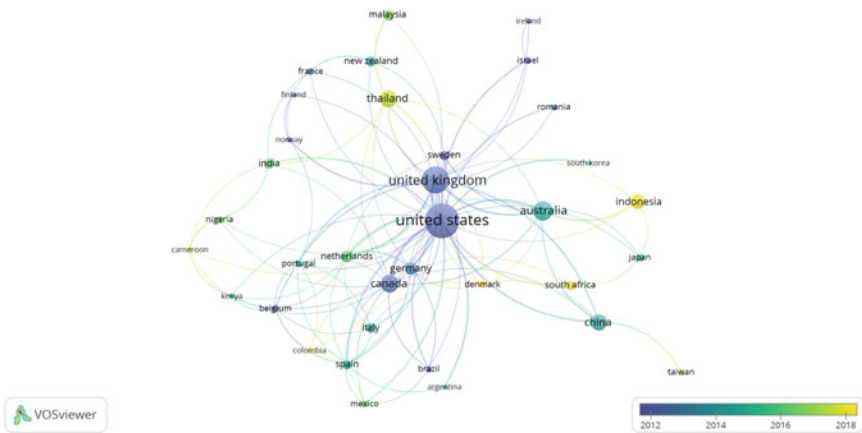
Fig. 3 Evolution of publications by time of countries over time. *Source* Author's own research results using Scopus database and VOSviewer

keywords out of a total of 1823 keywords that were used to conduct the analysis. The keywords with occurrences of more than ten are shown in Table 3.

Going deeper into the analysis, Fig. 4 shows the results of the keyword network visualization map by different clusters. Analyzing Fig. 4, there are a total of 5 clusters formed from the analysis results of VOSviewer software. From there, the red cluster (Cluster 1) includes keywords in the community area. In this cluster, there are community and community development keywords, such as 'Community', 'Community development', 'Communities', 'Social capital', 'Economic development', 'Rural communities', etc. The slight difference between them is that cluster 1 (red) contains some issues of the entrepreneur (for example, 'Entrepreneurs', 'Entrepreneurialism'). The second cluster (in green) contains words related to entrepreneurship and community entrepreneurship, including 'Entrepreneurship', 'Community entrepreneurship', 'Community engagement', 'Community of practice', 'Education', 'Culture', etc. The third cluster (in blue) considers social entrepreneurship issues, including keywords

Table 3 Keywords have more than 10 occurrences

Ranking	Keywords	Cluster	Occurrences	Total link strength	Link	APY
1	Entrepreneurship	2	77	79	34	2015
2	Social enterprise	2	48	55	26	2017
3	Social entrepreneurship	3	35	41	20	2016
4	Community	1	32	36	20	2015
5	Community development	1	25	32	19	2014
6	Community enterprise	2	25	23	16	2016
7	Social capital	1	20	27	15	2015
8	Community enterprises	4	18	14	8	2016
9	Sustainability	2	17	21	13	2016
10	Online communities	3	13	10	5	2014
11	Thailand	4	12	18	12	2016
12	Communities	1	11	10	8	2014
13	Community entrepreneurship	2	11	17	11	2016
14	Community forestry	5	11	11	7	2014
15	Management	4	11	18	11	2014
16	China	3	10	9	8	2016
17	Enterprise	3	10	11	4	2015

Note APY: Average publications year
Source Author's own research results, using Scopus database and VOSviewer
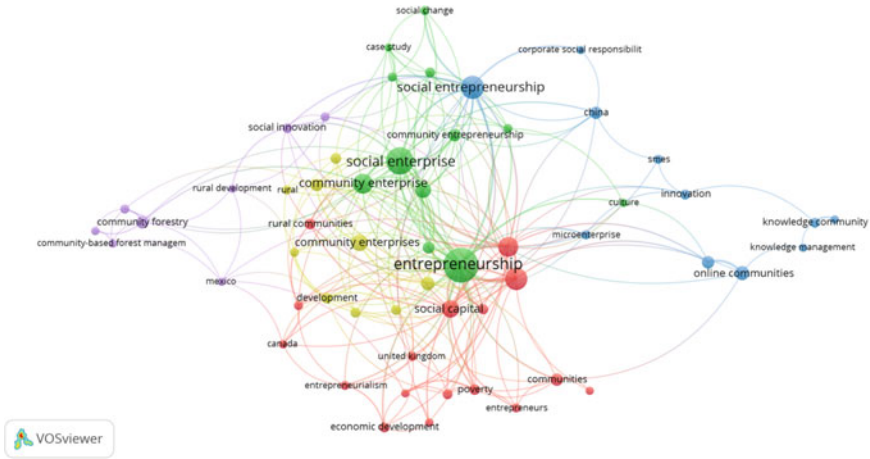
Fig. 4 Keyword group by clusters. *Source* Author's own research results, using Scopus database and VOSviewer

'Social entrepreneurship', 'Smes', 'Microentreprises', 'Knowledge management', 'Innovation', 'Corporate social responsibility', etc. The fourth cluster (in yellow) relates to community enterprises, such as 'Community enterprises', 'Community-based enterprises', 'Management', 'Empowerment', etc. Finally, the fifth cluster (in purple) contains phrases related to forms of community development and management, including 'Community forestry', 'Community-based forest management', 'Rural development', 'Community forest enterprise', etc.

In addition, the VOSviewer program also provides the ability to analyze the time evolution of the analyzed keywords. The results of the evolution of keywords are shown in Fig. 5. Besides, Table 3 also shows the time of keywords with a frequency greater than 10. The results show that, before 2016, researchers focus on aspects of entrepreneurship development, entrepreneurs in the community (the keywords usually appear are 'Entrepreneurship', 'Entrepreneurialism', 'Entrepreneurs', 'Knowledge management', etc.); In the next phase, researchers focus on research aimed at community development and community enterprise (keywords are 'Community', 'Community development', 'Online community', 'Community-based enterprise', 'Community enterprise' etc.). In the last phase, in the recent period from 2019–2021, the studies all focused on the research of social enterprises and rural community (keywords are: 'Social entrepreneurship', 'Social enterprise', 'Social innovation', 'Rural community', 'Community engagement', etc.).

More specifically, the links between keywords are analyzed. These links represent the number of links that one keyword associates with other keywords. The research analyzes the links between the keywords with the highest links. Based on the statistical results in Table 3, a total of 6 keywords were selected for analysis: 'Entrepreneurship', 'Social enterprise', 'Social entrepreneurship', 'Community',
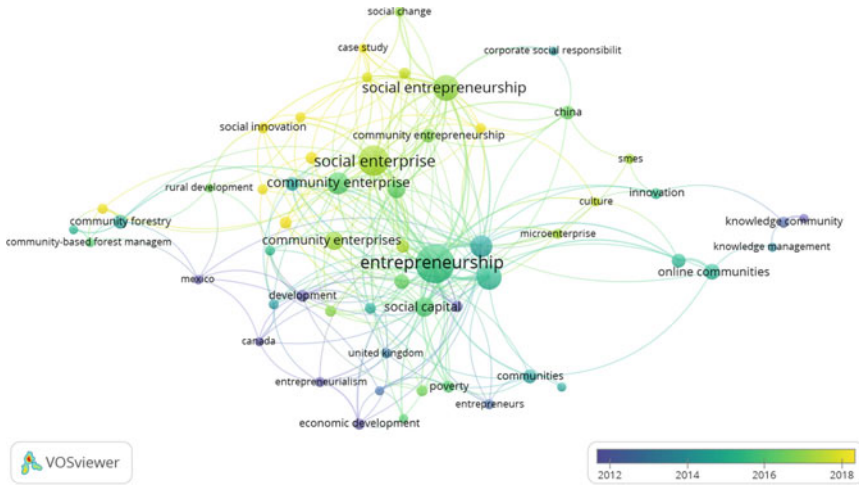
Fig. 5 Evolution of keywords overtime. *Source* Author's own research results, using Scopus database and VOSviewer

'Community development', 'Community enterprise'. The results of analyzing the strongest links of the six keywords above are presented in Table 4. The results show that the keyword 'Entrepreneurship' has the strongest association with 'Community'. Besides, there is a strong interdependence between 'Entrepreneurship' and 'Social capital', 'Entrepreneurship' and 'Social entrepreneurship', 'Social enterprise' and 'Social change', 'Social enterprise' and 'Community development', 'Community' and 'Social capital', 'Community enterprise' and 'Social enterprise' (Table 4).

Furthermore, to determine the driving force of research in the field of the relationship between community and entrepreneurship in different periods, keywords phrases that are extracted according to the Strongest Citation Bursts in the period 2001–2021 by Citespace software are conducted. The research chose this period because it is the most recent period, with a rapidly increasing number of publications. In addition, this period is also a period when many events take place that affects the community and entrepreneurship. Therefore, it makes sense to look at research trends for community and entrepreneurship in this period. The obtained information is divided into three time periods: 2001–2010, 2010–2015, and 2015–2021. The results are presented in Fig. 6. From the analysis of the three periods in Fig. 6, the research was able to identify the driving forces in the area of the relationship between community and entrepreneurship research In this regard, for the period from 2001 to 2010, many papers focused on aspects of the economic development and business development in Asia–Pacific (The keywords are 'Business development', 'Business objective', 'Asia', 'Canada', 'Entrepreneurialism', 'Development'). During the second period (from 2011 to 2015), the attention of researchers focused on community research and factors affecting the community (Keywords are 'Community development', 'Community care', 'Online community', 'Social capital', 'Industry'). The final stage (from 2016 to 2021), the research on green development direction and environmental

Table 4 Top 6 keywords according to their number of links

Ranking	Keyword	Link	Co-occurrence keyword	Link strength
1	Entrepreneurship	34	Community	9
			Social capital	6
			Social entrepreneurship	5
			Resilience	4
			Social enterprise	4
2	Social enterprise	26	Community development	6
			Entrepreneurship	4
			Sustainability	4
			Community enterprise	4
			Social entrepreneurship	4
3	Social entrepreneurship	20	Entrepreneurship	5
			Social change	4
			Social enterprise	4
4	Community	20	Entrepreneurship	9
			Social capital	4
5	Community development	19	Social enterprise	6
			Entrepreneurship	3
			Social entrepreneurship	3
6	Community enterprise	16	Social enterprise	4

Source Author's own research results, using Scopus database and VOSviewer

protection of rural communities (Keywords appear such as 'Timber', 'Forestry', 'Rural area', 'Agency'). In addition, the results that search by the keyword with the Strongest Citation Bursts are 'Industry', 'Online system', 'Online community', 'Human' (values are 8.61, 4.51, 4.10, 3.77, respectively). Besides, another important keyword is 'Community development' (2.5). From this result, the research provides a strong interest in community development through human factors, industry, and technological development, in which it is necessary to have the participation of stakeholders for community development.

5 Conclusion

At present, the research of the relationship between community and entrepreneurship is still attracting the attention of researchers with the aim of improving the effectiveness and the role of the community in the development of entrepreneurship in the context that entrepreneurship is the main driving force for the development not only of the economy but also of the society. In this paper, an analysis was performed for

Period	Keywords	Strength	Begin	End	2001 - 2021
	Development	1.21	**2003**	2007	
	Canada	2.25	**2004**	2009	
	Business development	1.63	**2004**	2006	
2001-2010	Entrepreneurialism	1.27	**2005**	2007	
	Asia	1.06	**2005**	2009	
	Conservation	1.88	**2008**	2010	
	Business objective	1.07	**2009**	2012	
	Industry	8.62	**2011**	2014	
	Online system	4.51	**2011**	2014	
	Online community	4.10	**2011**	2014	
2010-2015	Social capital	2.95	**2011**	2014	
	Behavioral research	1.09	**2012**	2014	
	Community development	2.50	**2013**	2015	
	Business	1.71	**2013**	2016	
	Community care	1.26	**2014**	2016	
	Timber	3.35	**2015**	2017	
	Forestry	2.85	**2015**	2017	
2015-2021	Agency	1.06	**2016**	2019	
	Rural area	2.65	**2017**	2021	
	Human	3.77	**2018**	2021	

Fig. 6 Top 20 keywords with the strongest citation bursts between 2001 and 2021. *Source* Author's own research results, using Scopus database and Citespace

articles related to community and entrepreneurship for nearly 70 years (1953–2021). For a long time, there was little interest in research on the relationship between community and entrepreneurship. After that, this interest began to grow explosively from 2010 and beyond. In 2021, the number of publications in this field will reach 92 documents. It is the highest number ever. The analysis was performed on 847 publications from the Scopus database. The results indicated that the most widely used research is through journals and less so through book chapters and conference proceedings (67.89% are articles in journals, books/book chapters are 16.41%, and 15.70% are Conference proceedings).

In addition, the studies focused mainly on the United States, Australia, and the United Kingdom. These are countries with a high number of entrepreneurship development levels and a large number of researchers in economics and business administration. Besides, the study also shows the increase in research of Asian and African countries. The countries in these regions have quite a large number of studies and the time of publication of the studies carried out in recent times.

Analyzing the keyword aspect of scientific publications, the research topics for the relationship between community and entrepreneurship mainly revolve around the following main areas: community sustainable development ('Community development', 'Economic development', 'Sustainability', 'Cultural', 'Social change', 'Rural development', 'Poverty', 'Knowledge community', 'Community-based forest management', etc.); community enterprise development ('Community

enterprise', 'Community enterprises', 'Community entrepreneurship', 'Microenterprises', 'Smes', 'Entrepreneurship', etc.); social enterprise development ('Social enterprise', 'Social entrepreneurship', 'Corporate social responsibility', 'Social capital', 'Social innovation', etc.). Besides, the link between keywords among each other for the top 6 keywords with the largest number of links always has community and entrepreneurship. It shows a strong link in research between entrepreneurship and community, not only studies on the relationship between entrepreneurship and community but also other related studies.

Finally, using the Citespace software, the paper is able to identify important factors in the research of the relationship between community and entrepreneurship, according to their citation buster. The results also show that have a link between practice and research, based on current studies. Furthermore, a strong interest in community development through human, industrial, and technology development is provided. From there, it is necessary to involve stakeholders in community development. In the current period, these buster keywords (such as 'Human', 'Rural area') are content that has had an impact on recent entrepreneurship and community research. From these analyses, it can be determined that research trends on the relationship between entrepreneurship and community have changed over time. This change is consistent with the changing socio-economic issues of the community and the characteristics of entrepreneurship. Regarding keyword analysis by using Citation Bursts, the results also show that the presence of many keywords (such as 'community care', 'human', 'community development', 'business development', etc.) has an important association with entrepreneurship and community because these keywords are the essential features and elements in the relationship between entrepreneurship and community.

This study has certain limitations. The research papers are based on the Scopus database. Although the Scopus database is reputable and highly influential, it does not yet include all scientific results in the area analyzed. Another limitation related to the tools used for the analysis is the VOSviewer software and Citespace software. In addition, the research was conducted based on finding the titles of the documents for assessment (the content, abstracts, etc. not analyzed). These are the methodological limitations of the aforementioned tools. Therefore, from the point of view of these limitations, the paper suggests some directions for future research. Firstly, it is possible to conduct an in-depth analysis of the content of the articles obtained. From there, a more detailed look at research trends in this field is provided. Secondly, it is possible to use a combination of different databases to have a more accurate and objective assessment of the current state of research on community and entrepreneurship because other databases may carry additional information for the study already performed. Finally, some other software can be used as a tool to analyze to obtain more results and conclusions.

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Green Finance—A Necessity in the Context of the Green Deal and Sustainable Development Goals. A Bibliometric Analysis

Check for updates

Mina Fanea-Ivanovici and **Małgorzata Siemionek-Ruskań**

Abstract Greening the economy has become an objective for the European Union within the framework of the Green Deal, but also worldwide, given the Sustainable Development Goals most countries have been trying to achieve. In this context, all activities within the economy and society need to be reconsidered, including those that regard which activities or projects should be financed. Financing green activities is therefore in line with this large desiderate. This paper aims to perform a bibliometric analysis of the existing green finance academic research. Although there have been similar endeavors in the literature, our research is new and different in that we propose an up-to-date analysis of all-time academic output regarding green finance using VOSviewer while investigating solely articles indexed in the Web of Science database. Our four research questions are formulated around topics such as: research trends and subjects; emerging topics; most prolific and most cited countries, organizations, authors. We discuss the main results, as well as the practical, research and policy implications. By looking at a large number of papers (n = 1,513) and without particularly limiting our search to the exact phrase 'green finance', we manage to obtain a useful overview of research interest and output, which can help in conducting future research, drawing attention to key areas from a policy perspective and setting the bases for future research networks.

Keywords Green finance · Bibliometric analysis · VOSviewer · Green Deal · Sustainable development

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1 Introduction

European green deal was introduced in 2019 as an integral part of this Commission strategy to implement the United Nation's 2030 Agenda and the sustainable development goals in order to deliver policy objectives related to sustainable finance (European Commission 2019).

On the one hand, financing the transition is taken into consideration, on the other hand the goal is not to leave anyone behind—a just transition. The European Union strongly supports the transition to a low-carbon, more resource-efficient and sustainable economy and has been at the forefront of efforts to build a financial system that supports sustainable growth.

The idea of green growth was first introduced by the United Nations Economic and Social Commission for Asia and the Pacific. The concept is similar to sustainable development as accepted in many developed countries. Research shows that fintech innovation supports green finance development through green credit and green investment (Zhou et al. 2021).

The article is structured using the standard format of a bibliometric analysis. The introduction is followed by the statement of the research questions; next, the data acquisition and methods are explained; further on, the research results are enlarged upon in a separate section, the paper ends with discussions and conclusion.

Using bibliometric analysis, we hereby answer the following research questions: (1) What are the main research trends and subjects dealt with in the academic literature on green finance? (2) What are the emerging topics in green finance research? (3) What are the most prolific countries, institutions and authors in the field of green finance research? (4) What are the most cited authors, organizations and countries in green finance?

2 Literature Review

Green finance focuses on providing investment, financing, operating funds, and other financial services for eco-friendly projects. Environmental protection and the effective use of resources are the most needed criteria for measuring the effectiveness of activities (Zhou et al. 2020). With the development of green finance, there is a significant increase in green investments and consumption, which are closely related to economic growth. Based on the study conducted in China by Yang et al. (2021) we can understand that green finance paves the way for high-quality economic development by positively affecting features such as ecological environment, economic efficiency, and economic structure. It is worth considering in the future not only to underpin the integration of fintech development with green finance but also to create medium and long term policies to promote the green finance in the private sector (Yang et al. 2021).

Green finance represents financial innovation product with the core aim to achieve a win–win situation between the economy and environmental quality. Furthermore, there are barriers for investing in renewable energy sources, such as the unavailability of green databases and the lack of environmental and green information of borrowers (Li et al. 2022). Studies conducted in China in years 2015–2020 indicated that green financing and green regulations play a vital role in promoting investments in renewable energy sources. Green companies should be given as an example in order to convince policy makers that investing in renewable energy sources is a long-term strategy (Li et al. 2022).

Green finance is also defined as the financial investment and activities in green industries. It plays a significant role in capital leverage and resource reallocation. The correlation between green finance and industrial structure in China in years 2008–2020 has been investigated by Xang et al. (2021) using the system GMM model. The results show that tertiary industry had the highest value. Another study by Tu et al. (2021) analyzed offshore wind power projects implemented in the period of 2014–2020, and the effect of green finance policy on the generation cost and the project profitability. The most popular instruments of green finance implemented in China so far are: green credit, carbon pricing and tradable green certificate (Tu et al. 2021).

Green innovation is an essential way to obtain coordinated development of economic growth and environmental protection. It can be, for example, a new technology, good, or service, productive processes, but also management systems with the aim to minimize the level of environmental pollution. A significant emphasis on green innovation is observed worldwide by the governments of different countries (Xiang et al. 2022). Studies undertaken by Xiang et al. (2022) showed that both internal and external financing can promote corporate green innovation.

In 2018, there were almost 2,000 green bonds issued for the North America region, 251 for Asia Pacific region and 397 for Europe (Statista 2021). Green bond is a fixed income security which finances investments with environmental or climate-related benefits. As an example of such investment it is worth considering projects focusing on renewable energy, energy efficiency or sustainable waste management. In 2020, the countries with the highest volume of green bond issued in selected European countries were: Sweden (54), Germany (32) and France (32) (Statista 2022a). In 2021, the biggest green bond issuers in Europe were financial corporate issuers, followed by non-financial corporates and government-backed entities, accounting for around two thirds of the green bonds issued (Statista 2022b).

3   Methodology

We hereby use the bibliometric analysis method to answer the four research questions announced in the previous section. The choice of the database, i.e., Web of Science, is justified by the acknowledgement that it includes quality papers published in highly-ranking journals (Zurita et al. 2020). The search was performed in February 2022

using the keyword combination 'green finance' and selecting solely the 'article' type of document, irrespective of the time range. A number of 1513 articles were generated, which were exported as full record and cited references. The rationale behind the choice of articles only stands in the fact that they are peer reviewed and represent quality publications. After retrieval of data, the VOSviewer software was used to further process it. In processing the data, networks were created both from bibliographic data and from text data.

Considering the academic articles published to date, Zhang et al. (2019) were the first to propose a bibliometric analysis of the green finance research topic. However, their investigation included papers published up until 2018, which were indexed in Web of Science, and using a different tool (i.e., CiteSpace). Their data was extracted using the following keyword combinations: 'green finance', 'green financing', 'climate finance', 'climate financing', 'carbon finance', 'green invest-ment' and 'green bond'. Given the narrow and precise searches, as well as the less developed literature by that time, a number of 381 papers were considered for the analysis. The authors discovered there had been a rapid increase in the academic interest in the period 2015–2018, after the 2015 Paris Agreement. A second biblio-metric analysis was published in 2021 (Cai and Guo 2021). However, this research used Scopus-indexed academic output. A similarity to the present research is the search using the 'green finance' keyword and the software used. Nevertheless, the number of papers investigated is even lower than the first one, i.e., 172, and the last year covered is 2020.

4   Results and Discussions

The yearly frequency of publications is a useful piece of information to understand how the research in the respective field is evolving. An increasing number of papers have been published recently, which proves growing attention paid to the topic both by academia and by policymakers. Table 1 presents the frequency of publication between 1976 and 2022, February 17th. Year 2018 marks the starting point of accelerated increase in green finance publications, surpassing 100 papers per year, and year 2021 is the most productive one, with 458 papers. Year 2022 also seems to be very productive, as the number of papers published in the first month and a half is already 53. We expect this number to be the highest of all the years if the production is maintained at the same level throughout the entire year. The sharp increase can be explained by the European Green Deal context, but also by countries' targets to green economies.

Please note that the first paragraph of a section or subsection is not indented. The first paragraphs that follows a table, figure, equation etc. does not have an indent, either.

Subsequent paragraphs, however, are indented.

Each of the 1513 papers under investigation belong to one or more Web of Science categories. Table 2 presents the best represented 15 categories in the green finance

Table 1 Frequency of articles by year

Year	Number of articles	Year	Number of articles	Year	Number of articles	Year	Number of articles	Year	Number of articles
2022	53	2015	50	2008	8	2001	4	1994	4
2021	458	2014	38	2007	13	2000	7	1993	2
2020	244	2013	31	2006	9	1999	8	1992	1
2019	192	2012	39	2005	4	1998	1	1991	2
2018	135	2011	18	2004	1	1997	6	1976	1
2017	85	2010	22	2003	5	1996	1		
2016	51	2009	15	2002	4	1995	1		

Source Authors' own research

literature. It is worth mentioning that environment-related categories and business and economic categories prevail, which is expected, given that one of the key terms is 'green', thus relating to environment, and the other is 'finance', involving the need to provide resources for economic activities.

Another useful analysis is that of the most productive authors. Table 3 presents the list of authors who have published five or more papers in the area of green finance. The threshold of five is inspired by the default rule of thumb used by VOSviewer, in order to select only representative items. Such list may prove useful in establishing or consolidating research networks.

A similar analysis can be performed by looking at the most productive publishers having published green finance articles. Table 4 presents only those publishers having

Table 2 Top 15 Web of Science categories

Category	Number of articles	Category	Number of articles	Category	Number of articles
Environmental sciences	412	Energy fuels	122	Geography	52
Environmental studies	391	Management	111	Regional urban planning	52
Green sustainable science technology	266	Business	98	Development studies	47
Economics	262	Engineering environmental	67	International relations	46
Business finance	152	Public administration	53	Political science	40

Source Authors' own research

Table 3 Most productive authors

Author	Number of articles	Author	Number of articles	Author	Number of articles	Author	Number of articles
Taghizadeh-Hesary F.	17	D'Orazio P.	6	Wang Y.	6	Steffen B.	5
Yoshino N.	9	Managi S.	6	Chien F.S.	5	Tsai S.B.	5
Zhang D.Y.	9	Ngo Q.T.	6	Iqbal N.	5	Wang C.	5
Mohsin M.	7	Schinas O.	6	Li L.	5	Wang L.	5
Zaman K.	7	Volz U.	6	Rasoulinezhad E.	5		

Source Authors' own research

Table 4 Most productive publishers

Publisher	Number of articles	Publisher	Number of articles	Publisher	Number of articles	Publisher	Number of articles
Elsevier	371	Taylor & Francis	168	Sage	42	Hindawi Publishing Group	13
Springer Nature	197	Wiley	93	Frontiers Media Sa	17	Oxford University Press	11
Mdpi	173	Emerald Group Publishing	71	IEEE	17		

Source Authors' own research

published more than 10 articles in the field. Knowing which publishers welcome academic articles in green finance can make research results dissemination easier, therefore such synthetic table can shortlist candidate journals.

Having briefly described the units of our analysis in terms of publication year, category, most productive authors and most productive publishers, the next part of our analysis is dedicated to research networks from various standpoints.

A query based on text data to create maps from title and abstract fields, by full counting has generated the terms mostly occurring in the papers, along with their relevance scores. The most frequently occurring terms are: China (699), effect (571), green finance (492), firm (380), green bond (374), company (366), efficiency (300), relationship (278), enterprise (260), index (186), difference (164), concept (147), climate finance (140), manufacturer (137), nature (134), bond (131) economic growth (130), variable (123), carbon emission (122), supply chain (120), financial development (119). However, the most relevant terms occurring in the 1513 articles are: social entrepreneurship (relevance score 4.87), transformational change (3.88), country ownership (3.78), initial capital (3.41), mdb (3.38) and multilateral development banks (3.08), green supply chain (3.29), retailer (3.06), blockchain technology (2.93), capital constraint (2.92), trade credit (2.89), urban green space (2.84), brick (2.81), bank financing (2.77), green product (2.75), green innovation economy (2.66), recipient country (2.64), financing risk (2.62), municipal valuation (2.52), paradigm shift (2.51), financial risk (2.46). Relevant terms revolve around social entrepreneurship, transformational change, financing, risks, firms, greening the economy and surrounding space, economic development, and new technologies. By combining and overlapping such terms, relevant hot fields of research can be further obtained. These terms have changed in the past years, starting from financial products and policies to address climate change and areas of activity (climate policy, climate finance) to include more sophisticated concepts, such as: green credit, ecological efficiency, optimization, financial development, digital finance. The new trends can be seen in the overlay visualization provided in Fig. 1.

Fig. 1 Term occurrence in overlay visualization. *Source* Authors' own research

A S Complementarily, an investigation that can generate further useful cues as to the most important subjects and topics in green finance, as well as in trends, is performed through a keyword co-occurrence analysis. This type of analysis, such like the analyses following in this paper, is based on bibliographic data, and it depicts the relatedness of items based on the number of documents in which they appear together. Figure 2 is a density visualization of the co-occurring keywords in green finance. The research is mainly concentrated around: green finance, finance, impact, policy, sustainability, China, climate change, climate finance, sustainable finance, CO_2 emissions, green credit, and green bonds. This result complements, but also confirms the previous results obtained based on text data. Various levels are addressed: countries/regions, policy, financial markets, firms, therefore the academic research employs macro, mezo, and micro approaches.

The term occurrence and keyword co-occurrence have helped to answer the first two research questions. Next, we will analyze co-authorship and citations of authors, organizations and countries involved in the green finance research, which will answer the last two research questions.

There are a total of three clusters of authors, totaling seven authors, which are most productive in green finance research. Different clusters are represented in different colors. The authors' clusters are shown in Fig. 3. The most productive five organizations in this field of research are: University of Oxford (19 documents), Jiangsu University (16 documents), Tokai University (15 documents), Chinese Academy of Sciences (15 documents), Wuhan University (14 documents). With few exceptions, organizations of Asian origin are the most present in top research networks. An

Fig. 2 Keyword co-occurrence in density visualization. *Source* Authors' own research

overlay visualization of the top research organization highlights a shift of the focus from European universities to Asian universities in recent years (Fig. 4). However, there are 102 organizations, mostly universities, which are grouped into 15 clusters, the knowledge of which can be useful information for new research collaborations and networks. In terms of most productive co-authoring countries, the most representative networks include: China, USA, Australia, Germany, Italy, France, Spain, the Netherlands, Canada, to name a few (Fig. 5). Various clusters are colored differently. This information confirms the preliminary conclusions stated above, according to which Asian and European academic output is among the most productive.

The research impact is typically measured using the number of citations, which also come as a validation of quality of work. The citation analysis in VOSviewer reveals the relatedness of items determined based on the number of times they cite each other. An author-based analysis generates Fig. 5. Comparing the authors in this network to the most productive authors in Table 3 we conclude that in the green finance research area, the most productive authors are also among the most cited when considered in their research networks. The top five cited organizations are from a total link strength perspective are: Jiangsu University (total link strength 172), Tokai University (146), Keio University (121), Capital University of Economics and Business (102) and the University of Economics Ho Chi Minh City (100). The list of most cited organizations is continued with other Asian universities. There is a
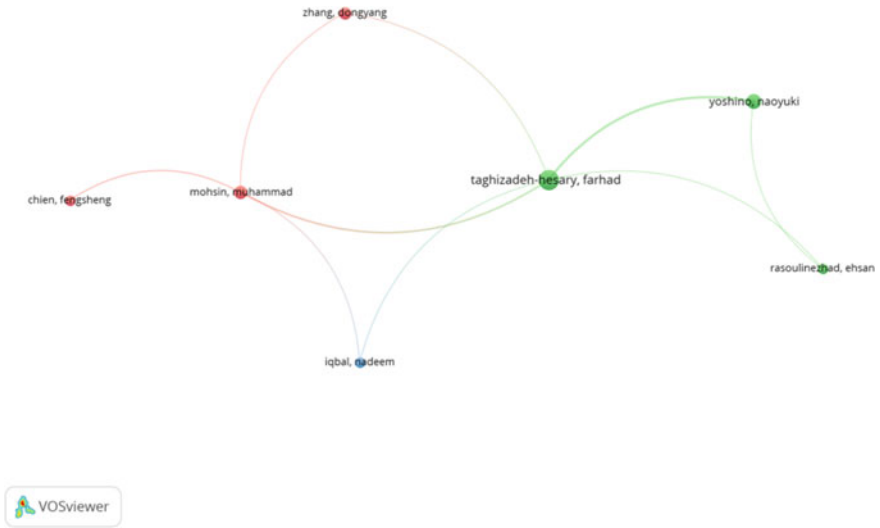
Fig. 3 Most productive authors' networks and clusters. *Source* Authors' own research
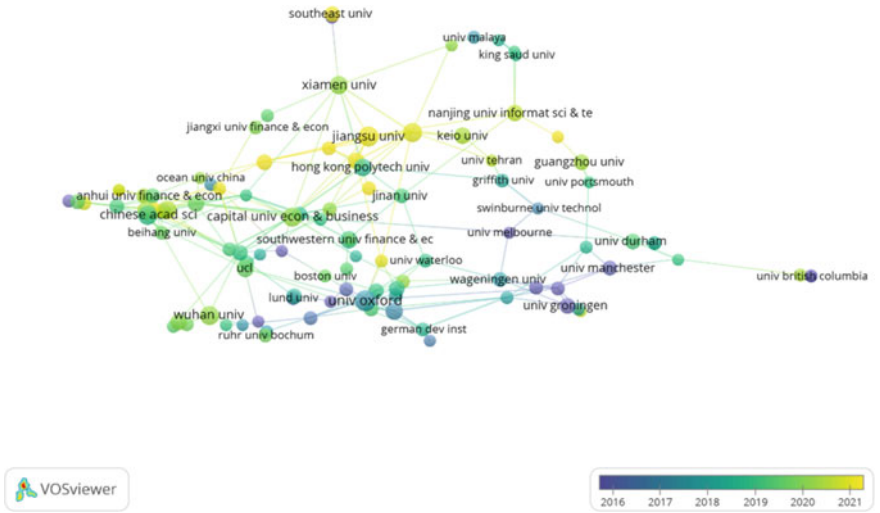
Fig. 4 Most productive organizations' networks in overlay visualization. *Source* Authors' own research

clear distinction between most productive and most impactful organizations, which is explained through the quality of research. Obviously, Asian organizations, including inter alia Chinese and Japanese universities, provide the scientific community with the most valuable results worth citing and being used. Nonetheless, research networks publishing together are cited, and a more inclusive picture of the citation network is
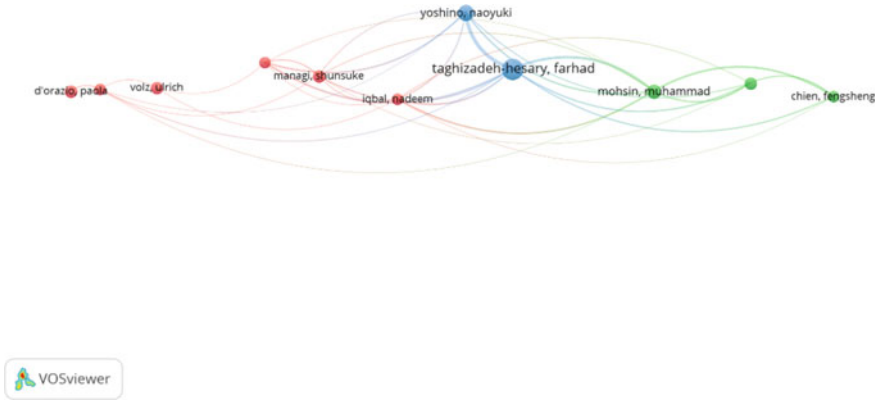
Fig. 5 Citation author network analysis. *Source* Authors' own research

presented in Fig. 6, which includes organizations from other continents, too. From the figure, European organizations stand out as being numerous. Last, but not least, the citation analysis of country networks confirm the fact that emerging and developing economies have gained attention more recently (China, other Asian and African countries), whereas highly cited Western countries in America and Europe remain of reference in the early stage of the analyzed period, 2016–2020. The most cited countries, as it results from Fig. 7, are China, USA, England, Germany and Italy.

The results of this research confirm the previous research, i.e., increasing academic interest in and output on the topic of green finance (Cai and Guo 2021; Zhang et al. 2019). However, US and Europe no longer provide the most prolific authors (Zhang et al. 2019), as emerging countries have come to the fore (Cai and Guo 2021). The keyword analysis has also shifted from climate finance, policy and climate change (Zhang et al. 2019) towards newer terms, combining new types of social entrepreneurship, more sophisticated types of finances and technology. Asian organizations still remain on top of the most productive ones (Cai and Guo 2021), but other new authors have managed to make the top lately.

5 Conclusion

With few exceptions, organizations of Asian origin are the most present in top research networks, which indicates choosing authors from that region for a literature review. Having into consideration the most popular phrases it is worth mentioning that researchers focused on green finance and green bonds from the enterprise perspective in a given period. On the other hand, there has been a positive tendency in enlarging the impact of government engagement on promoting green finance and sustainable development goals.
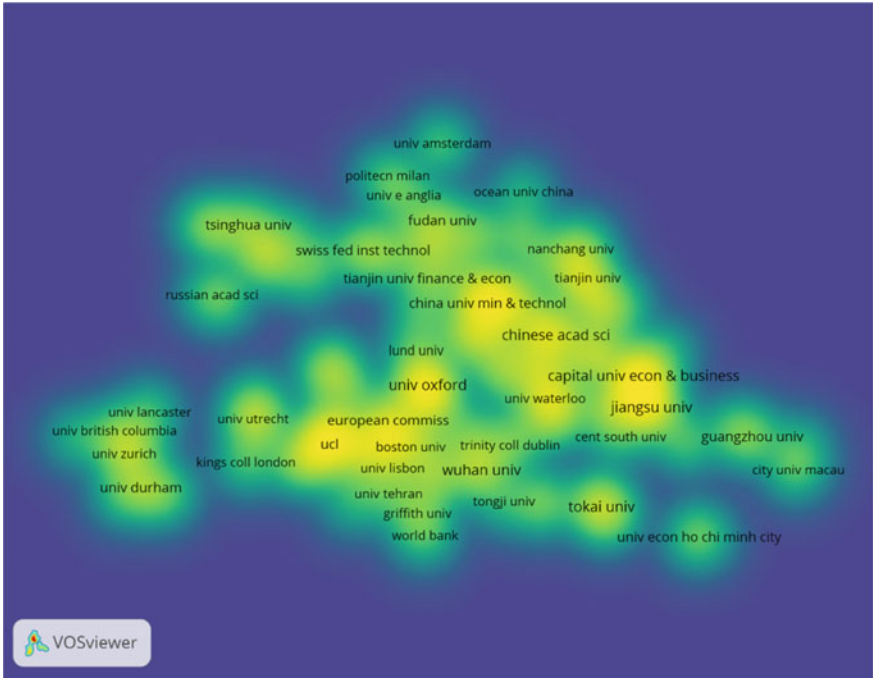
Fig. 6 Citation organization network analysis in density visualization. *Source* Authors' own research

From a practical and policy point of view, this research can provide stakeholders, including policymakers, with a set of terms and keywords that are topical and require attention for finance. From a research point of view, the most prolific organizations and authors involved in green finance research could be useful for creating or extending research networks. The list of publishing houses, too, can help disseminate research in the investigated area. The main limitation of the current research is the focus on a single database (Web of Science). Future research could include a systematic literature review, or analysis of more specific green finance aspects.

Fig. 7 Citation country network analysis in overlay visualization. *Source* Authors' own research

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A Deep Learning Approach
to Digitalization and Economic Growth

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Abstract From an economic point of view, shortly digitalization will lead not only to progressive growth, but also to important transformations of jobs and to the reorganization of the way of carrying out the activity of retail, transport, and banking services. Our research aimed to identify and analyze the correlations between digitization and economic growth of EU countries in the period 2019–2021. In this paper, we use deep learning and principal component analysis as an efficient technique to improve the accuracy of classification for the set of EU countries classified according to The Digital Economy and Society Index. The used databases were Eurostat and World Bank. We selected 15 indicators on which we first trained a 2-layer neural network and we obtained a classifier with 92.52% accuracy. Then, we applied principal component analysis and reduced the original dataset to 3 principal components which retain together 78.21% of the initial variability. We train a 2-layer neural network on the score matrix given by the three retained principal components. The results revealed that the classification improved from 92.52 to 100%.

1   Introduction

Digital technologies have become indispensable in many areas of private and economic life. Especially in industrial production, digitization establishes completely

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new possibilities for interconnection and optimization of equipment, systems, and processes.

The digital transformation has made its way into almost all industries and companies, including in production. Digitized processes and the precise collection and analysis of digital data determine the production landscapes of the future—from development and manufacturing to maintenance. In this way, processes, work procedures, and material flows can be optimally and flexibly adapted to new business models, customer desires, and market conditions.

Deep learning (also known as structured deep learning or hierarchical learning) is part of a family of machine learning methods based on artificial neural networks (NNs).

Entire equipment, systems, and processes can be seamlessly interconnected and controlled via the Industrial Internet of Things (IIoT) via a Cloud platform [1, 2]. Sensors, actuators, network components, and the like provide valuable information on the status of individual components as well as the entire production process. The direct exchange between them allows the equipment and machinery to adapt the activities according to the situation and to independently optimize the production process. Employees and operators of production equipment can also obtain information and important operating steps from the data processed and viewed holistically. Thus, the defects of the production process are diminished, and the production's efficiency, quality, and availability increase sustainably.

The digital economy is the cornerstone of EU development and employment [3, 4]. This is essential for the modernization of traditional industry. With an estimated €500 billion in further development gains and a substantial boost to job creation in Europe, the EU is working to create the right environment for the digital economy to flourish, provide more choices for consumers and promote social inclusion.

According to the literature [5–8] there are three distinct key concepts in terms of content: digitization, digitalization, and digital transformation. Digitization means the transformation of documents from physical form to digital form. Digitalization consists of the integration of information technologies and computer programs in the content of the economy and society. Digital transformation is the process of adapting organizations and human resources to the new changes determined by the digital society.

Digitalization ensures social and economic resilience not only in terms of connectivity and new technologies but also by stimulating citizens' digital skills and increasing the performance of public services. Its role and importance are increasing in many business areas [9]. Previous studies [10] have already established positive links between digitalization and economic indicators.

The urgent need to start the recovery after the COVID-19 crisis [11] is an opportunity that arises once in a generation, not only to rebuild the economy but to "rebuild better" [12, 13]. If successful, the benefits for the Member States, their citizens, and their businesses could be transformative—economically, socially, and ecologically.

The current level of digitalization in Europe varies widely [14]. While disparities in digitization levels have real economic and social consequences for markets with lower levels of adoption, the implications affect the whole continent. These disparities

limit the ability of the European market to reach the full potential of its combined economy of scale and could lead to fragmentation of policies and a reduction in the potential for innovation across the Union.

Political decision-makers will need to include digital solutions to these inequities in their national plans if they want the economies and societies of the Member States to enjoy a fair recovery and the wider benefits for society. Investing in digital technologies can bring about a substantial improvement in the quality of life of EU citizens. In our research, we identified some of these changes that have taken place in the context of the digital transformation and their impact on EU countries.

2   Literature Review

The digital economy had gained significant attention from a wide range of scholars representing various scientific disciplines, especially during the COVID-19 pandemic, when a substantial part of services moved online [15]. In this paper, we combined 14 input variables and analyzed the main factors that influence the Digital Economy and Society Index (DESI). DESI has been conceived in the context of the European Union to measure the progress of digital transition [16]. DESI is composed of four dimensions: human capital, connectivity, integration of digital technology, and digital public services. DESI (Digital Economy and Society Index) is measuring the progress of each EU country towards the digital economy and society. The Digital Economy and Society Index (DESI) is a composite index that analyzes more than 40 relevant indicators of Europe's digital performance and aims to the evolution of EU Member States in five main areas [17]: digital public services, use of internet services, connectivity, digital technology integration, human capital [18]. The overall DESI index is calculated as the weighted average of the five domains. The key areas are: connectivity and human capital are considered to be the most relevant in defining the DESI index because they represent the infrastructure of society and the digital economy; domain—the integration of digital technology highlights the use of ICT by the business sector, one of the most important growth factors of the digital society and economy; other domains: the use of internet services and digital public services is facilitated by the existence of infrastructure, and their contribution is strengthened by the quality of such an infrastructure [19].

DESI contains a detailed analysis of the digital policies of the EU Member States [20–22]. It provides an overview of the progress and implementation of public policies by the Member States, using data provided by Eurostat. It identifies the areas in which to invest and points out the countries of the European Union to take priority measures. DESI is a central tool used for the analysis of digital actions in the European Union.

The economic growth of a country is an increase in its capacity to supply more and more various economic goods, this capacity is based on advanced technology as well as on institutional and ideological adaptations [23, 24].

Economic growth is an increase in the real level of the national production of a country, which can be caused by an increase in the quality of resources (through education, etc.), an increase in the number of resources and improvements in technology, or otherwise an increase of the value of goods and services produced by each sector of the economy. Taking into account its beneficial effects, it can be seen that not every increase in production denotes economic growth. To mark a real economic growth, it is necessary that the increase of the production exceeds the natural increase of the population, so that from results in the increase of the value of the real national product per inhabitant, over a long period of economic growth is conditioned by existing potential resources and how they are used. The ways of economic growth are the same for all countries. But countries differ from each other in terms of opportunities to improve their economic situation over time [25, 26].

Economic development is an increase in living standards, improved needs for self-respect and freedom. The most accurate method of measuring development is the human development index, which takes into account literacy rates and life expectancy, which affect productivity and could lead to economic growth. It also leads to more opportunities in education, healthcare, employment, and environmental conservation. This implies an increase in the per capita income of each citizen.

Economic development involves an upward movement of the entire social system in terms of income, saving, and investment, along with progressive changes in the socio-economic structure of the country [27].

Development refers to the increase in human capital indices, the decrease in inequality figures, and structural changes that improve the quality of life of the general population. Economic development is reflected in HDI (Human Development Index), Gender Index (GDI), Human Poverty Index (HPI), infant mortality, literacy rate, etc.

Economic development is more relevant to measuring progress and quality of life in different countries. The increase of economic development refers to a gradual increase of one of the components of the Gross Domestic Product: consumption, government expenditures, investments, net exports.

We used both Deep Learning Approach and Principal Component Analysis to study digitalization and economic growth in the EU countries [28–30]. The deep learning approach is based on artificial neural networks that act like a human brain. It mimics the way the human brain thinks and performs. In this model, the system learns and classifies from images, text, or sound. Deep learning models are driven by labeled and multi-layered data to achieve high accuracy of the result even more than the human level.

The use of neural networks in combination with other machine learning techniques (Linear Discriminant Analysis, Principal Component Analysis) improved the NN performance [31–33]. The methodology, the main results, and discussion are presented in the following sections of our paper.

3 Methodology

Principal Component Analysis (PCA) [34] is a statistical technique used to reduce the data dimensionality by finding a new set of variables smaller than the original set. We selected 15 variables for which we could find available data for 2019–2021. The digitalization index named DESI initially took values between 0 and 1. We transformed this numerical variable into a categorical one, denoted by 1 the values being greater than the median, and 0 the opposite case. Therefore, our class variable also called DESI has the values 1 and 0, 1 signifying the most digitalized EU members and 0 the least digitalized ones. Surprisingly, France has a DESI index for 2021 equal to 50.6, which is lower than the median 51.8 therefore it is coded by 0. Recall that PCA does not take into account information about classes but only aims to analyze the variation of each feature because it is reasonable to assume that these characteristics that present a high variance are more likely to have a good division between classes [35]. The biggest benefit of the PCA application is that it goes from a space with 14 features to another space with only 3 features, which lost 21.79% of the initial information. This means the power of dimensionality reduction: after applying PCA, the uncorrelated data were used to train a 2-layer NN.

Deep learning models can obtain higher accuracy. Models are trained using a large set of labeled data and several layers of the NN. Deep learning models require a large amount of computing power. In combination with clusters [36] or other machine learning techniques, the training time of a NN reduces to hours or less.

The word "deep" in "deep learning" refers to multiple layers in the architecture of a NN. The multiple heterogeneous layers allow an optimized implementation of practical applications. An important part of machine learning is to use feature extraction. When the input data is large and redundant, the deep NN can convert it into a smaller subset of preferred features [37]. The trained NN acts as a feature extractor, such as the input propagate forward until it stops at a specified layer and the output of that layer consists of the extracted features. Deep learning feature extraction could be performed with PCA, T-SNE (t-Distribution Stochastic Neighbor Embedding), Autoencoder, latent semantic analysis, or any other algorithm for dimensionality reduction (Table 1).

4 Results and Discussion

We train a 2-layer NN with 2 nodes in the hidden layer in the R environment. The most frequently used NN is the backpropagation multilayer perceptron [38]. The performance of a NN depends especially on its capability of generalization, which relies on the data representation [39]. The input data of the NN should not be correlated. Data correlation confuses data representation during the learning process of the NN, therefore the capability of generalization becomes smaller. The data uncorrelation is done by applying PCA.

Table 1 The main research variables

Variable	Variable label	Source
EXPG	Expenses % GDP	World Bank
EG	E-Government (individuals using the internet for interaction with public authorities)	World Bank
ECOM	Enterprises with e-commerce	Eurostat
ICT	Employed ICT specialists—% of total	Eurostat
GDPG	GDP growth rate	World Bank
INTUSE	Internet use by individuals	Eurostat
PROD	Real labour productivity per person employed	Eurostat
HDI	Human development index	World Bank
WHI	Life ladder index	https://worldhappiness.report
RDE	Research and development expenditure, by sector of performance	Eurostat
HC	Human capital	https://digital-strategy.ec.europa.eu
CON	Connectivity	https://digital-strategy.ec.europa.eu
INT	Integration of digital technology	https://digital-strategy.ec.europa.eu
DIG	Digital public services	https://digital-strategy.ec.europa.eu
DESI	The digital economy and society index	https://digital-strategy.ec.europa.eu

The 2-layer trained NN from Fig. 1 was applied on the set of 27 EU member states and the following classification from the fifth column of Table 2 was obtained.

Checking the classifier accuracy using the confusion matrix, the accuracy rate was 92.59%. In the set of 27 EU countries, 14 have the DESI index equal to 0 and 13 equal to 1. On the main diagonal of the confusion matrix on the left-hand side in Table 3, the number of correctly predicted observations coded 0 is 13 and coded 1 is 12, respectively. The classifier produced two errors: namely, Luxembourg and France were wrongly classified. The confidence interval of this classification is (0.7571, 0.9909). The sensitivity of this classification was 92.86%, signifying the percent of correctly predicted true positives (countries with DESI coded with 0). The specificity of this classification was 92.31%, signifying the percent of correctly predicted true negatives (countries with DESI coded with 1).

We intend to improve the performance of the NN and we apply PCA to reduce the data dimensionality.
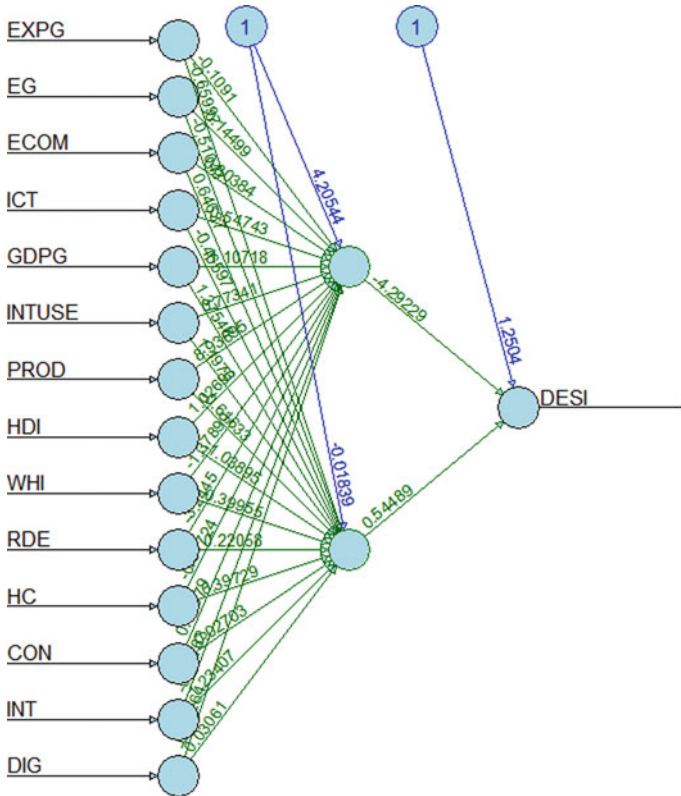
Fig. 1 2-layer neural network before PCA

5 Principal Component Analysis

By means of IBM SPSS we will apply PCA. An exploratory factor analysis will be performed. To make sure that PCA is appropriate, we determine the results of the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) whose values must be greater than 0.5 and the results of Bartlett's test of sphericity which should be significant at 5% significance level at least (Table 4).

Next, we compute the eigenvalues and by the principle of total variance explained we retain the first 3 PCs which explain together 78.213% of the initial variance. This result is confirmed by Kaiser's principle, by which we retain the number of PCs equal to the number of eigenvalues greater than 1, here the first three eigenvalues, as shown in Table 5.

To increase the interpretability of the factor, we apply the Varimax orthogonal rotation (Table 6), which assumes that there is no intercorrelation between PCs. As suggested by [40], factor loadings in absolute values greater than 0.5 will have a

Table 2 Classification of digitalized countries obtained by the neural network before and after PCA

No.	Country	DESI	Actual values	Prediction before PCA	Prediction after PCA
1	Austria	56.9	1	1	1
2	Belgium	53.7	1	1	1
3	Bulgaria	36.8	0	0	0
4	Croatia	46	0	0	0
5	Cyprus	43.5	0	0	0
6	Czech Republic	47.4	0	0	0
7	Denmark	70.1	1	1	1
8	Estonia	59.4	1	1	1
9	Finland	67.1	1	1	1
10	France	50.6	0	1	1
11	Germany	55.2	1	1	1
12	Greece	37.3	0	0	0
13	Hungary	40.5	0	0	0
14	Ireland	60.3	1	1	1
15	Italy	45.5	0	0	0
16	Latvia	49.5	0	0	0
17	Lithuania	51.8	0	0	0
18	Luxembourg	59	1	0	0
19	Malta	59.6	1	1	1
20	Netherlands	65.1	1	1	1
21	Poland	41	0	0	0
22	Portugal	44.8	0	0	0
23	Romania	32.9	0	0	0
24	Slovak Republic	43.2	0	0	0
25	Slovenia	52.8	1	1	1
26	Spain	54.7	1	1	1
27	Sweden	66.1	1	1	1

significant contribution to that PC. The larger the absolute size of the factor loading is, the more correlated is the corresponding variable with that factor [40].

According to Table 6, PC1 is strongly positively correlated with EG, ECOM, ICT, INTUSE, HDI, WHI, HC, CON, INT and DIG. Therefore, we could name PC1 the digitalization of public administration factor. PC2 is strongly dominated by EXPG and RDE, hence we could name it the public expenses factor. Finally, PC3 is dominated by GDPG and PROD, therefore it will be the productivity and economic growth factor.

Table 3 Confusion matrix and statistics for digitalized countries before PCA and after PCA

Prediction	Prediction
Actual 0 1	Actual 0 1
0 13 1	0 14 0
1 1 12	1 0 13
Accuracy: 0.9529	Accuracy: 1
95% CI: (0.7571; 0.9909)	95% CI: (0.8723; 1)
No information rate: 0.5185	No information rate: 0.5185
P-value [ACC > NIR]: 6.538e-06	P-value [ACC > NIR]: 1.989e-08
Kappa: 0.8516	Kappa: 1
Sensitivity: 0.9286	Sensitivity: 1
Specificity: 0.9231	Specificity: 1
Pos pred value: 0.9286	Pos pred value: 1
Neg pred value: 0.9231	Neg pred value: 1
Prevalence: 0.5185	Prevalence: 0.5185
Detection rate: 0.4815	Detection rate: 0.5185
Detection prevalence: 0.5185	Detection prevalence: 0.5185
Balanced accuracy: 0.9285	Balanced accuracy: 1
Positive class: 0	Positive class: 0

Table 4 KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling adequacy		0.731
Bartlett's test of sphericity	Approx. chi-square	342.870
	df	91
	Sig	0.000

We consider the scores of the first three PCs as input data for a similar 2-layer NN. Now the NN is presented with uncorrelated data. The trained network in Fig. 2 applied to the set of 17 EU countries will compute the unrounded values of the DESI index.

After data dimensionality reduction the NN classified the EU countries as in the sixth column of Table 2. One can notice that the column with predicted DESI values coincides with the column of actual values. On the right-hand side of Table 3 one can see that after applying PCA, the classification accuracy of EU countries improved from 92.59 to 100%. The accuracy rate after data dimensionality reduction improved, with a confidence interval (0.8723, 1).

Table 5 Total variance explained

Initial eigenvalues			Extraction sums of squared loadings		
Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
8.037	57.404	57.404	8.037	57.404	57.404
1.553	11.091	68.495	1.553	11.091	68.495
1.361	9.718	78.213	1.361	9.718	78.213
0.806	5.760	83.973			
0.713	5.096	89.070			
0.330	2.359	91.429			
0.326	2.326	93.755			
0.295	2.105	95.859			
0.209	1.494	97.354			
0.140	1.000	98.353			
0.099	0.704	99.057			
0.071	0.507	99.564			
0.039	0.278	99.842			
0.022	0.158	100.000			

Table 6 Varimax rotated component matrix

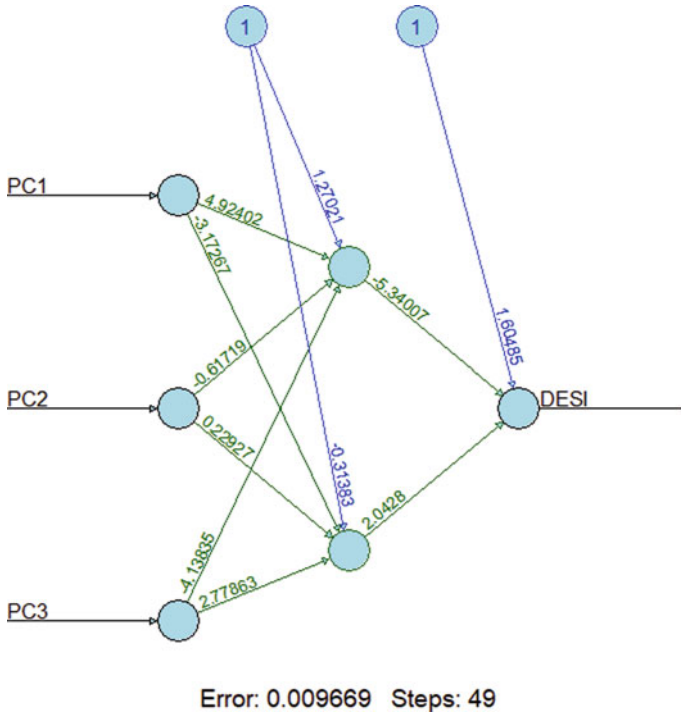|	Component		
	1	2	3
EXPG	−0.023	0.960	0.007
EG	0.780	0.320	0.339
ECOM	0.747	−0.019	0.056
ICT	0.835	0.261	0.068
GDPG	0.114	0.100	0.932
INTUSE	0.867	0.110	0.088
PROD	−0.413	−0.559	0.575
HDI	0.772	0.412	−0.193
WHI	0.830	0.345	−0.071
RDE	0.518	0.719	0.179
HC	0.890	0.323	0.108
CON	0.751	0.066	−0.069
INT	0.842	0.256	−0.177
DIG	0.821	0.013	−0.028

Error: 0.009669   Steps: 49

Fig. 2 2-layer neural network after PCA

6 Conclusions

The results obtained before and after PCA application showed that the elimination of the correlation between the input variables improved the predictive performance of the NN, in general with smaller architecture. In this paper, we use deep learning in combination with Principal Component Analysis as an efficient data dimensionality reduction and feature extraction technique to improve the accuracy of classification for the set of 27 EU countries classified according to The Digital Economy and Society Index. We selected 15 indicators on which we first trained a 2-layer NN and we obtained a classifier with 92.52% accuracy. Then, we applied principal component analysis and reduced the original dataset to 3 principal components which retain together 78.21% of the initial variability. We trained afterwards a 2-layer neural network on the score matrix given by the three retained principal components. The results revealed that the classification improved from 92.52 to 100%.

Future research will regard the use of NNs and other feature extraction techniques to build robust classification models to replicate and capture trends and patterns in data.

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The Quality of Internship Programs in Romania. The Employers' Perspective

Mihaela Covrig, Simona Irina Goia (Agoston), Ramona Ştefania Igreţ, Cristian Virgil Marinaş, Ana Alexandra Olariu , and Monica Roman

Abstract Higher education institutions are under continuous pressure of creating new skills and competencies of their students and graduates in order to increase their adaptability to the labor market. In the context of a mismatch between the labor market's needs and graduates' abilities in Romania, the role of various methods and practices deployed by universities and their stakeholders, aiming at addressing the aforementioned objective gains momentum. Internships, as tools of developing these competences and fostering students' employability, are investigated in this paper through the lenses of the representatives of the business environment. The paper presents the perspective of Romanian employers upon the characteristics and quality of the internships programs, recently implemented in their organizations. As our study is an exploratory one, the research question is mainly descriptive and it interrogates the factors that contributed to the internship programs success. Using an online distributed questionnaire, containing both open and closed-ended questions, the employers were asked about different aspects related to the internships, including the factors that contributed to the success of the internship program. The results show that most of the respondents have a favorable opinion regarding the internship programs and their added value is clearly acknowledged by all stakeholders.

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1 Introduction

Higher education institutions are under continuous pressure of creating new relevant skills and competencies among their students and graduates in order to increase their adaptability to the labour market. In the context of a mismatch between the labour market's needs and graduates' abilities in Romania (Dimian 2014), there is a need for developing the human capital of the graduates with practical skills and to be more responsive to the labour market's needs.

Many of the existing papers are related to the students' perceptions on the internships (Bratianu et al. 2020; Marinaşet al. 2018) while the employers' side is mostly overlooked. The present paper presents the perspective of the Romanian employers upon various characteristics and the quality of the internship programs conducted by students in their organizations. The data collection tool was an online questionnaire, containing both open and closed-ended questions, through which several aspects of internships are investigated, including the factors which might influence their quality. Data analysis relies mainly on various descriptive statistics and visualization instruments.

The present article firstly presents a brief literature review in the field of internships and employment of young graduates, followed by some methodological remarks. Next, the sample, the results and discussions are presented. The Conclusions section summarizes the main outcomes of the research and advances future directions for investigation.

Considering the above mentioned aspects, the added value and originality of the study is as follows: we firstly aim at filling the gap in the literature by considering companies' perspective on internship programs; secondly, we are looking at the quality of the internship programs. Finally, we should also acknowledge that the case study is country specific, as we only consider the Romanian business environment, less covered by the existing evidence in the field of study.

2 Literature Review

The connection between business environment and human capital development was suggested and discussed in several empirical papers. The purpose of this paper is to analyse specific patterns expressed by the representatives of the Romanian employers related to internship programs, as a useful tool for developing employability skills.

In our *theoretical framework* we rely on Becker's human capital theory, arguing that individual workers have a set of skills or abilities which they can improve or accumulate through training and education. The set of employability skills includes

education, technical skills, creativity, experience, problem-solving skills, communication skills, and personal resilience. Internship is a form of education in which business is directly involved, useful for developing such characteristics. Gary S. Becker, the Nobel Prize laureate, defined human capital as "activities that influence future monetary and psychic income by increasing resources in people" (Becker 1964, page 1), and its main forms were schooling and on-the-job training, although he also considered medical care, migration, and searching for information about prices and incomes. Therefore, Becker stated that developing human capital is a vital component of knowledge based economies. The interest of business environment, employers and entrepreneurs is to have access to a well-developed human resource, able to contribute to an efficient economic activity and to maximize their output.

The relevant results from the *revised literature below* suggest that there are many cases where employers are actively engaged in the human capital development of their future employees. Internships are considered by higher education institutions as an effective way to gain practical experience and enhance employment marketability. However, few studies have provided empirical evidence linking internship participation to success in post-graduation employment (Gault et al. 2010).

The need for cooperation between business and education institutions was demonstrated in the case of vocational training (Martin 1991). Vocational training creates multiple benefits not only for students, but for companies as well: employers will benefit by developing a well prepared active population with increased chances of recruiting some better trained employees (Mason et al. 2009). The study elaborated by Mobarak (2021) reveals the need for a multi-stakeholder-responsibility approach in prescribing a comprehensive normative solution aimed at enhancing graduates' employability. A relevant conclusion shows that the culture of learning and gaining varied skills, in different spheres of life needs to be inoculated amongst students from early years.

It is crucial for graduates' professional success that companies are directly involved in the educational processes, as they are the main beneficiaries of the newly developed skills. They may be part of the educational process, as they contribute to developing courses, teaching and assessment methods and materials, updating curricula and innovating in the educational process in general; these employers are the direct evaluators of graduates' performance, a process through which they choose to hire (Wye and Lim 2009). Also, it was postulated that employers' time is even more limited nowadays and their financial resources are being diverted from employees' development- therefore, even more, they will need to rely and in turn support higher education institutions in their process of abilities development among students. Most importantly, employers must take responsibility and play a leadership role in closing the employability-skills gap among new labor market entrants (Mason et al. 2009).

Organizations are increasingly recognizing the value of internships as part of their employment process. Lynch et al. (1999) conducted a study on companies in southern New Jersey that regularly hire interns from colleges and universities situated in the area. Even if the small sample size precluded from making many comparisons, the study produced relevant results. Companies were asked about the quality of their interns, about their relationships with the colleges and about details of their programs.

Companies rated this professionalism higher than the skill areas and reliability was given the highest importance rating. Employers did not rate proficiency levels of interns at a very high level. The authors explain their result as being related to the general dissatisfaction of industry with the skills of college graduates. Finally, the study demonstrates that some differences between large and small companies do exist as to how they perceive and evaluate interns.

Companies in general tend to value work experience when hiring new graduates. Employers' involvement in developing employability skills within institutions is critical for students' employability (Cranmer 2006). In the cases where employers were directly involved in course design and ensuring student work-based opportunities, graduates experienced greater success in finding employment.

Gault et al. (2010) also confirm the value of an internship in job marketability. The study provides an estimate of the perceived value of internship experience in employees' compensation. The outcome of their paper puts forth internships as a component of experiential learning that can enhance the employability opportunities offered by higher education institutions.

When considering the case of the employers in North Africa, Yasin et al. (2015) show that the business community in Morocco is looking for employees who have the ability to learn and adapt quickly and solve problems. This empowers business schools to equip their graduates with a broader business perspective and more balanced skills. Therefore, the authors conclude that business education needs to emphasize a cross disciplinary approach, which consequently leads to the development problem-solving and decision-making skills. Secondly, it is mandatory, but not sufficient to equip business students with certain technical, course specific skills. Other abilities and competencies are required, as those expressed by Becker's Human Capital theory. Therefore, business education must develop the ability to work with others in a dynamic organizational culture.

In the same line, Siddiqui and Meshram (2019) look at the specific skills which the professional education institutions must consider for inclusion in their regular curricula, so that their graduates are more employable and valued by potential employers. The authors consider that professional educational institutions are the vital source of providing qualified workforce to the employers across various domains, and they should consider the critical views of the industry when designing their educational offer.

Moreover, the Romanian perspective is not yet visible in the specialized literature. Therefore, the novelty of this initial study is to reveal the way Romanian employers perceive the effectiveness of internships. In a program evaluation context, Popescu and Roman (2018) demonstrated the positive role of training upon developing various competencies and increasing employability.

3 Methodology

In order to highlight the employers' opinions about the necessary ingredients for a quality internship, an online questionnaire has been developed. Data collection was conducted within the project "Practice smart your development—PRIDE-U" which is co-financed by the European Union through the Operational Program Human Capital 2014–2020, Priority Axis no. 6 "Education and skills".

The questionnaire, aimed at assessing various aspects related to internships programs from the perspective of the organizations where the internship has been conducted, was distributed online using Google Form to individuals from organizations that have recently hosted internships and had direct contact with the interns. Pandemic context prevented the face to face communication, and we have used other communication channels, mainly online or via phone. The data was collected between October 2021 and February 2022 from representatives of 15 organizations that had interns. In order to get as many responses as possible, the link to the questionnaire was sent by email and representatives of the organizations were also contacted directly by phone. The challenge of obtaining valid answers from business representatives was confirmed within this research study and a lot of reminders from the authors were needed in order to get 15 answers, which were used for data analysis.

The main purpose of the questionnaire was to assess the quality of internships from different perspectives in order to identify the optimal solutions for their improvement and functioning, which will further on lead to better integration of students into the labour market. Most of the questions are closed-ended, with either single or multiple choice or Likert-type scales from 1 to 5. There are also a few open-ended questions that seek either to identify the universities from which interns come or the departments in organizations where internships are carried out, or to assess the positive and negative aspects of the organizational experience with internships, as well as suggestions for improvement given the experience accumulated.

Data analysis implied a descriptive part, in which the responses are analysed, followed by a statistical analysis. Given the small sample, we mainly used rank correlation coefficient to assess the association between several variables, and descriptive statistics. Analysis was performed in Microsoft Excel and R (R Core Team 2014) and figures were produced in Microsoft Excel and R using the package `corrplot()` (Wei and Simko 2021).

4 Results and Discussions

In the first part of this section, a *brief description of the sample* will be outlined, with reference both to individuals and the organizations they represent. Therefore, analysing the demographics of the respondents, it can be observed that about 75% of the respondents are female. In terms of age category, about 40% of respondents are between 41 and 50 years old, and one third of respondents are between 31 and 40 years

old. 20% of the respondents are people with more experience in the profession, in the "51–60" age category.

About 75% of respondents are senior managers and 20% are middle managers. This ratio is important for the present research as it highlights that respondents are employees with decision-making authority in organizations, people that should value internships and understand the need for organizations to be involved in the education and training of new generations of workforce. In terms of experience in the organization, almost 50% of respondents have more than 10 years' experience in the organization, with less than 7% having less than one year's experience in the company. In terms of the relationship with the trainee, 60% of the respondents had a direct relationship with the trainee as the manager of the department where the internship took place and one third is represented by the internship coordinators in the organization. The demographic description of the sample outlined above shows that the responses obtained are highly relevant, being obtained from people with experience in the field and on the labour market in general, who have direct relations with the interns or who coordinate internship programs at organizational level. Thus, in terms of their origin, the answers obtained can be considered relevant and highly valuable, revealing a mature and relevant position of qualified and experienced professionals.

Concerning *the organizations' characteristics*, data reveal that more than 93% of the organizations in which internships were carried out are private companies, and about 75% have been present in the market for more than 10 years, the organizational experience in the sector of activity being an important aspect for interns. More than 50% are small companies with between 1 and 9 employees, and one third are large companies with more than 250 employees. In most of the organizations surveyed (40%), respondents say they have an average of one intern per year. In a third of the organizations, between 2–5 people conduct internships and in the rest more than 5 students. This result, not surprisingly, highlights the need to boost internship activities in organizations by underlining the long-term benefits of receiving interns and the need for their active involvement in the practical training of new generations.

Next, the *main aspects of internship programs, including quality related issues* are depicted.

The average length of an internship is between 7 and 30 days for more than 45% of organizations and between 1 and 6 months in more than 45% of cases. In a small number of organizations, internships are for longer periods of time, lasting more than 6 months. The length of these internships is also influenced by the requirements of the university curricula.

Most of the interns (60%) are Bachelor's students. This is probably due to the fact that most Master's students from Romanian universities have already a job.

Regarding the recruitment methods, it is worth noting that in more than 13% of the cases interns are recruited based on existing collaboration agreements with universities within the framework of European funded projects in the field, which suggests the usefulness of these projects in stimulating access to and learning through practical training. Data suggests that a third of trainees apply directly to the organization and around 20% are recruited from job platforms. About a third of interns come within

the framework of a collaboration agreement with various faculties, with the faculty assigning interns to the company (see Fig. 1).

Relating to remuneration of interns, almost 75% of students are not remunerated by the organization, and 6.7% would either be willing to pay them or are remunerated from other funds or are remunerated (see Fig. 2).

In terms of the motivation behind accepting interns, more than 45% of respondents declare that they are motivated by the desire to help young people and society to develop, and 13% are motivated either by the relationship with the university and its members, the creation of a database with potential employees for the future, or the need to solve certain tasks/activities by interns (see Fig. 3).

With regard to the open-ended responses on the positive and negative aspects experienced during the internships, the following aspects could be highlighted. Among the positive aspects frequently mentioned can be mentioned: a. The help offered by the students to the organization through the work they carried out, b. The openness
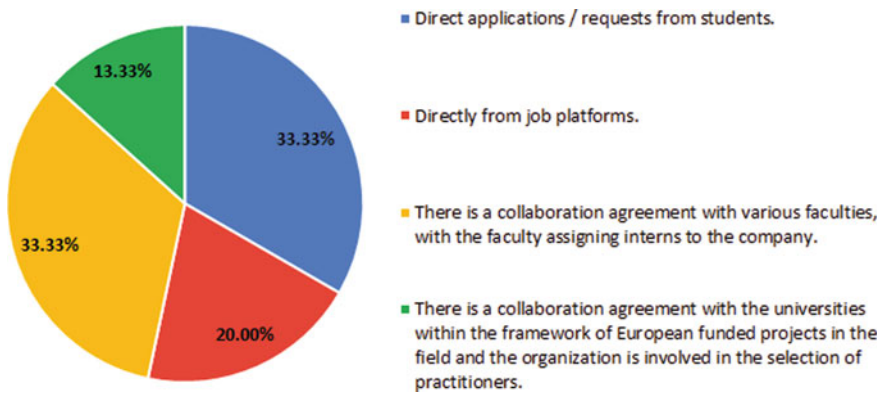

Fig. 1 Most common recruiting methods for interns. *Source* Own illustration based on data from the survey
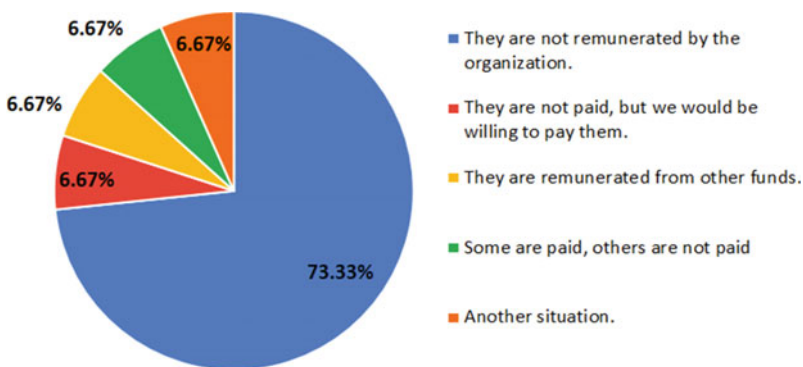

Fig. 2 Remuneration of interns. *Source* Own illustration based on data from the survey
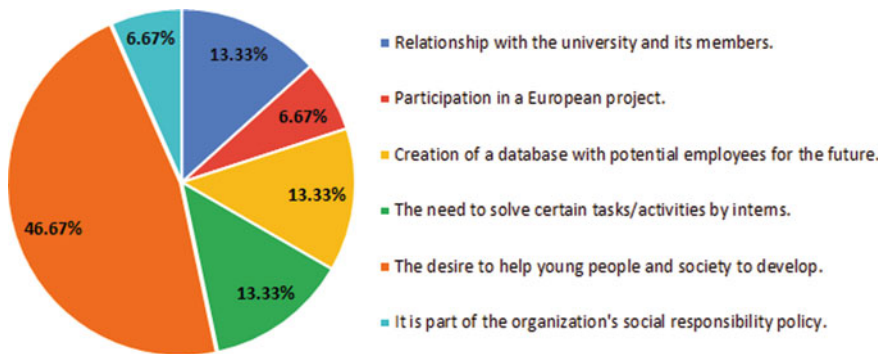
Fig. 3 Motivation for accepting interns. *Source* Own illustration based on data from the survey

of the interns to learn new things and gain experience in working relationships in a company, c. The assessment of the integration capacity of future employees, d. The relationship with the university.

Negative aspects mentioned included a. Lack of interest of some interns, b. Bureaucracy regarding the many documents to be signed, c. Relatively short duration of the internship, d. Short time to train interns, e. Pandemic which made it difficult to have an internship in the office/hybrid, and f. Lack of a direct relationship with the faculty to monitor progress.

The main suggestions for the improvement of the internship program listed by respondents are: a. Preliminary discussions with interns in order to identify the best internship opportunity so that they are motivated and have a real interest in the field of activity and the host organization, b. Company-student relationship and alignment of objectives between the two parties, c. Better planning to ensure internal resources are available in the organization to work with interns, d. Communication between mentor and intern, e. Reduced bureaucracy.

The success of the internship program can be analysed from several perspectives.

The first one is students' final assessment or grade given by the representatives of the organizations to the majority of practitioners. Data shows that most of the organizations are satisfied and very satisfied with the overall performance of the practitioners, as 40% were rated Very well and 46% Well, while only 13% of the organizations have been less satisfied. It is to be noted that categories such as Poor haven't been met in the sample.

The second perspective concerns the quality of the internship from the companies point of view and it was captured through several items grouped on six dimensions, such as: (1) The perception or opinion of the internship coordinators in organizations regarding the specialized knowledge of students, and the skills needed on the labour market; (2) The way the actual work of the practitioners in the company was organized: orientation, monitoring, completion through concrete results; (3) Attitude of the company's representatives towards the organization of internships: availability,

duration, desire of employees to mentor and integrate practitioners; (4) The perception of the organization representatives regarding the formal framework for carrying out the internships: legislation, documents; (5) University-company collaboration from the perspective of the documents requested by the university, the establishment of the attributions and the activities carried out by the students; (6) General evaluation of students and their activity at the end of the internship. Responses were measured on a Likert scale, from 1 to 5, where 1—Strongly Disagree, 2—Partially Disagree, 3—Neutral, 4—Partially Agree, 5—Strongly Agree.

In the following analysis, we will focus particularly on the first and last dimension. After a brief univariate descriptive analysis of the corresponding items, the bivariate analysis is carried out visualizing the common distribution of the students' final assessment or grade and some of the items that quantify company representatives' perceptions or opinions corresponding to the first dimension, with the purpose of displaying associations of the responses.

For almost all of the items corresponding to the first dimension, partial agreement (variant 4) and total agreement (variant 5) predominate, but in the item 'Practitioners have a wealth of useful theoretical knowledge, gained during the study, which they can apply at the practice site,' respondents gave balanced answers between favourable ratings (variant 4 and 5) and the least favourable ones (variant 2 and 3). This aspect might be explained by the fact that during the bachelor's cycle of economic studies the internship takes place in the second of the three years of studies, i.e. in the middle of the study period, when the transition from the general disciplines to those specific to each specialization takes place.

Regarding the last dimension, the 6th one, which includes items on general appreciation of students and their activity at the end of the internship, we noted that over 70% of respondents chose partial agreement and strong or total agreement to the item on the general degree of satisfaction with practitioners. This optimistic attitude is confirmed in a proportion of about 53% in terms of the prospect on the benefits that the company has after receiving students in practice. A possible explanation for such a proportion close to 50% is given by the relatively short period of the internship, as well as by the fact that the main activity field of the organization may not fit perfectly with that of the specialization of interns. However, there is hope that things can be optimized because 60% of respondents expressed a desire to definitely continue organizing internships in the future.

Figure 4 shows several mosaic plot diagrams, displaying the common distribution of the items corresponding to the respondents' appreciation of the students' specialized knowledge and students' final assessment obtained at the end of the internship. The advantage of such a visualization is that the diagram shows, by the dimensions of the tiles, the relative frequency distribution of the qualitative variables. As can be seen in Fig. 4, classes 4—Partially Agree and 5—Strongly Agree of the items that reflect the respondents' perception or appreciation of the knowledge and skills of the intern students overwhelmingly correspond to the grades Well and Very well. For the situations in which observed classes are 3—Neutral or more unfavourable, the final grade obtained by the student is predominantly Well.
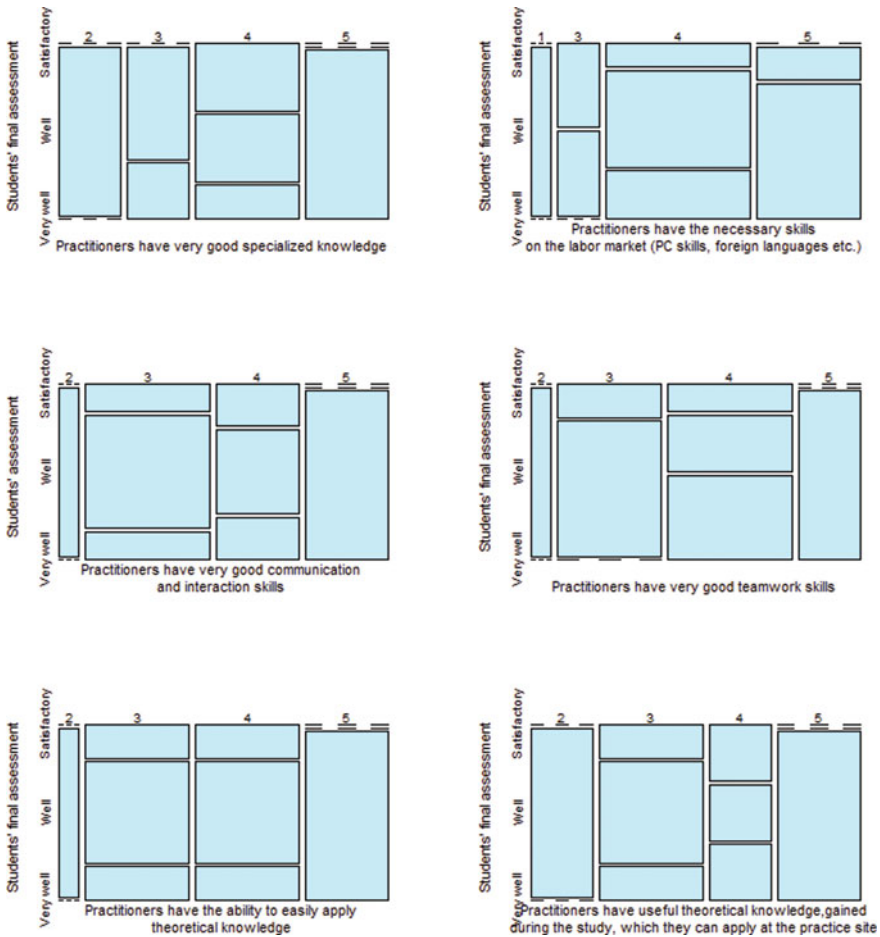
Fig. 4 Mosaicplot visualization of the common distribution between students's final assessment and several items showing the perception of internship coordinators regarding the specialized knowledge of students or the skills needed in the labor market, where 1—Strongly Disagree, 2—Partially Disagree, 3—Neutral, 4—Partially Agree, 5—Strongly Agree. *Source* Own illustration in R based on data from the survey

The third perspective on the success of the internship program refers to the perception of the benefits, in the short and medium term, brought to the company that receives interns. The answers to the eleven corresponding items were also measured on a Likert scale, from 1 to 5, where 1—Not at all, 2—To a small extent, 3—Neutral, 4—To a large extent, 5—To a very large extent. For all items, the predominant categories were, cumulatively, those that showed agreement by choosing variant 4, and 5, respectively. The bivariate analysis was performed in this case by calculating and interpreting the Spearman and Kendall rank correlation coefficients, an appropriate choice because the variables are measured on the ordinal scale. The graphical

representation of the Spearman rank correlation matrix is shown below, in Fig. 5, made in R, with the `corrplot` package, we chose to display the upper part of the matrix, eliminating the elements on the main diagonal, all of which are equal to 1, in this way the strongest correlations, as well as the weakest correlations can be better distinguished.

All the correlation coefficients are positive, suggesting a direct association between all possible pairs of the eleven items quantifying the benefits of the organizations. The strongest correlations, given by correlations coefficients above 0.90, are, for example, between the items 'Possibility to meet the need for short-term staff' and 'Possibility to have staff without having to make long-term commitments' or between 'Possibility to evaluate potential employees for the future' and 'Possibility to have access to potential future employees at lower employment and training costs'. Other high correlation coefficients, around 0.75, can be observed relating the item 'Possibility to get new ideas and skills for the organization' to the item 'Possibility to
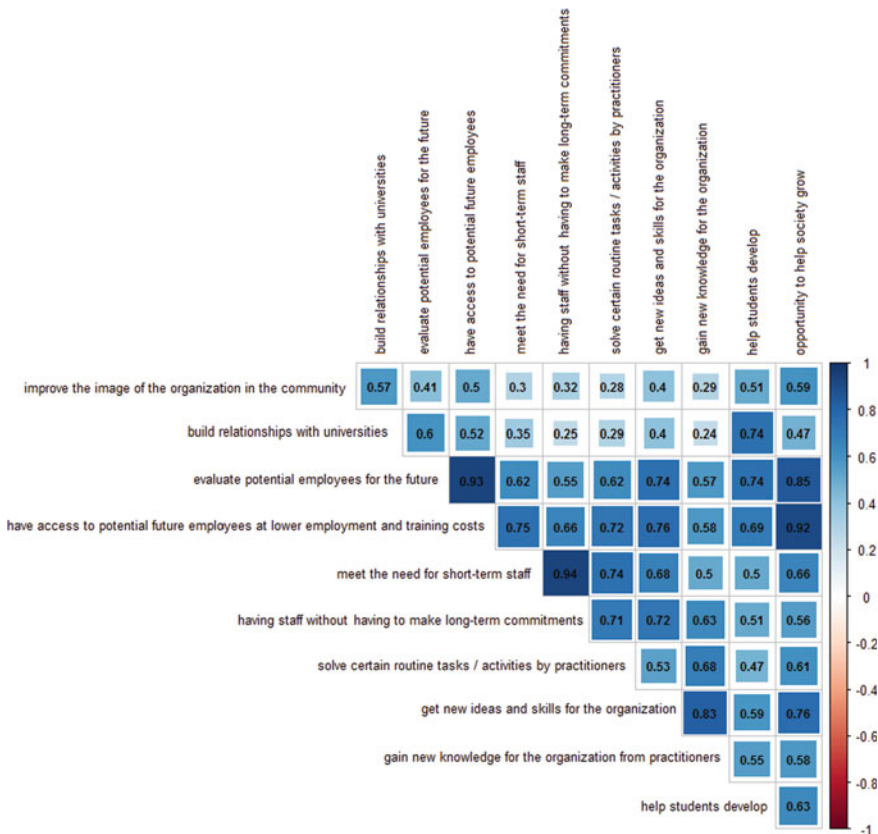
Fig. 5 Spearman rank correlation matrix for the benefit items 'Possibility to ….'. *Source* Own illustration in R based on data from the survey

evaluate potential employees for the future' or to the item 'Possibility to have access to potential future employees at lower employment and training costs'.

Last, but not least, the fourth perspective on the success of the internship program refers to the future relationship between students and the company. 60% of the representatives of the organizations expressed their interest in immediately hiring interns (a benefit for both parties with immediate effect in almost 47% of the cases) or the possibility of a first option if positions are opened in the future, in about 13% of the cases. Given the shortage of qualified people on the Romanian labour market, it is obvious from these high percent that internships can be a very good source of young candidates for Romanian organizations.

5   Conclusion

The employers' perspective over the quality of internships is very important as the companies are direct and indirect beneficiaries of the knowledge, skills, abilities and competencies (KSAC's) of interns. Research state that internship quality variables are predictors of career exploration activity during the internship and that the autonomy and learning opportunities increase self and systematic exploration (Gamboa et al. 2013). Therefore, following the internship, employers have the opportunity to select high potential graduates, that have already proved their engagement and general competencies during the practical activity. Moreover, studies confirm the higher marketability of graduates on the labour market after completing an internship programme (Gault et al. 2010; Marinaș et al. 2018). Students with internship experience are supposed to have advantages on the labour market and thus be hired more rapid (Knouse and Fontenot 2008).

The results of the study conducted in this paper emphasize the important role the organizations play in developing the business skills of undergraduates. The results of the study are in line with other research that reveal that very high percent of business schools have some type of internship experience (Coco 2000) and that companies are willing to be involved in such educational programs.

The length of internships provided in Romania is relatively short, almost half of the employers organizing a less than 30 days' internship, in line with the curricula of different universities. This fairly short internship period is debateable as the students have to complete the internship hours during the school semester and do not have a special period dedicated to internships. Most of the organizations are not remunerating the interns during their stay in the organization, the activity being considered more a corporate social responsibility activity, the benefits being outside the financial reward: the organization creates a satisfying experience for students that can easily find jobs later. Meanwhile the organization consolidates the relationships with universities, develop the potential candidates' databases and even solve different routine activities. In general terms, organizations consider internships a "win–win" situation. However, the tutors involved in managing trainees also bring into light some negative aspects related to organizing internships, especially the high amount

of papers required to formalize the internship and the low involvement of some interns and faculty members. They suggest that the relationships with both the students and universities can be improved through better communication and involvement.

In terms of implications over the quality of internships, our main contribution lies in the idea that organizations can be actively involved in improving the content, duration or the thematic of internships programs, having a positive impact on overall students' development. Therefore, the relationship between business practitioners and universities should improve.

Finally, we have to admit the limitations identified in this study, which may be overcome in the future research. First of all, our analysis has only highlighted the employers' opinion about the quality of internships. Future research may be conducted in relation to students and faculty opinion regarding the internships content, training plans, tutors profile and background, technical resources at the disposal of interns, overall learning experience etc. Secondly, our data sample was limited, so further research should be conducted in order to increase the reliability of the results.

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Seller's Liability in Online Sales of Goods

Ariadna Grigore

Abstract Digitalization is one of this century's challenges and the current pandemic context has intensified this trend. Online sales are a practical application of this trend, and in this study we will analyze the online sale of movable goods from the perspective of the seller's liability for the sold goods. We start from a general review of the sale contract, and we will particularize the contract depending on the features of operations performed online, by highlighting their individuality.

Keywords Online sales · Liability · Hidden flaws · Apparent flaws · Eviction

1 Introduction

Trade has adapted to the new requirements generated by the current epidemiologic context, transferring sales online even more than before the pandemics occurrence. Online commerce emerged and developed as a result of the economy digitalization process. This was a response to a need to improve the relationship between the effects obtained and the efforts made, as it results from the hedonistic principle (obtainment of a maximum level of effects by making minimum efforts) (Ștefan and Dogatu 2012, p. 24).

Electronic commerce is an economic activity carried out for the sale of goods/services through electronic means. Thus, if the sale is performed between absent parties, it can be qualified as remote sale. In such case, two coordinates of the contract conclusion can be distinguished: the offer as such and the offer acceptance.

The offer expresses a general and abstract willingness of the seller to provide a potential buyer with particular goods/services. An offer produces legal effects only when accepted by the buyer, this being the moment of the contract conclusion. Yet, since we deal with a remote sale, the seller's liability does not arise simultaneously with the contract conclusion, but at the time when the buyer is able to see the actual

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condition of goods, meaning at the time when it takes possession of the goods and can identify their flaws. In this work, we will analyze the online sale of goods.

2 General Conditions Necessary for Obtaining Consent

Under Art. 1179 of the Civil Code, in order to be valid, a contract must meet the following cumulative requirements: the contracting parties must have the required legal competence, under the law, to conclude the contract, i.e., their consent must be valid and must be given in respect of a determined, possible and licit item, and the cause for obligations must be a valid one.

In turn, in order to be deemed valid, consent must cumulatively meet particular requirements, such as: the party giving it must have judgment, and consent must be expressed, must be given for the purpose of production of legal effects and must be free of any undue influence or error (Stoica 2008, p. 20; Deak 2006, p. 31; Turianu 2007b, p. 89). A valid legal document implies the expression of consent freely and on an informed basis. As a result, any impairment that could interfere with consent obtainment will lead afterwards to the nullification of that document (Cosma 1969, p. 151), because legal documents should be seen, at least at the time of their conclusion, as volitional constructs (Reghini et al. 2008, pp. 416–417).

In particular, in case of online sales, the seller must provide, in electronic format, all information regarding their identity[1] and the sold good/service,[2] in such a way that the buyer have an accurate picture on the seller and on the offer presented by it, as per Art. 8 para. (4) of Government Emergency Ordinance no. 34/2014. Also, according to Order no. 433/2009,[3] economic undertakings have an obligation to post on their own website the link to the ANPC's website.

2.1 Judgment of the Person Giving His/Her Consent

The presumption of judgment existence operates in relation to a natural person having full legal competence. Yet, there are legal incapacities (in case of minors under the age of 14, as well as in case of persons whose legal competence has been prohibited by the court[4] and natural incapacities (in case of temporary lack of judgment caused

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[1] Name, sole registration code, office address, phone number, email contact etc.

[2] The good's/service's features, price, delivery conditions etc.

[3] ORDER no. 433 of 6 March 2009 on the Creation of the Committee for Local Public Finance (updated on 27 April 2015*) (website legislatie.just.ro, accessed on 09.02.2022, 18:00 h).

[4] The draft amending the Civil Code, drafted based on the Romanian Constitutional Court's Decision no. 601/2020, extends the scope of persons incapacitated to conclude legal documents, by replacing the prohibition on persons subject to interdiction by that on persons subject to judicial counselling. This amendment offers a wider protection to vulnerable persons, being a timely amendment. (Annex: Point 1 of the draft amending the Civil Code stipulates that:"Thus, the difference

by drunkenness, hypnosis, strong anger, somnambulism etc.) (Turianu 2007b, p. 90). Through this, the lawmaker protects persons who cannot realize the consequences of their acts (Dogaru 1986, p. 70). The absence of judgment is sanctioned by relative nullity,[5] but some authors (Hamangiu et al. 2002, p. 80) believe that the deprivation of judgment is equivalent to the non-existence of legal volition, which would trigger the sanction of absolute nullity of the relevant document.

To establish the type of applicable nullity is important for the person entitled to rely on nullity and for the applicable limitation term (Turianu 2007a, p. 54). In this paper, we considered that, since the absence of judgment is a state of fact, not a law one, relative nullity is the applicable sanction.

2.2 Expression of Consent

Volition can be expressed expressly or tacitly, in writing or verbally, through relevant gestures or acts. Tacit consent can be expressed both through an action and an inaction. Thus, tacit consent can be expressed as per Art. 1240 para. (2) of the Civil Code.

2.3 Intent to Generate Legal Effects

The intent to conclude a legal document does not automatically trigger the effective exercise of such intent by assuming a legal commitment. Such intent lacks if consent is given vaguely, jokingly (jocandi causa), with a "mental reserve" (reservatio mentalis) or under a purely potestative condition (si voluero).[6]

2.4 Non-Alteration of Consent

Consent alteration is equivalent to its non-existence; it exists, but its effectiveness is diminished (Dogaru 2002, pp. 92–93, 94). An altered consent affects the conscious

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between persons subject to interdiction and those subject to judicial counselling operates at two levels. These are the level of impairment of mental faculties (total in the first case and partial in the second one), and the nature of support necessary for the exercise of rights and freedoms (the first situation requiring representation, and the second one requiring assistance/counselling) Art. 41. Restricted legal competence. (1) A minor who reached the age of 14 and a person subject to judicial counselling have restricted legal competence." (website https://www.juridice.ro, accessed on 09.02.2022, 14:15 h).

[5] Turianu (2007a, b), quoted work, p. 91.

[6] Cosma (1969), quoted work, p. 120; Turianu (2007a, b), p. 92; Dogaru (2002), 94, quoted work, p. 72.

nature of the volition incorporated in the legal document to such an extent that it can be sanctioned by relative nullity. The doctrine (Moțiu 2020, p. 187; Ungureanu 2007, p. 165) has considered that, terminologically, the wording "alterations of volition" is more appropriate than the wording "alterations of consent," because the concept of volition is broader than that of consent. In this paper, we have considered that the wording "alterations of consent" is more accurate precisely because consent is part of the legal volition and limits to the expressed volition.

The draft European Code of Contracts places the alterations of consent under the scope of causes for invalidation of a contract. The causes for invalidation provided for by the draft European Code of Contracts also include reverential fear (McKendrick 2016, p. 109), and moral violence (Gatt 2008, p. 289).

3   Time of Transfer of the Contract Risk to the Buyer

Unlike physical sales, in case of online sales, there is an intermediary stage of product delivery. This stage influences the time of transfer of the contract risk because this is transferred to the buyer, or a party appointed by it takes effective possession of the products. However, if a non-professional carrier is tasked by the buyer to deliver the product to it, the risk is transferred to the buyer at the time when the seller delivers the product to the carrier, in compliance with Art. 20 of Government Emergency Ordinance no. 34/2014.[7] The non-observance of these legal provisions triggers the sanction of a fine, as per Art. 28 para. (5) item (w) of Government Emergency Ordinance no. 34/2014.

4   The seller's Warranty Obligation

Similarly to sales performed physically, online sales also trigger the seller's liability for hidden flaws or for eviction. In the online medium, both goods and services can be sold. The seller's warranty obligation is materialized by assuring the quiet and useful enjoyment of the good purchased by the consumer. This way, the seller warrants the buyer both against the loss of title and against hidden flaws.

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[7] Emergency Ordinance no. 34/2014 on Consumer Rights under Contracts Concluded with Professionals, and Amending and Supplementing other Normative Acts, Published in Part I of Official Journal no. 427 of 11/06/2014 (website anpc.ro, accessed on 10.02.2022, 18:30 h).

4.1 Warranty for Eviction

The seller is liable both for the eviction caused by acts of third parties and for that caused by its own acts. In case of eviction caused by the act of a third party, the seller is held liable only if the third party causes a *de jure* disturbance to the buyer, the cause for the loss of title is precedent to the sale and was not known to the buyer at the time of the contract conclusion (Deak 2006, p. 103).

Given that the sale of real property requires an ad validitatem authentic form, it cannot be concluded in electronic format. Hence, only movable goods can be sold online. Such goods can be evicted if they are charged with easements undisclosed by the seller and non-apparent or if the real owner can claim them under the terms of Art. 563 of the Civil Code.

Therefore, the seller can sell another person's good but, in such case, if on the date of the contract conclusion of the individually determined good, such good is owned by a third party, the contract is valid, and the seller has an obligation to ensure the transmission of the ownership right from its holder to the buyer in compliance with Art. 1683 of the Civil Code.

This obligation of the seller is deemed to be performed either through the acquisition of the good by it or through the ratification of the sale by the owner or through other means, directly or indirectly, which secure the ownership over the good to the buyer.

In the event that the seller fails to perform its obligation to secure the transmission of the ownership right to the buyer, the latter can request for the contract rescission, the return of price and, if the case, liquidated damages.

A loss of title caused by the seller's own acts has its origin in a fact or action concealed by the seller of nature to disturb the quiet enjoyment of the good. In such case, the seller is held liable irrespective of whether the relevant disturbance is a de jure or a de facto one. Such situation would translate practically in the area of online sales through the sale of a good several times or through reliance on a usufruct right over the relevant good.

The sale of a good several times (in such case, the seller is held liable for loss of title towards the first buyer), can be qualified as a form of loss of title, given the consensual nature of the sale, as it is concluded once the offer acceptance gets to the seller. In case of an eviction resulted from a personal act of the seller,[8] the buyer has available a warranty objection"quem de evictione tenet actio, eundem agentem repellit exceptio" (the one bound to warrant against loss of title may not evict) (Deak 2006, p. 101).

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[8] In such case, a loss of title caused by the universal or universal-title successors of the seller is also deemed as a personal act of the seller, in compliance with Art. 1699 of the Civil Code.

4.2   Warranty for Hidden Flaws

In case of online sales, the seller is liable for hidden flaws that make the good improper for use or diminish its value in such a way that the buyer would not have purchased it or would have paid less for it if it had known them. In order for this warranty to operate, the flaw must be hidden, must have existed on the date of the contract conclusion and must be serious.

Given that online sales are remote sales, the buyer cannot check the good before it is delivered to it, so after the contract conclusion. This aspect that triggers also the liability for apparent flaws in the case of such sales, because the buyer is physically unable to conduct a normal and careful check before the contract conclusion.[9]

If the parties postponed the time of transfer of the risks after the contract conclusion, for example, at the time of the effective handover of the good to the buyer, then the seller is liable including for flaws occurred after the sale, but until the time of transfer of the ownership right.[10]

5   Conventional Change of Liability (Limitation/Removal or Encumbrance)

Art. 1708 of the Civil Code indirectly regulates a possibility to conventionally change the liability for hidden flaws. From an interpretation of the first paragraph, one can understand that, *per a contrario*, the parties can conventionally eliminate such liability, and according to the principle *qui potest plus, potest minus*, the parties can also limit it, not only remove it. However, the buyer's consent must be given on an informed basis and must be explicit in order to produce legal effects. Therefore, in case of online sales, the buyer should be able to clearly see such option in the offer posted on the Internet.

Also, the parties can agree to extend the seller's liability. This possibility to limit/remove/extend the liability for hidden flaws illustrates the principle of contractual freedom.

6   Conclusions

In case of online sales, there are some specific particularities of the contract resulted from the additional features of technical nature and from the fact that these are remote sales. Therefore, the seller's liability for hidden flaws and for eviction does not arise at the time of the contract conclusion, but at the time of the good handover to the

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[9] Court of Review, Judgment no. 258/08.02.1935, in Revista de drept comercial (Commercial Law Magazine), 1935, p. 449.

[10] Ditto, p. 116.

buyer/ a representative of it, in order for it to be able to check the good in physical format.

Precisely because a normal but careful check cannot be conducted before the time of the contract conclusion, online sales also imply a liability for apparent flaws for the seller.

The risk of the good impairment is transferred to the buyer only at the time when the latter effectively takes possession of the good, provided that the transfer of the good/goods is secured by the seller.

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Innovation-Driven Performance in European SMEs: A Theoretical Approach

Marilena-Loredana Jerdea

Abstract In a globalized economy, innovation is a priority of ensuring the competitiveness degree of companies, being the core of the development in any economic activity. The purpose of this paper is to study from a theoretical perspective the agile management of innovation in European small and medium sized enterprises, to analyze their particularities and how they act to stay competitive through innovating their business models. The literature review will cover the importance of innovation for companies, the multiple definitions and classifications of innovation and innovation management, theoretical models of innovation, the applicability of innovation management in different fields and in companies with different specifics, elements within companies that are important for an efficient innovation management, features of innovation management in an agile company, the geographical features of innovation management, business model innovation, efficiency growth, company's performance. The paper will investigate the methods and practices, the connection with the business models used in order to drive innovation, how innovation's agile management can be described in European SMEs, what results are achieved by SMEs in terms of innovation, how to describe the compatibility of innovation management—agile management. The paper aims to clarify from a theoretical point of view the particularities of the companies that fall into the previously defined niche, being a current and relevant one for the European economic space, given the challenging times the European SMEs had to face.

Keywords Innovation · Innovation management · European SMEs · Agility · Business model innovation · Company's performance · Organizational agility

1 Introduction

Considering the globalization process, the companies must prove a maximum competitivity, being in a competition not only with the conational entities, but with

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all the companies from the respective field, regardless the origin country. We discuss, therefore, about a tight competitivity at a global level, within which are successful only the ones that manage to keep the track with the technological evolutions and not only. This aspect is even more actual at regional level, within the European Union, where the companies have free access in all the state members and the companies from the countries with less developed economies are competing directly with the ones from the more developed countries. Moreover, we do not discuss only about a competition within the European Union, but also about an economic competition between the European Union as a whole and the other developed economies around the globe. Therefore, we can ask ourselves how a European software company can compete with American or Asian well-known brands or how can an East-European start-up to level and compete against a developed West-European company, keeping in mind that they have access on the same markets.

We can also ask additional valid questions, whether or not these inequalities can be balanced and how the market players stay relevant, keep the competitiveness or become competitive and manage to develop despite of all viable options existing on the market, some of them being already developed and already international. An answer would be through continuous innovation, in order to manage to offer to the consumers experiences that are not offered by others yet or can not be offered due to a certain cause, together with a relevant marketing campaign.

However, precisely because of the multitude of options existing on the market, thereof the vast majority confront the same question, innovation can be considered a competition itself. Anybody can have innovative ideas, this resource is unlimited. Therefore, it becomes important how the respective ideas are implemented: as fast as possible, as efficient as possible, with as few resources as possible, with as few costs as possible, with a better and more successful perspective before the consumers. This way, it becomes important the management of innovation.

In my opinion, the subject is relevant and actual, because it presents the theoretical grounds and the methods in which a start-up can tackle the innovation management in order to be more competitive both at the European Union level and globally. Also, at national level, the subject is relevant and actual, considering that many Romanian companies, especially the smallest ones, show a great interest in agile methodologies. It is mandatory that the limited resources are used in the best manner and the companies are flexible in order to meet their innovation objectives as soon as possible.

The majority of the theoretical resources are focused on the theorization of the innovation management as a field, insisting on its multidisciplinary character and on the multiple definitions. There are studies related to the applicability of the innovation management in certain fields or for particular types of companies, in general, there are studies related to the applicability of the innovation management within particular economy types (as emergent economies), or studies that analyze the influence of particular factors over the efficiency of the innovation management (such as leadership, the team's creativity, the team's diversity and so on), or studies focused on the general complementarity of the agile and innovation management.

2   Literature Review

2.1   From Innovation to Innovation Management

"Innovation is the core of development and productivity in any economic activity" (Kogabayev and Maziliauskas 2017, p. 59). In the knowledge century, as the global business environment becomes more competitive, innovation becomes critical for a dominant role in the market (Ratten et al. 2017). Drucker (2015) outlines seven sources of innovation opportunities: four internal (unpredictability, inconsistency between current and desired reality, innovation based on the need for a process, changes in industry or market) and three external (demography, changing perceptions and scientific and non-scientific new knowledge).

Definitions of the innovation concept may vary: Schumpeter (in Kogabayev and Maziliauskas 2017) defined innovation as the economic impact of technological change; Twiss (in Kogabayev and Maziliauskas 2017) as the process that combines science, technology, economics and management to create novelty and expand it from idea to commercialization; Afuah (in Kogabayev and Maziliauskas 2017) as new knowledge embedded in products, processes and services. Their common element is the process by which a good idea is transformed from an idea into practical use, with the help of the full development and exploitation of new knowledge (Tidd and Bessant 2013). Thus, innovation can be treated as a tool used by entrepreneurs to turn change into opportunities and these into new ideas to translate them into widespread practice (Tidd and Bessant 2013). It is emphasized, however, the need for the innovation process to be sustainable and responsible, in order to take into account the consequences of innovation decisions and to anticipate the possible negative impact (Bessant and Tidd 2015).

The innovation process is a complex one, which involves efficient management of several different activities; it is, therefore, a management process, the approach of which is decisive for the results obtained (Trott 2017). Although the process seems random and uncertain, models can be found that tip the chances of innovation to success: not by developing and implementing a predictable mechanism, but by creating conditions within the organization that increase the likelihood of success of a resolution of several challenges with a high level of uncertainty (Tidd and Bessant 2013). Innovation management allows organizations to focus on competitiveness and performance and nationally and internationally it is acknowledged the importance of standardization to contribute to business innovation and to increase competitiveness and value creation (Caetano 2017).

There are several ways in which organizations can approach the innovation process, the main ones being: the champion of innovation (a single person in charge of this aspect, who enjoys a lot of freedom, but generally little authority), the team dedicated to innovation (which tends to be more radical than incremental and more skeptical), the central innovation department working with innovation ambassadors (the department denotes youth, novelty, out-of-the-box vision and ambassadors company experience, expertise and in-depth knowledge) (von Stamm 2003).

Various authors point out differences between the concepts of "innovation management" and "management of innovation": the first is associated with changes in the activity of managers that create long-term benefits, rather than referring to an innovative nature of management in general, without necessarily emphasizing the outcome of innovation, and the latter has four cores: new ideas, people, transactions and the institutional context, taking into account the results of innovation as well (Albors-Garrigos et al. 2018). It can be concluded that innovation management requires an extensive holistic approach to the issue of innovation management, including both technology management techniques and innovative management techniques in order to increase the efficiency of the innovation process in a company (Albors-Garrigos et al. 2018).

2.2 Innovation Management: Classification and Theoretical Models

In the case of innovation, there is no single formula or model that is applicable to all companies, as a consequence of the multitude of its definitions and classifications, due to its multidisciplinary origin, with significant influences from product management, project management, procurement management, knowledge management, technology management, strategic management and others (Viveiros Lopes et al. 2016).

From the purpose point of view, innovation can be classified into four types, according to the OECD: product innovation (to introduce a new product or significantly improve an existing one), process innovation (a new method or the improvement of an existing method), organizational innovation (organizational methods as a result of strategic decisions) and marketing innovation (introduction of a new marketing method) (Viveiros Lopes et al. 2016).

In terms of the extent of implementation, innovation can be classified into four types: incremental innovation (improvements using existing technologies), modular innovation (similar to radical innovation in terms of necessary concepts), architectural innovation (similar to incremental innovation in terms of necessary concepts) and radical innovation (introduction of a new technology) (Viveiros Lopes et al. 2016). Incremental strategy starts from the philosophy of a limited ability to understand the present and predict the future and requires the company's ability to adapt its strategy at any time, based on new information and understanding, which it is constantly looking for (Tidd and Bessant 2013). In contrast, the rationalist strategy is based on military experience, where the strategy consists, in principle, in a linear model: it evaluates, determines and acts (Tidd and Bessant 2013).

In terms of technological uncertainty, innovation can be classified into four types: small innovation, medium innovation, large innovation and very large innovation (Viveiros Lopes et al. 2016).

From the point of view of where the innovation takes place, it can be open (it also involves the external environment, such as customers, suppliers, competitors, universities, etc.) or closed (it happens entirely and exclusively within the organization) (Viveiros Lopes et al. 2016).

From the point of view of the source of innovation, it can be recombinant or obtained by design (Tidd and Bessant 2013). Recombinant innovation involves the transposition of an old idea, already used in a completely new context, where it has the potential to bring an element of novelty (Bessant and Tidd 2015; Tidd and Bessant 2013). Design innovation involves changing the meaning of a product or service in the mind of the consumer, with a new purpose; this can range from incremental innovation to radical innovation (Bessant and Tidd 2015; Tidd and Bessant 2013).

Allan Afuah (2003) outlines the following theoretical models of innovation: the Abernathy-Clark model (which explains why established entities may perform better than new entities in terms of radical innovations), the Henderson Clark model (which explains why established entities seem to have significant difficulties in tackling incremental innovations), the disruptive technological change model (which explains why established entities fail to exploit disruptive technologies), the value-added innovation chain model (which explains why established entities can perform better than the new ones in terms of radical innovations, as well as why they fail to approach incremental innovations) and the Teece model (which explains why established entities can still take advantage of radical technological innovations).

Regarding the implementation of innovation management, Trott (2017) mentions almost 50 tools that can be used, tools that can be grouped in the following types of management: knowledge and technology management, market research, cooperation and networking, human resources management, interface management, creativity development, process improvement, project management, product development and design, business creation.

2.3 Applicability of Innovation Management

Innovation is responsible for creating and maintaining the competitive advantage of companies and ensures their sustainability and continuity (Santos et al. 2019). The success of a business is related to the processes of quality management and innovation management, as they allow the creation of value for consumers by implementing a new product or process or a significantly improved version, a new marketing method, a new organizational method aimed for business practices. (Santos et al. 2019).

In the service industry, production and delivery occur simultaneously and the implementation of new ideas is more difficult than the process of creating those ideas (von Stamm 2003). In service industry innovation, five angles have been proposed that can be addressed: positioning innovation (developing a unique proposal that differentiates the product or company from existing market offerings), process innovation (improving the consumer experience by adding or removing a step in the process), innovation in service delivery (reorganization of existing bundled services,

improvement of an existing service, creation of a whole new service), innovation of people (increase or decrease of individual discretion to improve the consumer experience through individualized services), innovation of communication (use of branding for differentiation of a service) (von Stamm 2003).

In family business, although the budget available for research and development is low, the results of innovation are often better (Frank et al. 2019). Compared to other companies, family businesses rarely invest in innovation, but they prove a high disposition to engage in innovative activities, especially when there are conditions that press them in this regard, such as the threat of profits (Frank et al. 2019). They tend to prefer incremental innovations (Frank et al. 2019).

In general, small and medium-sized enterprises have a reputation for high innovation potential and the innovation process is accelerated by the fact that management and ownership are often identical, by direct contact with consumers, by production flexibility and flexible organizational structures (Gaubinger et al. 2015). The weaknesses of SME innovation are the lack of a structured innovation process, underdeveloped planning systems and the lack of inter-departmental staff involvement (Gaubinger et al. 2015).

Within companies, there are several elements that are important for the smooth running of the innovation process: leadership (different stages and types of innovation have different leadership needs and each leadership style has its own particularities and its own methods of contributing to different types and stages of innovation) (Łukowski 2017), team diversity (which can, on one hand, increase creativity and innovation, and on the other hand create barriers to collaboration) (Weiss et al. 2018), team creativity (which can have both positive and negative results) (Brem et al. 2016) and team preparation (knowledge management: generating new knowledge, identifying, storing, distribution and exploitation of existing knowledge) (Bessant and Tidd 2015).

2.4   Organizational and Geographical Features of Innovation Management

An essential contribution to innovation management comes from operational management, which has proposed a set of best practices that together are called "Lean management" and combines process management with attention to people, culture and leadership to ensure that resources are used efficiently (Goller and Bessant 2017; Solaimani et al. 2019). The culture of learning within companies increases the capacity for innovation, employees are encouraged to develop proactive attitudes towards continuous development and positively affects the company's innovation (Solaimani et al. 2019). Lean innovation management is a socio-technical system that aims to promote an analytical mindset to stimulate continuous development, problem-solving approaches and process efficiency (Solaimani et al. 2019).

In small and medium-sized enterprises, innovation can be influenced by digitalization and agility (Niewohner et al. 2019). Agility refers to the ability of the team to react quickly and be flexible to unexpected changes, and various studies confirm a positive correlation between agile methods and the innovative ability of companies or the probability of success of innovations (Niewohner et al. 2019). Thus, developing a detailed plan for each task will increase the innovative efficiency of SMEs (Niewohner et al. 2019).

Innovation management can also have a regional component, taking into account the particularities and opportunities of each region: for example, in the European Union there are public policies to support SMEs in developing a business-friendly environment, to support their internationalization and to support them for innovation (Todeva and Ketikidis 2017).

2.5   Business Model Innovation and firm's Performance

Nowadays, in order to overcome the market competitiveness, it becomes extremely important for a market player to gain, develop or expand its agility capability and translate it through future innovation, given the dynamics of the market and the accelerated rhythm that the operational management has to face. This may refer to any type of innovation that can be adapted to the specifics of the respective SME, as described above through the conceptualization of innovation, starting from any new idea that can conduct to product innovation, service innovation, close or open innovation, but being rather dependent on the available resources and management's ability to predict or strategically plan the approach for at least a medium term.

However, depending on each company's capabilities and resources, there may be a different business model suitable to be applied. This refers actually to a cluster of organizational capabilities, which is defined as "the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, p. 516). Therefore, the business model innovation approach will focus on efficiency growth, revenue growth and organizational capabilities. The efficiency growth will include key performance indicators based on cost reduction, productivity and reduce time to market, while the revenue growth would regard new customers, new market, new value proposition, service bundling. As far as the organizational capabilities are concerned, they have an orientation towards innovativeness, entrepreneurship, organizational learning, opportunity recognition and organizational culture (Latifi et al. 2021).

According to Mitchell and Coles (2003), the innovation within business models can be manifested in three different ways: on one hand, business models can represent a form of innovation, by introducing new methodologies or modifying internal operations without affecting the core of the product/service, on the other hand, a technological push consisting in a technological breakthrough, may enable the firm to become the first mover on the market and not least, to maintain a cutting edge of innovation and maintain leadership on the market, firms develop initiatives that may

include secondary products or adapted existing products to a different context (Trimi and Berbegal-Mirabent 2012).

Performance is defined as an organization's ability to achieve the determined goals for preserving profit, having a competitive advantage, increasing market share and preserving long term survival, which depends on using appropriate organizational strategies and practical plans (Oyemomi et al. 2019).

Therefore, the creation of new or adjusted business models needs special attention as this triggers effects on medium to long term, through the supporting strategy. It might also be the case of not only one single business model, but different business models to be applied, therefore it is required a strategic approach depending on the company's needs and objectives. In the same time, the company can opt for a suitable innovation type, depending on the available internal and external resources and also in conformity to the company's agility and openness towards change. Business model innovation comprises a formula specific to the firm, that refers to searching and finding new ways of creating value and transferring value to the customers, suppliers and partners through its products/services.

3   Methodology

Starting from the literature review and understanding properly the main concepts of "innovation", "innovation management", "business model" and "business model innovation", "organizational agility", the main objective referred to a correct conceptualization and connection between them.

The existing literature review allowed, for the purpose of the present paper, to collect primary information from existing sources, through a first step of data collection, considering two stages. The first stage regarded the correct definition and understanding of "innovation" and "innovation management" and the second stage was focused on establishing the connection between the innovation and the business model, how the business model can be impacted by innovation and how the company's performance can be influenced, further on, by the business model innovation. This has been performed by choosing published articles that would provide clarity regarding the conceptualization of innovation and innovation management, tackling the connection between these and the business model innovation with a final touch on the company's performance.

Literature search has been applied by using journals, articles and books, available on various academic databases, such as: Science Direct, Journal of Business Research, Strategic Management Journal, International Journal of Innovation Management, International Journal of Entrepreneurial Behavior & Research.

After eliminating duplicates, there was a screening performed of the relevant titles and related abstracts, followed by individual analysis of the papers in order to verify their potential contribution to the current study. Only papers that focused on classifying components and conceptualize definitions for innovation, innovation

management, business model and business model innovation were selected for further basis.

4 Results and Discussions

Given that innovation is a priority in ensuring the competitiveness of companies in a globalized market, it has to be stated that attention should be also paid to the prerogatives of market resilience of European SMEs through agile innovation management. The elaboration and implementation of further research will have to consider first of all the niche character of the topic, to identify the common characteristics, to standardize the good or bad practices the companies use in order to have an effective management of the innovation process and to achieve concrete results from it, and to consider the geographical, political, economic and cultural circumstances in which these companies operate for a better understanding of the opportunities, advantages, disadvantages and limitations they face, compared to the rest of the companies, which are not found in the niche approached. At the same time, the elaboration and implementation of the research will have to consider the significant differences between the companies in the niche approached, in order to study the differences regarding the approach to innovation management depending on the field, the specifics of the company, the structure of the SME, taking into account the economic differences and opportunities between the companies in the west of the Community bloc compared to those in the East of the Community bloc.

As subject to potential further analysis, I can outline the following general objectives of research:

Analysis of how small and medium-sized enterprises in the European Union approach the innovation process, as opposed to companies in other geographical areas;

Analysis of the differences in the approach to the innovation process in small and medium-sized enterprises in the European Union depending on the country of origin;

Analyzing the innovation opportunities enjoyed by small and medium-sized enterprises in the European Union;

Analysis of agile management implementation methods in small and medium enterprises in the European Union;

Analysis of the approach to innovation management in small and medium-sized enterprises in the European Union;

Analysis of how innovation management and agile management complement each other in small and medium-sized enterprises in the European Union;

Analysis of the evolution over time of the innovation processes approached by the companies from the European Union.

The rationale for these objectives is to generate new theoretical and applied aspects that provide clarity on the specifics of small and medium-sized European enterprises, in order to highlight possible differences in the applicability of innovation management between them and those in other geographical areas, as well as between small

enterprises and medium ones from different parts of the Community bloc. Thus, it will be possible to observe possible cultural, political, administrative or economic additions to the general concepts well documented from a theoretical point of view, which will bring a better understanding of the methods by which companies in the niche addressed by this paper can develop through innovation.

In order to turn these objectives into reality, the following research questions can be formulated:

What methods and practices do European small and medium-sized enterprises use to develop effective innovation management?

How can the agile management of innovation in European small and medium-sized enterprises be described?

How can the results of small and medium-sized European enterprises in terms of innovation be described?

How can the compatibility of innovation management—agile management be described?

How can the innovation of small and medium-sized European enterprises before the COVID-19 pandemic be characterized by innovation during or after the pandemic?

In order to find answers with academic value of these research questions, given the nature of the subject and all its estimated features, it is found appropriate to conduct qualitative research, which allows the investigation of the meanings and processes of innovation management. Qualitative research will be able to produce descriptive data, which will then be analyzed for extracting representative conclusions.

5   Conclusion

The daily focus of the European SMEs is significantly rooted within the competitivity approach, trying to identify the company's needs, resources and opportunities to stay competitive on the market and keep the current performance or aiming to increase it, by taking into consideration that the European market is a free market and the competitiveness rules apply to all market players, regardless their position within the European Union.

From the economy lens, despite of the fact that the companies may be located in European countries that are more developed than others, they thrive to stay competitive on the global market, therefore the pressure to adapt, to stay flexible and be agile may become a burden on the management's shoulders.

The paper aims to provide theoretical background in order to facilitate the understanding of the connection between the innovation and, furthermore, the innovation management process, through its multiple definitions given its multidisciplinary character and the need of the company to develop its agility and flexibility, so that it may encourage the development of its business model innovation, depending on the types of innovation that can be applied given the company's particularities.

The final goal is oriented towards the company's performance, through an innovated business model, single or multiple, that would be only set up depending on the company's available resources and needs and which will be measured through revenue growth, efficiency growth and organizational capabilities, by highlighting the importance of the innovation management, in order to be aware of any negative impact and mitigate any potential risks.

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Assessing the Relationship Between Corporate Social Responsibility and Financial Performance in the Oil and Energy Romanian Industry

Nour LAKISS

Abstract The purpose of this study is to examine the influence of corporate social responsibility (CSR) on the financial performance (PF) of firms working in the oil and energy sector in the Romanian market in order to develop a realistic approach for evaluating company's profitability. Accounting metrics (ROA, ROE, ROIC, EPS), liquidity parameters (current ratio), and market-based indicators were used to assess the financial performance of the firm treated as a dependent variable (PBV). As per the findings of a regression analysis, CSR has a favorable impact on EPS but no impact on ROA, ROE, ROIC, or PBV. In the first model, the variable CA ANG had a negative impact on ROA and a negative impact on ROE (where the total number of workers indicates the company's size and the Long-term debt / Equity ratio represents the debt). Furthermore, CA ANG had a positive impact in the second model (where total assets indicate firm size and the ratio Total debt / Equity denotes debt), a negative influence in the two ROIC models, and a positive impact on the PBV. When it comes to size metrics, the total number of workers has a favorable impact on ROA and PBV. In the case of debt, the variable DT CP has a negative impact on ROE and ROIC, but the variable DTL CP has a positive impact on ROIC and a negative impact on PBV. The two models that included the liquidity ratio as a dependent variable were not statistically valid.

Keywords Corporate social responsibility · Financial performance · Financial indicators · Pane · Regression

1 Introduction

Corporate social responsibility (CSR) expectations have recently risen; firms are under increasing pressure to conduct their operations while considering social and environmental implications and maintaining profitability. Firms should be socially accountable in both their production and the redistribution of profits among various

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stakeholders (Capron, 2000). They should incorporate sustainability into their operations in order to mitigate the impact of limited resources on their financial performance.

Furthermore, sustainable development emerges as a new opportunity for improving the quality of economic growth and disseminating its benefits to all levels of society by creating value through more proactive and better-controlled risk management (Olivier, 2002). Olivier (2022) has found that corporate behavior is already impacted by sensitivity to sustainability initiatives to solve the company's multiple problems.

Globalization compels businesses to use their resources to assist and solve social problems within societies they manage. The engagement in stable relationships with stakeholders and efficient utilization of resources will increase shareholder income and help the company create intangible assets considered as great competitive assets in comparison to other companies. Companies must accomplish their strategic goals and profit by adhering to business conduct in society (Simionescu and Gherghina, 2014).

CSR practices are embraced either as a result of government compulsion or as a result of the advantages they provide to businesses. (Dumitrescu and Simionescu, 2015). CSR is among the most important aspects that determine a company's profitability. By accumulating reputational capital, it aids the organization in becoming more lucrative. As a result, the firm will be able to get better trade agreements in discussions with stakeholders, as well as increased consumer satisfaction and retention. It also enables businesses to take advantage of new investment and finance alternatives, as well as cost-cutting potential, by minimizing risk and favorably affecting staff productivity and retention.

This study aims to examine whether corporate social responsibility (CSR) has a positive or negative influence on financial performance (FP) using data for 11 companies active in the energy and oil sector listed on the Bucharest Stock Exchange during the period of 2011 to 2018.

Human resources) on employees' satisfaction in Romania and which dimension has the most impact among the dimensions?".

2 Literature Review

2.1 Corporate Social Responsibility

Due to its association with success the concept of corporate social responsibility remains unclear and contentious though it has been discussed in academic circles for decades (Miron and Petrache, 2012). This standard has established a unified agenda for business and society by accommodating new concepts like CSR, ethical behavior, and corporate environmental concerns. As a result, the CSR concept has garnered significant theoretical and empirical consideration.

CSR was defined by Bowen in 1953 as a set of necessary principles that managers and business owners must follow while executing approaches, making choices and establishing strategic activities that are in line with societal expectations and values. His CSR outlook reflects the insight that businesses can no longer disregard the importance of their societal influence.

The function of CSR in fostering a healthy society has been hotly disputed by academics. Carroll's (1979) CSR classifications, which encompass economic, legal, ethical, and discretionary duties, have an influence on comprehending the scope of firms' societal commitments. He highlights that the economical obligation of businesses is to make products, offer services that society demands, and sell them for profitability while adhering to legal restrictions. Other duties are established based on the notion that businesses are supposed to follow all applicable laws while attempting to generate a profit, as well as acting ethically in areas not governed by legislation (Banerjee, 2007).

When a corporation commits to contributing to the societal well-being through its business operations and resources, it is considered socially responsible (Kotler et al., 2005). In other words, while fulfilling the basic goal of creating a profit –the goal for which the firm thrives- ethics and regulatory compliance stand for the core of CSR. It refers to a range of organizational endeavors that benefit both community and businesses (McWilliams and Siegel, 2001). The company's culture must incorporate sustainability and CSR, for instance all workers are vital elements in the CSR formula (Stanciu and Bran, 2015). To sum up the preceded perspective; responsibility is nothing more than a lucrative business.

Still, embracing CSR guidelines is a difficulty considering the lack of research institutes and qualified assistance. It turns out to be an integrated phenomenon based on a common pattern adopted from industrialized nations, rather than a clear understanding of its key importance in the evolution and shaping of each community (Porter and Kramer, 2011).

The basic assumption that underpins current CSR thinking is harmonizing the interests of many stakeholder groups. Freeman et al., (2010) suggests more prospects—incorporation of social, ethical, and environmental factors- for adapting strategies to CSR, as conditions required in the corporate plan. There are many justifiable reasons for a firm to be investing in CSR initiatives listing: Authenticity and brand boosting, synergistic creation besides establishing a powerful competitive advantage (2006) (Husted and Salazar).

2.2 Financial Performance

Financial performance is a broad indicator of a company's ability to obtain revenue from its key business model assets. It reflects the company's long-term financial stability. The major purpose of the firm is to maximize the market value of capital investors' assets. The finest investment decisions result in a rise in the market worth of

the company's capital. In addition, evaluating a company's performance is a complicated procedure that necessitates the use of numerous financial ratios based on the concept of value creation (Stancu, Brașoveanu, and Stancu, 2015). The management evaluate firm's performance through a wide range of profitability indicators in order to enhance its effectiveness. These indicators mostly include financial performance ratios, profit related or other financial ratios generated from them.

As for the relationship between PF and CSR, the reasons why organizations adopt and implement CSR initiatives varied according to the researchers: Friedman (1970) claims that CSR results in additional costs that may surpass profit, impacting shareholder returns. On the other hand, according to Freeman (1984), managers should be mindful about the stakeholders, for the efficiency of the business. Thus, the literature demonstrated the existence of negative relationship between CSR and FP (Gherghina, Vintila and Dobrescu, 2015;) and positive relationship between CSR and FP (Baird et al., 2012; Adeneye and Ahmed, 2015; Franzoni et al., 2021).This diversity will be tackled in this study to find out the link between CSR performance and corporate financial performance.

3   Methodology

3.1   Hypotheses

The aim of this article is to investigate empirically whether the corporate social responsibility impacts positively or negatively the financial performance of the listed Romanian companies on Bucharest Stock Exchange, operating in oil and energy industry. Thus, the below hypotheses will be tested:

H0: CSR had a positive impact on the FP.

H1: CSR had a negative impact on the FP.

H2: There is a positive relationship between company size and financial performance.

3.2   Sample

This study's sample includes quarterly data from 11 Romanian companies operating in the oil and energy industry from 2011 to 2018 listed on the Bucharest Stock Exchange. The CSR data was derived from the following resources: Companies' annual reports, CSR reports, governance reports, rules of ethics and conduct, and ISO standards implementation. Financial data was extracted from the Thomson Reuters Eikon and Bucharest Stock Exchange database, such as income statements and balance sheets for the period 20,011–2018.

Table 1 Variables' description

Type	Variables	Calculation
Dependent variables	Return on equity	$ROE = Net\ profit \div Eauity$
	Return on assets	$ROA = Netpofit \div Totalassets$
	Return on invested capital	$ROIC = EBIT(1 - TC) \div CI$
	Earnings per share	$EPS = Netprofit \div Numberof shares$
	Price-to-Book Value	$PVB = Marketcapitalization \div Netbookvalue$
	Overall liquidity ratio	$RLC = Currentassets \div Short - termdebts$
Independent variables	Social responsibility	Dummy variable
	Turnover/Total number of employees	$CA\_ANG = Turnover \div Totalnumberof employees$
Control variables	Company size	Total assets
		Total number of employees
	Years of listing on BSE	Number of years of listing on BSE
	Degree of indebtedness	$DTL\_CP = Longtermdebt \div Equity$
		$DT\_CP = Totaldebt \div Equity$
		$TA\_CP = Totalassets \div Equity$

Source: Authors' own research

3.3 Description of Variables

Table 1 lists the variables that were used in this study.

3.4 The Regression Model

The empirical relationship between CSR and the FP of the companies' sample was investigated using the panel data regression model as follows:

$$Y_{it} = \alpha_{0i} + \beta_1 * x_{it} + u_{it} \cdot \cdot \cdot \cdot \cdot i = 1, \ldots, N; t = 1, \ldots, T$$

In separate regression equations, the financial performance variables ROA, ROE, ROIC, EPS, RLC, and PBV were considered dependent variables. CSR and CA_ANG were considered independent. Whereas the degree of indebtedness, the years of listing of Bucharest Stock Exchange and the company size were considered as explanatory variables.

4   Findings Discussions

Table 2 showed the regression results with ROA as the dependent variable; CSR has no effect on ROA in both models. As for the variables representing the company size, NrTotAng is significant in the first model and positively influence ROA. However, TA (total assets) is not significant in the second model.

Table 3 shows the outcomes of the regression results for the dependent variable ROE. In both models, CSR has no effect on ROE. The variable CA ANG has a negative impact on ROE in the first model and a positive impact on ROE in the second model. The two models show that the independent variables can both impact ROE, and thus both ROE models have statistical significance.

Table 4 demonstrates the results where ROIC is used as dependent variable; results showed that CSR has no effect on ROIC in both models. CA_ANG has a negative impact on ROIC in both models. In terms of indebtedness, DTL_CP has a positive impact on ROIC, whereas DT_CP has a negative impact on ROIC. Both ROIC models have been statistically validated.

Table 5 shows the model where the independent variable was EPS; the results showed that CSR is significant and has a positive impact on EPS. There is no effect of indebtedness variables on EPS. This model was statistically validated.

Table 6 shows the model where the dependent variable was PVB. The results showed that CSR has no effect on PBV. DTL_CP has a negative impact on PBV when

Table 2 ROA model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	0.016130	1.083499	0.2818	0.020604	1.353567	0.1796
CA_ANG	–2.16E-05	–2.221908	0.0290	–1.53E-05	–0.962429	0.3387
ANI_LIST	–0.000694	–0.573569	0.5678	–0.000795	–0.640784	0.5234
NRTOTANG	4.49E-06	3.072678	0.0029	–	–	–
TA	–	–	–	5.68E-09	1.974570	0.0517
DTL_CP	–0.048224	–0.520874	0.6039	–	–	–
DT_CP	–	–	–	–0.026944	–0.867023	0.3885
C	0.026190	1.749024	0.0840	0.031098	2.113192	0.0376
R-squared	0.214055			0.171119		
F-statistic	4.466593			3.385711		
Prob(F-statistic)	0.001195			0.007869		
Durbin-Watson	0.689965			0.684005		
Hausman	0.6221			0.1527		
Jarque–Bera	0.000002			0.000003		
Breusch-Pagan	0.0000			0.0000		

Source: Authors' own research

Table 3 ROE model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	0.490017	0.988996	0.3256	− 0.017865	− 0.046694	0.9629
CA_ANG	−0.001432	−4.421488	0.0000	0.001097	2.737804	0.0076
ANI_LIST	0.021508	0.533829	0.5949	− 0.015899	− 0.509581	0.6117
NRTOTANG	3.92E-06	0.080673	0.9359	–	–	–
TA	–	–	–	− 1.21E-08	− 0.166998	0.8678
DTL_CP	3.92E-06	1.832171	0.0706	–	–	–
DT_CP	–	–	–	− 6.042072	− 7.735407	0.0000
C	−0.526918	−1.057300	0.2935	0.673051	1.819606	0.0725
R-squared	0.221525			0.531741		
F-statistic	4.666830			18.62336		
Prob(F-statistic)	0.000846			0.000000		
Durbin-Watson	0.00000			0.824173		
Hausman	0.4535			0.0012		
Jarque–Bera	0.00000			0.00000		
Breusch-Pagan	0.00000			0.00000		

Source: Authors' own research

Table 4 ROIC model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	0.115512	1.426329	0.1576	0.072091	0.914397	0.3632
CA_ANG	−0.000311	−5.884357	0.0000	−9.62E-05	−1.165473	0.2472
ANI_LIST	0.004465	0.677969	0.4997	0.000123	0.019084	0.9848
NRTOTANG	4.58E-06	0.576794	0.5657	–	–	–
TA	–	–	–	7.05E-09	0.473602	0.6370
DTL_CP	1.164544	2.312214	0.0233	–	–	–
DT_CP	–	–	–	−0.492319	−3.058708	0.0030
C	−0.096435	−1.183856	0.2399	0.048591	0.637506	0.5256
R-squared	0.343396			0.372265		
F-statistic	8.577015			9.725676		
Prob(F-statistic)	0.000001			0.000000		
Durbin-Watson	1.112008			0.590653		
Hausman	0.0826			0.2447		
Jarque–Bera	0.00000			0.00000		
Breusch-Pagan	0.00000			0.00000		

Source: Authors' own research

Table 5 EPS model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	1.690457	2.879096	0.0051	1.868024	3.208461	0.0019
CA_ANG	–0.000215	–0.559575	0.5773	2.79E-05	0.045796	0.9636
ANI_LIST	–0.085211	–1.784728	0.0780	–0.077180	–1.625516	0.1079
NRTOTANG	–1.21E-05	–0.210832	0.8335	–	–	–
TA	–	–	–	–1.72E-07	–1.566146	0.1212
DTL_CP	–5.047508	–1.382317	0.1706	–	–	–
DT_CP	–	–	–	–0.653168	–0.549509	0.5841
C	1.163013	1.969286	0.0523	1.003518	1.782818	0.0783
R-squared	0.144097			0.151017		
F-statistic	2.761044			2.917229		
Prob(F-statistic)	0.023494			0.017882		
Durbin-Watson	0.109403			0.121672		
Hausman	0.0018			0.0003		
Jarque–Bera	0.00000			0.00000		
Breusch-Pagan	0.00000			0.00000		

Source: Authors' own research

it comes to indebtedness variables. PBV is impacted positively by NRTOTANG, whereas TA has no effect on PBV.

Table 7 showed the model, in which the dependent variable was RLC. CSR is not statistically significant and has no impact on RLC. CA ANG has no impact on RLC. Liquidity has no effect on the indebtedness factors. RLC was not statistically validated in the two models. The independent variables had a minor impact on the total variation of RLC for the two models.

5   Conclusion

The purpose of this article is to analyze the impact of corporate social responsibility (CSR) on the financial performance (FP) for companies operating in the oil and energy industry in Romanian in order to suggest a practical framework for assessing companies' performance. Analyzing the data of 11 Romanian companies listed on the Bucharest Stock Exchange from 2011 to 2018 by using quantitative approach and regression analysis, the results revealed that CSR has no impact on ROA, ROE, ROIC, and PBV. However, it has a positive effect on EPS. This result was found by Simionescu and Gherghina, (2014). This means that the more the firms spends in CSR initiatives, the higher their financial performance, as reflected by EPS, will be in the long run. CSR practices have a positive impact on employee performance at work.

Table 6 PVB model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	t	0.973308	0.3333	0.120695	1.450462	0.1507
CA_ANG	0.000320	6.336382	0.0000	0.000324	3.717607	0.0004
ANI_LIST	– 0.001562	–0.248328	0.8045	–0.000145	–0.021369	0.9830
NRTOTANG	2.48E-05	3.267126	0.0016	–	–	–
TA	–	–	–	2.32E-08	1.477221	0.1434
DTL_CP	– 1.250590	–2.600228	0.0110	–	–	–
DT_CP	–	–	–	–0.110090	–0.648037	0.5188
C	0.471223	6.057825	0.0000	0.434970	5.406833	0.0000
R-squared	0.399709			0.298926		
F-statistic	10.92010			6.992675		
Prob(F-statistic)	0.000000			0.000017		
Durbin-Watson	0.252590			0.196807		
Hausman	0.2033			0.0126		
Jarque–Bera	0.105089			0.000000		
Breusch-Pagan	0.000000			0.000000		

Source: Authors' own research

Table 7 RLC model

Independent variables	(1)			(2)		
	Coef	t-statistic	Prob	Coef	t-statistic	Prob
CSR	– 1.408059	– 0.854323	0.3954	– 1.629399	– 0.982912	0.3285
CA_ANG	– 0.001597	– 1.482654	0.1420	– 0.000219	– 0.126382	0.8997
ANI_LIST	– 0.144437	– 1.077715	0.2843	– 0.127216	– 0.941027	0.3495
NRTOTANG	– 0.000162	– 1.001534	0.3195	–	–	–
TA	–	–	–	– 3.60E-07	– 1.147887	0.2544
DTL_CP	– 17.97214	– 1.753394	0.0833	–	–	–
DT_CP	–	–	–	– 3.833435	– 1.132688	0.2606
C	8.161364	4.923071	0.0000	7.477640	4.665723	0.0000
R-squared	0.109843			0.091566		
F-statistic	2.023724			1.653046		
Prob(F-statistic)	0.083789			0.155323		
Durbin-Watson	1.138893			1.132483		
Hausman	0.7549			0.8751		
Jarque–Bera	0.00000			0.000000		
Breusch-Pagan	0.000000			0.000000		

Source: Authors' own research

The indicator CA_ANG had a positive impact on ROA and PVB. This result was demonstrated by Dumitrescu and Simionescu, (2015). The two models in which the liquidity ratio was used as the dependent variable were not statistically validated. In terms of size, the total number of employees has a positive impact on ROA and PBV. Additionally, firms should adapt their CSR spending to reflect changes in EPS over time. This result gives an overview of long-term CSR investment in the Romanian context. The researcher's main limitation was a lack of a data, which resulted in a small number of statistical observations included in the sample. In terms of future research, the researcher recommends the use of a larger sample of data and a longer analysis period to generate more reliable results, besides incorporating data from various industries to ensure a better approach for companies operating in Romania regarding their CSR investment. As well as including more performance indicators such as EVA and MVB.

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Evidence from Romanian Companies on the Effect of Corporate Social Responsibility on Employee Satisfaction

Nour Lakiss

Abstract The following study's purpose is to examine at how corporate social responsibility CSR affects employees' employee satisfaction, which is assessed by a positive attitude toward their work, in companies listed on the Bucharest Stock Exchange. CSR has three aspects: environmental, community service, and human resources. A questionnaire was created and distributed via Google Forms to 84 Romanian businesses in order to collect data. To investigate the link between the dependent and independent variables, research questions and hypotheses were developed. The data collected using the SPSS system was then analyzed. Employees in higher managerial positions at the chosen firms were included in the respondents. There were 589 surveys collected that could be analyzed. The results of the study showed that corporate social responsibility has a favorable effect on employee satisfaction in Romania through its chosen aspects, which in turn helps increase employees' performance at work.

Keywords Corporate social responsibility · Environment · Employee satisfaction · Human resource · Community service

1 Introduction

Competition between corporations is identified based on a variety of factors, such as human resources, operational effectiveness, customer happiness, and other concerns. Competent employees enable a corporation to obtain several advantages when corporations are competing (Lu et al., 2020). As a result, it is important to note that, according to Osborne and Hammoud (2017), a particular firm must pursue profit maximization in order to exist in the market. In order to sustain profitability, it was also noted that corporate leaders must take into account the involvement and participation of employees. Additionally, it was highlighted by Estacio and Cabrera (2018)

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that the involvement of employees is a sign that those who are more familiar with their work have strategies for managing work operations.

Therefore, it is essential to incorporate corporate social responsibility, which will contribute in attracting and maintaining staff. According to Petrenko et al. (2016), corporate social responsibility (CSR) refers to practices and initiatives adopted by a company as a voluntary matter that is necessary for social well-being. Corporate social responsibility concerns relating to the environment, employees, and society have recently become crucial and significant for business in general (Al-Zoubi and Al-Tkhayneh, 2019). The level of employee satisfaction is another indicator. According to Abuhashesh et al. (2019), job satisfaction relates to employees' perceptions of their attitudes about both their jobs and the workplace. The fact that these emotional states and sentiments are a result of upholding work values was added. As per Abuhashesh et al. (2019), having a job that makes you satisfied is related to essentials like motivation, productivity, and performance.

In the current study, the researcher will investigate how corporate social responsibility affects employees' satisfaction among companies that are listed on the Romanian Stock Exchange.

1.1   The Study Problem and Its Questions

The awareness of implementing corporate social responsibility has rapidly become familiar. It is worth mentioning that firms listed on the stock exchange were forced to implement corporate social responsibility. On the other hand, customers became familiar with corporate social responsibility from different aspects and they also supported firms that apply and follow corporate social responsibility. Therefore, firms might have expenses in order to implement corporate social responsibility from different aspects including: The environment, community, and employees, and these expenses will lead to satisfaction among employees. This is justified because firms are aware that they don't own their employees. So, employees may leave their jobs even after firms have spent expenses on them and then loss will be incurred. Keeping in mind that in general the main aim of firms is to have continuous profitability by considering the implementation of corporate social responsibility and spread it among different firms.

Therefore, this current study has one major question:

Q: "Is there any significant impact of corporate social responsibility through its dimensions (environmental, community services, and human resources) on employees' satisfaction in Romania and which dimension has the most impact among the dimensions?".

1.2   The Importance of the Study

For each company, it is crucial to consider concerns relating to corporate social responsibility. Also, it is vital to remember that implementing corporate social responsibility will enable workers to get associated with and take part in business activities. Corporate social responsibility is therefore essential for boosting workplace relationships. A company should also provide corporate social responsibility initiatives that reflects the demands and requirements of its personnel. Bearing in mind that a company that practices CSR will provide its its staff with the opportunity to express their values in a variety of topics, such as: Community service and charity.

Additionally, businesses invest in their employees' training in order to raise their credentials and boost production. As a result, anytime employees receive quality training, this will improve their performance and commitment.

1.3   Research Model

The link between the independent and dependent variables, which were established based on several studies, is presented in the study's model. As an illustration, consider the study done by Ali et al. in 2021, which examined the environmental aspect of corporate social responsibility. In addition, Appiah (2019) and Gahlawat (2015) conducted a research that, respectively, looked at community service and human resource elements. However, Omer (2018)'s research looked at employee happiness as a dependent variable (Fig. 1). Relying on studies of Ali et al., (2021), Appiah (2019), Gahlawat (2015), and Omer (2018), the below model was designed.
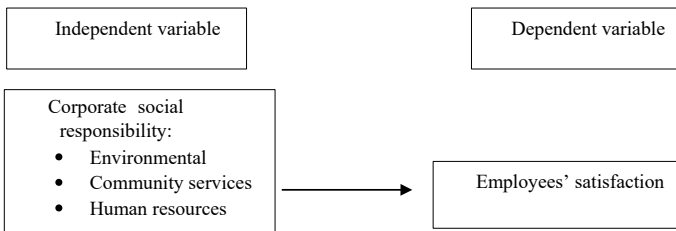
Fig. 1 Variables description. Source: Authors' own research on the basis of (Ali et al., (2021), Appiah (2019), Gahlawat (2015), & Omer (2018))

2   Literature Review

2.1   *About Corporate Social Responsibility*

According to Appiah (2019), corporate executives are now putting more emphasis on all stakeholders. Furthermore, according to Omer (2018), corporate social responsibility is regarded as a contemporary idea that is connected to the ethical business practices of a particular company.

Additionally, according to Shuli & Suwandee (2017), corporate social responsibility encompasses a variety of perspectives, definitions, and techniques. A company is likely to make contributions to its stakeholders through corporate social responsibility, which is involved with more than just the interests of stakeholders in a corporation. Additionally, Ali et al. (2021) discovered that it is advantageous for staff members to participate in CSR initiatives and make contributions in order to enable businesses to develop Csr activities as stakeholders. It was also stated that as workers are more conscious about these corporate social responsibility initiatives, their awareness of CSR will affect how they respond to such approaches.

According to Gazzola and Mella (2016), the analysts found that companies generally engage in CSR activities in response to stakeholder demands from outside the company as well as because they are aware of the benefits CSR has on a company's reputation. Also, businesses that practice corporate social responsibility might tackle the measures taken to raise employee dedication, productivity, and attitude. According to the same study, the relationship between workers' contributions and corporate social responsibility is seen as a collection of methods and processes that take into account people's linguistic expression and knowledge when evaluating their significance, worth, and relevance. Also, firms that apply corporate social responsibility are able to address the efforts spent to improve workers' motivation, performance, morale, and commitment. In the same study, it was stated that the link between the contribution of employees and corporate social responsibility is considered as a group of tools and techniques that consider the experience of people and their verbal expression whenever examining their meaningfulness, value, and applicability.

Cazeri et al. (2018) noted that through taking part in social, economic, and environmental management, a company's social responsibility seems to have an impact on overall continuity. Furthermore, Ali et al. (2021) claimed that businesses demonstrate their commitment to society via corporate social responsibility by displaying their admirable deeds on a national, regional, or local level. The experts likewise suggested that a specific company think about incorporating corporate social responsibility into its agenda because doing so will enhance a business's overall efficiency.

As per Sarkar and Searcy (2016), corporate social responsibility means that a particular firm must primarily account for both its moral and economic responsibilities that go above and beyond the requirements of the law. As a result, the business will always act ethically while doing anything that has an impact on stakeholders in a community, especially when it comes to sustainability efforts around the world.

Returning to the study by Ali et al. from 2021, corporate social responsibility encompasses both the psychological and behavioral impact on staff where employees participate in everyday activities related to corporate social responsibility, watch the results, and develop an awareness of the CSR practices of their workplace as a whole.

2.2 The Dimensions of Corporate Social Responsibility

Environmental practices. Environmental practices. As asserted by Chwilkowska-Kubala et al. (2021), the primary goal of environmental practices is to lessen environmental harm and strengthen an organization's commitment to environmental sustainability. Environmental practices likewise address the activities that a company considers taking in order to lessen its impact on the environment. As a result, environmental practices represent the steps done to safeguard natural resources. Additionally, according to Hoogendoorn et al. (2015), environmental practices comprise the activities and steps that a business considers taking in order to execute these practices inside ecologically friendly actions. According to Morales-Raya et al. (2019), a company implements and comply by environmental policies to meet users' environmental expectations, adhere to the law, and create an effective brand.

Community services practices. A community is categorized by a variety of characteristics, such as the country in which it is being developed, the virtual communities in which participants can engage, the location where the community's affiliation will take place, and a group of individuals who will engage in activities and share interests (Deigh et al., 2017). Additionally, according to Ying et al. (2022), a community is made up of members of the public, customers, and interest groups who all contribute to the company's reputation. Additionally, it was mentioned that as corporate social responsibility is linked to stakeholders within a community, it also benefits them. Corporate social responsibility will strengthen a community's ability to act, work together, and respond. The term "communication" inside a firm, as well as an awareness of its social influences, will help in developing the perception of stakeholders within a community, according to Li et al. (2019). Finally, Ying et al. (2022) pointed out that there are key elements that reflect how a firm responds to social expectations and the local community, namely: The expectation of a firm's behavior, the growth in stakeholders' ability to influence a business' operations, and the changes in how a community presents its expectations. Furthermore, according to Deigh et al. (2017), communities differ depending on a variety of specialties, such as psychological, anthropological, urban planning, philosophical, sociological, and political sciences. Additionally, it was found that whether or not people live in the same location, communities that rely on face-to-face or electronic interaction include people who are creating and fostering social connections.

Human resources practices. The main objective of human resource management is to increase a company's productivity by maximizing the effectiveness of its employees (Chong et al., 2020). It was also mentioned that using human resource management techniques can help a company's strategy by giving services that focus

on the value of its clients. The use of human resources by a company and its competitive strategy are intrinsically tied (Kutieshat and Farmanesh, 2022). According to the same study, the development of information technology and its integration with new human resource management practices may result in innovative performance, which will reduce risks and failures. Additionally, any company's human resources are considered to be the key component in gaining a competitive advantage, implying that implementing human resource policies can affect how well a particular organization performs. It's interesting to note that it was also mentioned that the use of human resource practices in relation to the empowerment, support, and development of a firm's culture is thought to have a good association with both its performance and innovation performance (Kundu and Gahlawat, 2015). According to Chong et al. (2020), managing human resources is seen as a strategic method that is used to handle employment-related issues that are beneficial to employees' skills in order to obtain a competitive advantage.

Employees' contentment. Employee happiness is generally influenced by a number of factors, including efficiency, work productivity, and individual well-being. Different leadership and motivational techniques can affect each employee differently, which will improve both job satisfaction and productivity. Employee happiness is therefore seen as a crucial element in motivating and advancing workers to achieve greater results (Dziuba et al., 2020). A pleased worker is a happy worker, and according to Al-Zoubi and Al-Tkhayneh (2019), such individuals are seen as advocates for a company both internally and outside. A contented employee was also discovered to be more dedicated and devoted to the company and its objectives. The degree to which employees are satisfied with their jobs shows the general avourable mindset of the staff. Also, the physical environment of the workplace affects how satisfied employees are. In general, people's levels of job contentment are stable (Omer, 2018). Therefore, there are various elements that can result in either a higher or lower degree of employee satisfaction. That according Al-Zoubi and Al-Tkhayneh (2019), employees' satisfaction refers to the grateful and avourable response, which is an output that varies depending on the assessment of people's job experience. Managers and businesses believe that supplements and salary are two important workplace variables that influence employees' satisfaction.

3 Methodology

3.1 *Hypotheses*

This study intends to investigate the impact of Romanian corporate social responsibility on employee satisfaction across three areas: The environment, community service, and human resources.

H1: In Romania, corporate social responsibility has a avourable effect on employee satisfaction.

H1. A: In Romania, the environmental dimension has a avourable effect on employee satisfaction.

H1. B: The community service dimension has a avourable effect on employee satisfaction in Romania.

H1. C: In Romania, the human resource factor has a avourable effect on employee satisfaction.

3.2 The Used Method and Tool

A quantitative approach is used in the current study. Interestingly, it is beneficial for a variety of reasons, including time and money savings, generalization, and replicability (Abuhamda et al., 2021). Questionnaires were used to gather the data. The 84 enterprises that are listed on the Bucharest Stock Exchange make the population of this study, which consists of employees in higher management. With the assistance of a company that specializes in sending questionnaires, surveys were sent using Google Forms. Additionally, an average of 7 surveys per firm out of 589 total questionnaires were pertinent to analysis.

3.3 Test–Retest Reliability

Test-Retest The study tool's reliability was tested initially on a small sample of (45) observations in the month of (4) of (2022). The test was then repeated and it was discovered that there was a match in the sample replies of 88.69 %, showing a high level of validity in the questionnaire. Additionally, the following reliability test analysis, model validation, and convergent validity analysis of the study model were adopted:

The internal consistency and consistency of the questionnaire paragraphs were tested using Cronbach's alpha, and the results showed that (Alpha $\geq$ 0.70) indicates a high level of stability in the research variable and is regarded appropriate according to prior studies (Aslanidis and Hartigan, 2021; Shrestha, 2021; He et al., 2021; Spoorthy et al., 2021). However, the factor loadings were used to assess the convergent validity of the responses, and according to a different study (Van et al., 2020; Cho, 2021), all factor loadings should be higher than (FL > 0.50). Cronbach's alpha values for all variables are higher than the suggested value of (70%), as shown by the data in Table 1, where the values ranged from (0.712) as the lowest value, which was for the Environmental dimension, and (0.919) as the highest value, which was for the Human Resources variable. This clearly shows that Cronbach's alpha coefficient ratios imply a high degree of stability for all questions of variables within the questionnaire. The analysis's results also show the convergent validity of all the questionnaire's variables' questions, as evidenced by the fact that all of their FL values are greater than the suggested level of (50%), with values ranging between (0.525–0.982) The

researcher believes that this is because the study sample observations were carefully chosen for this study, based on the results of the analysis that demonstrate the validity and reliability of the study instrument.

Descriptive analysis. Using a Google Form, the survey was disseminated online to (589). The researcher had to exclude (49) incomplete questionnaires from the study sample. The (540) surveys were included in the final analysis. The study sample's demographic distribution is shown in Tables 2 and 3:

According to prior findings of the authors' own research, the descriptive analysis of the research variables show that the Human resources dimension had the highest

Table 1 Variables reliability and validation of model

Environmental		Factor Loading (FL > 0.50)	Cronbach's (α ≥ 0.70)
E1		0.597	0.712
E2		0.645	
E3		0.785	
E4		0.747	
E5		0.811	
Community services		Factor Loading (FL > 0.50)	Cronbach's (α ≥ 0.70)
CS1		0.678	0.842
CS2		0.691	
CS3		0.696	
CS4		0.525	
CS5		0.716	
Human resources		Factor Loading (FL > 0.50)	Cronbach's (α ≥ 0.70)
HR1		0.802	0.919
HR2		0.678	
HR3		0.824	
HR4		0.709	
HR5		0.647	
SMEs performance		Factor Loading (FL > 0.50)	Cronbach's (α ≥ 0.70)
Employees' satisfaction	ES1	0.802	0.820
	ES2	0.708	
	ES2	0.982	
	ES3	0.587	
	ES4	0.799	
	ES5	0.799	

Source: Authors' own research

Table 2 The results of the descriptive test for the distribution of the study sample

Item		Choice	Frequency	Percentage
Personal information	Gender	Male	60	11.1%
		Female	480	88.9%
		All	540	100.0%
	Level of education	Diploma	22	4.1%
		Bachelor	265	49.1%
		Higher diploma	105	19.4%
		Masters	109	20.2%
		PhD	39	7.2%
		All	540	100.0%
	Age	From 35 or Less	26	4.8%
		From 35 -40	342	63.3%
		From 40–45	141	26.1%
		From 45–50	12	2.2%
		More than 50	19	3.6%
		All	540	100.0%
	Level of experience	Less than 5 Years	38	7.0%
		(5- less than 10) Years	33	6.1%
		(10- Less than 15) years	346	64.1%
		15 years and Above	123	22.8%
		All	540	100.0%

Source: Authors' own research

Table 3 Results of the descriptive analysis of the study variables

No	Variable	Mean	Std. Deviation	Degree of approval
1	Environmental	4.003	0.297	High
2	Community services	3.531	0.867	High
3	Human resources	4.461	0.105	High Very
4	Employees' satisfaction	4.226	0.135	High Very

Arithmetical mean has a value between (1 to1.79), the result of degree of approval is "Very low"; (1.80 to 2.59) the result of degree of approval is "Low";(2.60 to 3.39) the result of degree of approval is "Medium";(3.40 to 4.20) the result of degree of approval is "High";(4.21 to 5.00) the result of degree of approval is "Very High"

Source: Authors' own research

Table 4 The results of the multiple regression test for the study model

F-statistic:	37.305		Adjusted R-Square:	0.469	
Sig (F-statistic):	0.000		R-squared:	0.472	
S.E. of regression:	0.079		R:	0.687	
Variable	Coefficient	T-Statistic	Sig.T	VIF	Tolerance
Constant	–	7.234	0.000	–	–
Environmental	0.169	5.323	0.000	1.142	0.876
Community services	0.498	15.034	0.000	1.676	0.597
Human resources	0.365	11.926	0.000	1.095	0.913

Source: Authors' own research

level of importance among the Corporate Social Responsibility dimensions, with an arithmetic mean of (4.461) and a very high degree of approval, the Environmental dimension was in second position in terms of importance with an arithmetic mean of (4.003) and a high degree of importance, and the Community services dimension was in second place in terms of importance with an arithmetic mean of (4.003).

Hypotheses test. Through the use of both (Variance Inflationary Factor) (VIF) and Tolerance (Tolerance), it was determined that there was no linear interference problem in the study models. All of the variables' VIF values were less than (10), and the analysis's findings, which are shown in the table below, showed that the Tolerance coefficient values for all variables were greater than ten (0.10). There is no evidence of a linear interference problem in the study model, according to the studies of (Ekiz, 2021; Salmerón et al., 2018) and all independent study variables pass these two indications. The following study hypotheses were therefore tested using the multiple regression test, as follow (Table 4).

Based on the authors' own research, it can be seen that the calculated F value was (37.305) and that it is significant at the level of (0.05), demonstrating the appropriateness of the suggested study model. The findings of the regression analysis also showed that the value of the (Sig. F-statistic) was (0.000), which is lower than the level of significance, which is (%), and based on the correlation value of (R = 0.687), it is obvious that the main hypothesis is accepted, which demonstrates that in Romania, corporate social responsibility has a favorable effect on employees' satisfaction. The adjusted R-square value for the regression analysis reached (0.469), which indicates that only about 46.9% of the variations in employee satisfaction can be attributed to changes brought about by the implementation of corporate social responsibility. Another study that ranked explanatory power (Purwanto & Sudargini, 2021) determined that this model's explanatory power is strong and reliable when it comes to predicting and assessing employees' satisfaction in Romania. The findings also revealed a level of significance decrease for all aspects of corporate social responsibility at the level of significance of (Sig.T 0.05), which suggests that all aspects of corporate social responsibility, as represented by environmental, community, and human resource concerns, have an effect on the employees 'satisfaction. Additionally, based on the value of the coefficients, it was discovered that each of

these dimensions has a favorable effect; as a result, the study's sub-hypotheses are all accepted. Along with the coefficient value of (0.365) that belongs to the human resources dimension, indicating that this dimension is ranked second in terms of order, and the coefficient value of community service, the environmental dimension's score of (0.169) shows that environmental influences employees' satisfaction the least in Romania among the dimensions covered by the study within the CSR application.

4 Findings Discussions

Firstly, Romanian employees are more satisfied as a result of corporate social responsibility. That is acceptable since CSR improves an organization's culture and encourages people to work with purpose. The reason for this is because anytime workers do something they are concerned about and that is important to them, they will be at ease. As a result, it will encourage employees' contribution and partaking. This outcome is aligned with a study conducted by Gazzola and Mella (2016) that found that corporate social responsibility influences employees' perceptions, which in turn affects company's environmental and societal effectiveness.

Secondly, the environmental measurement is determined to have the minor impact among the examined dimensions, yet it does have an impact on employees' contentment. That is acceptable because implementing an ecofriendly workspace will reduce the harmful effects of the business on the planet by providing a safe and sanitary working atmosphere. As a result, that will contribute to job satisfaction by boosting productivity among employees. This finding is in line with a study done by Ali et al. in 2021, which revealed a major and obvious association between the environmental factor and the level of working participation among employees.

Thirdly, the social service factor has been determined to have the highest beneficial influence on employees' happiness of all the tackled dimensions. This is reasonable because volunteering in the community often makes workers feel more linked to their place of employment. Workers who are involved in community activities outside their job are more likely to increase their output as a sign of fulfillment. This finding is in line with a study by Appiah (2019), which demonstrated the importance of community service in addressing employee fulfilment.

Fourthly, the human resource component has a favorable effect on employees' enjoyment; it is discovered to have the second-highest impact among the evaluated variables. This is reasonable since if workers are happy to work for a firm, it will show in their output, which will improve as a result of their satisfaction. Employees will be pleased about their jobs by being both dependable and contented, recognizing the fact that human resources procedures and guidelines are useful to identify various issues in a specific organization.

4.1   Limitations and Recommendations

When completing this study, the researcher encountered two major limitations: First, despite using a specialized company to send out surveys, not all recipients completed them and returned them. The absence of comparable studies in the area generally and Romania particularly was another drawback.

Furthermore, after performing this study, the researcher gave several suggestions, such as: Promoting corporate social responsibility to raise awareness of employees' roles.

It is also recommended to do the survey again while taking into account other corporate social responsibility factors. Additionally, it is advised that businesses promote sustainability inside their own walls. Another thing to think about is that it's advised for businesses to implement ecologically friendly procedures at workplace. For the sake of progress and evaluation, it is also advised to consider other industries and in various nations.

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Impact of the Germanwings Flight 9525 Air Crash: Financial Analysis and Relationship with the Media

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Abstract On March 24, 2015, the largest air accident on the European continent of the last decade took place; the Germanwings Flight 9525 crashed. The main objective of this research is to determine the economic-financial impact of this air crash on the market stock price of the involved companies, Lufthansa airline, and its manufacturer Airbus. This study also contributes to determining whether the financial value of both companies was impacted by the media activity after the event. The primary methodology used is the event study methodology, applying both the market model and the Fama–French model. The results reveal that the impact of the Germanwings Flight 9525 on the financial value of the companies involved is different, since there is a significant effect on the financial value of Lufthansa under the market model, and this effect is immediate, but there is no significant effect on the financial value of Airbus with any of the models analyzed. In the same way, it happens when analyzing the impact of the media, since there is only a significant relationship between Lufthansa's share prices and the impact of media research with the market model. These results are important for the companies involved, and especially for their investors. It also shows that the manufacturing company is less vulnerable to the impact of the media, and it does not suffer significant losses on the stock market.

Keywords Air crash · Event study methodology · Germanwings

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1 Introduction

The airline sector is known worldwide as the safest way to travel (World Health Organization, 2015); however, accidents still happen. In fact, on the morning of March 24, 2015, the worst European aviation catastrophe of the last decade took place (El País, 2015), Germanwings Flight 9525 crashed in the French Alps as a result of a fall deliberately caused by the co-pilot claiming the lives of the 150 people on board. Thus, an Airbus A320-211 took off from Barcelona Airport (Spain), and its destination at Düsseldorf International Airport (Germany) operated the flight. A short time later, it became known that the co-pilot had planned the multiple homicides.

Many questions arise as a result of the fatality, however official investigations ignore the economic aspects caused by it. Indeed, when stock markets react to air crashes, in most cases, information about the crash is not entirely available because the cause of the crash and details remains unknown. The financial impact of these devastating events on the commercial airline industry (Kaplanski & Levi, 2010) has captured the interest of many economists. In addition, for the companies involved in the event and for their investors, it is important to know if there is a negative effect after the air crash and quantify this loss.

Besides the uncertainty generated by the event, the publication of evidence obtained from research in the media can influence the decision-making of consumers and investors, so it can cause a greater decrease in the cash flow of the companies involved (Alcaide et al., 2022). This is because as the causes of the event and those responsible for it are known; thus, consumers and investors can be influenced differently by them. (Alcaide et al., 2021).

Thus, this research work focuses on analyzing the impact of the Germanwings air crash on the financial value of both the airline and the involved manufacturer, and on determining whether this financial value can be affected by the impact of the media after the event. Furthermore, our two objectives are analyzed by firstly modeling the stock prices reactions of the firms involved through the market model and Fama–French Model; secondly analyzing the impact of media on the financial value of firms empirically by applying the Event Study Methodology to both models. Hence, two research questions (RQ) are built:

RQ 1. Is there a relation between the Germanwings Flight 9525 air crash and the financial value of the involved firm, both the airline and the manufacturer?

There are very few authors who analyze the effect of air crashes on the share price of the manufacturers involved in these events and they obtain divergent conclusions. This makes it necessary to bring clarity to this issue. In addition, previous studies do not analyze a single accident, but the average of a set of air accidents.

RQ 2. In the Germanwings Flight 9525 air crash, is there a relation between the financial value of the companies involved, Lufthansa and Airbus, and the advancement of research in the media?

Most of the literature considers airlines solely responsible for accidents, and therefore the only ones affected. However, other factors can also affect the financial value of the companies involved in an air crash such as the reaction of the media. The

Germanwings Flight 9525 caused a stir in the media due to the magnitude of the event, being the only European accident because of a deliberate act, (El País, 2015). For all these reasons, it is necessary to check whether the publication of news in the media about the investigation of Germanwings Flight 9525 caused a reaction in the investors of the companies involved in the accident and consequently, in its financial value.

It should be noted that this work is a preliminary study, so it only analyzes an air crash, which allows its analysis in greater detail. Even so, the selected accident has very unique characteristics that make its study have a special interest in literature. Specifically, this accident has been selected because it is the most recent air crash with fatalities of those that happened in the EU, it is also the first accident of a low-cost line in this continent, and it is also considered the worst catastrophe of European aviation of the 2010s (El País, 2015), in addition to being the only European accident as a result of a deliberate act.

2 Literature Review

A large literature body exists about the relation between air crashes and companies' financial value. Moreover, the vast majority used the Event Study Methodology.

Many authors focus on studying the impact of an aggregate set of air crashes (Ho et al., 2013; Ho et al., 2011: Bosch et al., 1998; Davidson et al., 1989; Mansur et al., 1989; Borenstein & Zimmerman, 1988; Barrett et al., 1987); generally, these studies focus only on the financial consequences on the airline involved, and not on the manufacturer, and many compare their results with rival airlines. They all reveal that the listings value of the involved air companies, and those of rival firms, quickly react to events. For instance, Borenstein and Zimmerman (1988) indicate that airlines suffering from a crash bring shareholders to lose around one percent of their wealth. Consequently, air crashes negatively affect the price of these firms' shares during and after aviation disasters. Regarding competition, studies conclude that fatal accidents impact negatively rival airlines, while less serious ones can positively influence competing airlines. Also, the more fatalities there are, the more the profits of the company fall (Ho et al., 2013).

In contrast, very few researches have investigated the effect of air crashes on the manufacturers of these airlines. Furthermore, the financial consequences on manufacturers are inconclusive. Chance and Ferris (1987) determine that the share price of participating companies is negatively affected on the day the event takes place and a few days after the event. In the same year, Chalk (1987) analyzed a sample of air crashes to determine whether such events were related to the manufacturer, concluding almost immediate negative ARs, especially on the first day, 3 days, and 8 days after the event. While Rose (1991) shows that aircraft manufacturers are not significantly affected.

The vast majority of research has centered on the US airline industry and in the study of an average sample of companies. However, there are no studies that focus

on the study case of one air crash, as our paper proposes; only, Nethercutt and Pruitt (1996) study the effect of one crash, the US ValueJet Flight 592. They investigate the effect on the quote of both the airline and its competitors with an event-time analysis. In addition, these authors distinguish between "low cost" companies, such as the airline of the flight analyzed, and main airline companies.

It is worth considering the existence of factors whose influence may favor such an impact. One of them is the media's presence because it affects the feelings of investors on the Stock Exchange. After all, the media's activity influences investors' decisions, whose concerns are reflected in the lower demand for risk assets (Kaplanski & Levi, 2010). Consequently, the involved companies lose their reputation (Cocis et al., 2021; Li et al., 2015). Only a few authors have studied the effect of the media on-air accidents (Rodriguez-Toubes and Dominguez-Lopez, 2017; Dimitriou and Antoniou, 2017; Henderson, 2003; Boin et al., 2001), but they do not analyze their effect on the firms' share price. Thus, Walker et al. (2014) consider the link between the hypotheses of mechanical failures put forward in the media and the effect on listings. Krieger and Chen (2015) observe that when the media potentially blame a manufacturer's fault, the initial reactions in these firms are significantly negative, but the impact is insignificant if this is not the case.

The present study contributes and updates the literature about the subject, especially by analyzing a recent air crash separately, and not in an aggregate manner as other studies have done. In addition, the air crash is on a low-cost European company, while all the previous literature focuses on American airlines. Moreover, it studies the impact on the financial value of the involved manufacturer for which not so many previous pieces of evidence are available. This paper also examines the causes of the accident when abnormal results exist to investigate the relation between the factor that triggered the accident and the market's reaction, and whether the market reaction can be attributed to the media. Thus, the relation between an air crash and the media impact has barely been studied, which adds value to this work. In addition, we also focus on verifying our results with the Event Study Methodology through both the Market and Fama–French models to determine if the results differ when studying a single event. Previous studies only apply the market model.

3 Methodology

This research examines the Germanwings Flight 9525 air accident. Specifically, this paper focuses on two research questions (RQ).

According to RQ 1, this work studies the effect of an air crash on the Stock Exchange value of both involved companies, the airline Lufthansa, and the manufacturer Airbus. To this end, the closing prices of the shares of both companies were collected from the electronic trading platform of the German Stock Exchange: The XETRA system, since it is the quotation market of the country of destination of the flight. The employed data also include the average yield obtained with the DAX Stock Exchange rate and the yields of the risk-free assets issued by the German

government. This last piece of information includes the yields of both the bonds issued by the German government and of the shares of the main firms comprising this market index at the time of the accident and their market capitalization volume. All these data were obtained daily from Eurostat and Investing.com (Eurostat, 2021; Investing, 2021).

To fulfill our objective, firstly a descriptive data analysis was performed. Then the following data assumptions were verified: linearity, multicollinearity, homoscedasticity, normality.

Secondly, the methodology followed was the Event Study Methodology (Sorescu, 2017). The date when the event took place, March 24, 2015, is defined as the event day (t = 0). Then, we first calculate the daily stock returns for both firms (Lufthansa and Airbus) as:

$$Rit = (Pit - Pit - 1)/Pit - 1 \cdot *100 \tag{1}$$

where: Rit represents the daily profitability of the shares of a firm i on day t belonging to the estimation window; Pit represents prices of the shares of a firm i on day t belonging to the estimation window.

Then we calculate the ARs (ARit) for each firm i on day t as:

$$ARit = Rit - E(Rit) \tag{2}$$

Three models exist to make the short-term calculation E(Rit) (Sorescu, 2017): The market model (Brenner, 1979), the market-adjusted model (Brown & Warner, 1985), the Fama–French model (Fama & French, 1993). However, the results of the first two models are similar over a short-term window. This is why the present study selects the Market model, which has been widely used in the literature, and, the Fama–French model.

According to the Market model, E(Rit) is:

$$E(Rit) = rft + Bi * \cdot[E(Rmt) - rft] \tag{3}$$

where: Rmt is the average rate of return of all the stocks trading on the DAX stock market at time t, rft is the risk-free rate of return at time t, and β is the risk factor estimated from regression.

The employed risk-free assets are calculated by applying an arithmetical rate according to Expression 1. To calculate the market's yield, the rate defined by Expression 4 is applied.

$$E(Rmt) = (Mit - M(it - 1)) \cdot / \cdot M(it - 1) \cdot *100 \ldots \tag{4}$$

where Mit refers to the market index value at time t.

According to the Fama–French model, E(Rit) is defined as:

$$E(Rit) = rft + B(i1) \cdot * \cdot [E(Rmt) - rft] + B(i2) \cdot * \cdot SMB \cdot + \cdot B(i3) \cdot * \cdot HML$$
$$(5)$$

The three risk factors $\beta(i1)$, $\beta(i2)$, $\beta(i3)$ are obtained by OLS regression. The two new variables, Small Minus Big (SMB) and High Minus Low (HML) are obtained with the data from the German market. SMB represents the risk size and is calculated as the daily difference of the mean of the yields of the three companies with less market capitalization and the mean of the three companies with more capitalization. Factor HML represents the risk value and is estimated as the daily difference of the mean of the yields of the three firms with a high listing price and the mean of the three firms with a low listing price (Hunga & Liu, 2005).

Both the Market and Fama–French models estimate the expected returns (E(Rit)) of the airline and involved manufacturer when no accident occurs. To estimate models, we use data from 255 to 46 days before of event (Ho et al., 2013; Nethercutt & Pruitt, 1996).

Having obtained the ARs (ARit), we then calculate the CARs (CARie) for each firm i as follows:

$$CARie = \sum_{t=t_1}^{t_2} AR_{it} \qquad (6)$$

where t1 and t2 respectively represent the start and end of the event window.

For our study, we define an event window from 7 days before the event day (t = 0), and 7 days after the event (Nethercutt & Pruitt, 1996); that is, from March 4 to April 2, 2015.

Finally, to test the significance of the impact, that is, if the effect on the listings of the involved firms is strong, a significance test is used (T-Test) according to Expression 7:

$$T - Test = ARit \cdot / \cdot SE \qquad (7)$$

where SE is the standard error or standard deviation of all the collected daily data. The hypothesis that no relation exists between an accident happening and companies' stock market listing is rejected if the absolute T-Test value is higher than 1.96 (Corrado & Zivney, 1992).

According to the RQ 2, we propose a case study of the different media, mainly written and digital press, which published news about the Germanwings air crash from the same day of the event and during the following 7 days, that is, from March 24 to April 2, 2015.

This information will be compared daily with the ARs obtained in the RQ1. We will consider that the media caused an impact on the quotes of both companies analyzed, if, on the same day that the news is published in the media about the investigation of the air crash, the AR is significant.

In addition, as ARs are calculated with two different valuation models, the market and Fama–French model, it will be possible to find out if there are differences in terms of the possible relation between the financial value of companies and publications in the media, depending on the model used.

4 Results and Discussion

4.1 RQ 1. Is There a Relation Between the Germanwings Flight 9525 Air Crash and the Financial Value of the Companies Involved, Lufthansa and Airbus?

First, the results obtained for the airline Lufthansa are analyzed (Table 1), justifying its variations in the shares' price with the news published in the media, which are the basis for the analysis of RQ 2.

According to the obtained AR in Table 1, we confirm a significant effect between the event and Lufthansa's financial value on the event day according to the Market model. It is observed that Lufthansa's risk premium on the day of the event was 4.22% below that expected in the absence of the event. This is a significant drop, and

Table 1 Daily abnormal returns (AR), cumulative abnormal returns (CAR), and daily T-statistics for Lufthansa

Event date	Market Model			Fama–French Model			Reaction in the media
	AR	CAR	T-Test	AR	CAR	T-Test	
− 7	5.04%	16.00%	2.9699	− 0.59%	− 5.52%	− 0.3289	
− 6	−1.31%	14.69%	−0.7713	− 1.35%	− 6.87%	− 0.7497	
− 5	12.53%	27.22%	7.37861*	2.80%	− 4.07%	1.55897	
− 4	−2.36%	24.85%	−1.3922	1.64%	− 2.43%	0.91411	
− 3	3.86%	28.71%	2.27078*	2.19%	− 0.24%	1.22226	
− 2	−0.44%	28.27%	−0.2599	0.72%	0.48%	0.40082	
− 1	−9.75%	18.52%	−5.7402*	− 0.48%	0.00%	− 0.2681	
0	−4.22%	14.30%	−2.483*	− 2.05%	− 2.05%	− 1.1452	YES
1	−9.28%	5.02%	−5.4639*	− 2.81%	− 4.87%	− 1.5688	YES
2	4.51%	9.53%	2.65354*	− 3.00%	− 7.86%	− 1.6694	NO
3	1.50%	11.03%	0.88131	0.08%	− 7.78%	0.04704	NO
4	5.24%	16.27%	3.08856*	− 0.84%	− 8.62%	− 0.4677	YES
5	−6.80%	9.47%	−4.0046*	0.38%	− 8.24%	0.21395	YES
6	−2.22%	7.25%	−1.3082	0.25%	− 7.99%	0.13945	NO
7	0.14%	7.39%	0.07997	− 2.61%	− 10.59%	− 1.4529	YES

[*] Significant T-Test

undoubtedly justifiable, as a perfectly equipped aircraft had crashed for no apparent reason. This trend is maintained the day after the event, when the AR is even more significant, at –9.28%, this fall could be due to the first interventions of the authorities in the media, who raised the possibility that the accident had been the result of a deliberate act. However, 2 days after the accident, Lufthansa's risk premium results in a positive value, of 4.51%. The causes that could have caused this sudden increase are unknown. The same happens 4 days later, with a significant AR of 5.24% higher than expected. On the same day, the Düsseldorf Public Prosecutor's Office revealed that Andrea Lubitz, co-pilot of the aircraft, had previously been treated for suicidal tendencies for a long period several years before obtaining his license. The 5th day after the event, March 31, 2015, stands out for obtaining again a negative and significant AR, of –6.80%. This may have been due to news that the company knew the medical history of the co-pilot, who a few years earlier had directly informed Lufthansa that he had suffered from an episode of severe depression.

The results obtained with the Fama–French Model are substantially different. Although ARs show a generally negative trend, they do not show any significance on either the day of the event or the day after.

According to the obtained AR in Table 2, we confirm that there is no significant effect between the event and the Airbus's financial value on the event day according to the Market model, specifically it is shown that the risk premium of Airbus on the day of the event is only 0.74% below expectations, not being a significant fall. The small impact on the financial value of the manufacturer may be since the causes of the impact are not yet known, and several hypotheses are considered as a possible terrorist attack. The day after the event, the AR falls more below expectations, –2.56%, although it is not significant either. It may be logical that negative values appear after the tragic event since shareholders can show rejection towards the firm, causing the decline of its value on the stock market. Especially, the day following the event, knowledge of the crashed model and suspicions about a possible depressurization of the aircraft could have influenced the fall in the value of Airbus shares. In general, the following days show values close to 0%, although they are not significant either.

Regarding Airbus' results under the Fama–French model, they are similar to those shown with the previous financial asset valuation model. Therefore, according to the Fama–French model, we confirm that there is also no significant effect between the event and Airbus's financial value on the event day. Airbus' AR on the same day of the event was not significant at –0.85%. While the AR of the day immediately following is significant, taking a value of –3.87%.

Table 2 Daily abnormal returns (AR), cumulative abnormal returns (CAR), and daily T-statistics for Airbus

Event date	Market model			Fama–French model			Reaction in the media
	AR	CAR	T-Test	AR	CAR	T-Test	
− 7	1.29%	7.06%	0.68519	1.69%	7.59%	0.87004	
− 6	−1.94%	5.12%	−1.0305	−2.82%	4.77%	−1.4491	
− 5	−3.42%	1.70%	−1.8133	−2.50%	2.26%	−1.2882	
− 4	0.63%	2.33%	0.3339	0.39%	2.65%	0.19854	
− 3	−0.20%	2.13%	−0.1073	−0.40%	2.25%	−0.2076	
− 2	0.25%	2.38%	0.13289	−0.59%	1.66%	−0.3025	
− 1	−2.38%	0.00%	−1.2621	−1.66%	0.00%	−0.8531	
0	−0.74%	−0.74%	−0.3906	−0.85%	−0.85%	−0.4355	YES
1	−2.56%	−3.30%	−1.3603	−3.87%	−4.72%	−1.9922*	YES
0.2	1.13%	−2.17%	0.59857	1.93%	−2.79%	0.99434	NO
3	0.13%	−2.04%	0.07146	0.89%	−1.90%	0.45726	NO
4	−0.91%	−2.95%	−0.4819	−1.08%	−2.97%	−0.5535	YES
5	0.20%	−2.75%	0.40441	−0.40%	−3.38%	−0.208	YES
6	−0.07%	−2.82%	−0.0352	−0.24%	−3.62%	−0.1244	NO
7	−0.28%	−3.10%	−0.1494	0.30%	−3.32%	0.15416	YES

* Significant T-Test

4.2 RQ 2. In the Germanwings Flight 9525 Air Crash, is There a Relation Between the Financial Value of the Companies Involved, Lufthansa and Airbus, and the Advancement of Research in the Media?

The last column of Tables 1 and 2 indicates whether (YES) or not (NO) there was impact news in the media about the Germanwings air crash.

Based on these results, we can conclude that, in the case of the airline Lufthansa, there are differences depending on the asset valuation model applied when estimating a relationship between Lufthansa's listings value and the progress of the research in the media.

According to the market model, there is a relationship between the financial value of the airline and the progress of research in the media, because the days that there was new news in the media, the impact was significant on Lufthansa's ARs. Only two exceptions appear, the second and seventh days after the event, but in which we can find a possible explanation. On the 2nd day after the event, there was no impact on the media, but the AR was significant, however, with a positive value, possibly the shareholders when there was no news, returned to trust the company. On the 7th day the opposite happened, there was news in the media (appearance of the second

black box), but the return was not significant, possibly because the value of this AR was close to 0%, not very significant.

However, the Fama–French model contradicts these results, as it shows no relation between Lufthansa's financial value after the accident and the progress of the investigation in the media.

In the case of the manufacturer Airbus, with both models the results are similar, since there is no relation between the company's listings value and the impact on the media, there is only one exception. This is the case of the first day after the event with the Fama–French model, in which the AR is significant and there was news in the media.

5   Conclusion

Firstly, this research studies the impact of a specific air accident, the Germanwings Flight 9525, which occurred on March 24, 2015, on the financial value of the companies involved, the airline Lufthansa and the manufacturer Airbus.

We confirm a significant impact of the event on Lufthansa's financial value on the event day, and also 1 and 2 after according to the Market model. However, according to the Fama–French model, this relation is not significant. Despite this, both valuation models show that investors in the airline Lufthansa do react immediately to the accident since negative AR is shown in the short term, as evidenced by other studies (Ho et al., 2013, Chance & Ferris, 1987). Also, the results show there is no significant impact between the event and Airbus's financial value with any of the valuation models. Investors in the manufacturer Airbus react to the event, however, the fall in the financial value of Airbus is not significant.

These results are in line with the literature, as other studies also show an effect between accidents and airlines (Kaplanski & Levy, 2010), but not with manufacturing companies (Chance & Ferris, 1987). However, this study is a pioneer in analyzing the same air event with different valuation models.

Secondly, we analyzed whether there is a relation between the financial value of the companies involved in the Germanwings accident and the impact of the progress of the investigation on the media.

We conclude that in the case of the airline Lufthansa, there are differences depending on the asset valuation model applied since there is only a relation between Lufthansa's quotes and the progress of research in the media with the market model. In the case of the manufacturer Airbus, with both models the results are similar, confirming that there is no relation between the company's listings value and the impact on the media, which contradicts other authors (Krieger and Chen, 2015).

These results are important for airlines, for manufacturers, and especially for investors in them, since although we cannot prevent air accidents, it does allow us to estimate that their financial consequences are immediate, but they only affect in the short term. Furthermore, it is observed that the most affected company is the airline since no significant relationship has been found between the financial value

of Airbus and the air crash, nor between it and the progress of the investigation in the media. Therefore, the manufacturing company is less vulnerable to the impact that the news had on the media, and equally, its stock market values do not suffer significant losses.

The main limitation of this research is that only one air accident was studied, so it is not possible to draw general conclusions. Despite this, our results do coincide with the literature. Future lines of research will expand the sample to all air accidents of the XXI century to corroborate these preliminary results.

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Reputation Management Through People. The Case of the Romanian Banks

Anamaria Mişa

Abstract This article analyzes the involvement of human resources in rebuilding trust and building reputation in Romanian banks. Numerous researches in the field of marketing or communication emphasize the importance of reputation for an organization. In addition, modern theories of the "new economy" show the connection between human resource management and reputation. These encourage the transformation of employees into "ambassadors" of the company, although they recognize the challenges that arise with the implementation of this process. With the help of in-depth half-structured interviews with 30 employees of the main banks in Romania, we tried to investigate whether the reputation is an objective assumed by them. At the same time, we aimed to analyze the stage of involvement of human resources in reputation management. Although the study has a subjective character given by the type of research, namely, the qualitative one, we can conclude that the financial-banking institutions in Romania seek to build a positive reputation but fail to outline authentic, clear and efficient employee branding processes. Although employees in Romanian banks can become extremely valuable resources, they are limited and strongly controlled instead of being encouraged to become a voice inside and/or outside the company. This article contributes to the study of human resource management and makes the connection between reputation management and people management. At the same time, the article offers relevant perspectives that can be taken into account by Romanian banks in order to strengthen their reputation through their employees.

Keywords Reputation management · People management · Romanian banks · Human resources · Employee branding · People voice

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1   Introduction

More and more research has shown that reputation is a strategic asset owned by a company (Pfarrer et al. 2010). Although it takes a long time to build a good reputation, it can be easily spoiled if not managed properly. The literature has often approached the subject, but the general appreciation considers that "reputation management" is, for the most part, the field of communication and marketing. Recent studies show that in the "new economy", this theory can be improved by involving human resources and cultivating processes by which employees become "corporate ambassadors" and contribute to building a "good" reputation for the company (Hearn 2010). This article aims to analyze, with the help of qualitative data obtained from the top five banks in Romania, the way in which human resources act in the direction supported by this last theory. Are HR departments in the financial-banking system involved in what we call "reputation management?" Are Romanian bankers aware of the major role they play in building confidence in the financial-banking system? Are employees in these companies encouraged to have a voice inside and outside the organization? We try to answer these questions by analyzing the answers in the semi-structured interviews conducted with employees of the Romanian banking system. Although we recognize that research has its limitations, we believe that it gives us a relevant picture of the subject and can be followed and developed through further studies.

2   Literature Review

2.1   *Reputation—Strategic Good of Organizations*

Many authors consider the term reputation as indispensable in any transaction or commercial exchange in the economy so that it can be seen as a "precondition of customers/partners to do business with a company" (Ettenson and Knowles 2008). From the perspective of stakeholders, the reputation shows us the contribution of this company to the well-being of many or to social welfare in general. Therefore, reputation is crucial when the relevant organizations (stakeholders) decide how they will position themselves towards a company: "if the stakeholders will have a good impression or act positively towards a company, then this will be like a reciprocity towards the contribution in the life of their community" (Lewis 1999). Also, reputation can be defined from a deontological perspective. Thus, it is assumed that an organization can build a good image as long as the values it shares have a moral component and the company's actions pursue the common good, the general good.

This multidisciplinary approach to the concept makes it difficult for the academic community to take on the challenge of dealing with the term "reputation", a term so difficult to define that specialists call it a moving target (Helm 2010). And that's because it has different meanings and different connotations, for different authors from different fields. Corporate reputation-theoretical background. Much of the

research places the term reputation under the ownership of the fields of marketing and communication. Of course, if we refer to some of the accepted definitions, we tend to be right. Fombrun argues that reputation is "the collective image that describes the perception of multiple stakeholders about the company's performance" (Fombrun 1996), and Herbig and Milewicz believe that "reputation is how a company manages to associate a certain attribute, along time" (Herbig and Milewicz 1993). Other theories speak of the company's actions that leave impressions and attitudes among stakeholders, perceptions that are compared to those of the competition (Rao 1994). There are studies that consider that the perceptions and judgments of the general public are the defining ones for the reputation of the organization (Roberts and Dawlings 2002). Therefore, we can observe that "reputation is built over time based on the actions and behavior of the organization" (Balmer and Greyser 2003) or that it reflects the way the company is viewed both internally (from the perspective of employees) and external (by stakeholders) in the competitive and institutional environment". (Bromley 2002). Therefore, we can say that a careful analysis is required on the hypothesis that, in the middle of the idea of reputation, we have the company, the organization and its behavior (of its employees) in relation to various partners.

## 2.2 Involvement of Human Resources Management in Reputation Building

More and more theoretical approaches emphasize the role of employees in sustaining the company's reputation in an organic and healthy way (from the inside out) based on assumed behavior in which they believe. These ideas go as far as talking about "a lifestyle related to the brand of the organization (Martin and Hettrik 2006). Such involvement of human resources in reputation management is desirable because employees who adhere to the values and principles of the organization can easily be transformed into corporate ambassadors (Dreher 2014). Recent studies show us more and more that the voice and behavior of employees have a great impact on the way the company is perceived both internally and externally. With the expansion of social platforms (facebook, instagram, twitter, linkedin, etc.), any individual can have a positive or negative role in building the reputation of the organization they belong to (Dreher 2014). In order to turn employees into "company ambassadors", the way they communicate needs to be closely linked to the values, ideas and principles of the organization so that the targeted reputation is built. (Waeraas and Dahle 2019). In conclusion, it is necessary to correlate the actions and initiatives of the staff with the image objective of the organization and this initiative is called "internal branding" or "employee branding". This "conceptual model by which the brand is widely reproduced through employee messages" (Miles and Mangold 2004) or "these activities and behaviors expressed by employees to support the reputation of the corporation" (Waeraas and Dahle 2019) works at odds. maximum when the

human resource believes with conviction in the messages they send to clients, partners or stakeholders. (Vallaster and de Chernatony 2010).

Researchers are optimistic about the possibility of creating these positive behaviors among employees. Therefore, it is intended that conservative human resource management be replaced and developed in the direction of greater staff involvement in building an appropriate reputation for the organization to which they belong. Current theories even tend to emphasize the importance of identifying the needs and aspirations of employees so that they are the source of inspiration for creating the company's vision. Such proposals are based on the belief that human resources are superior and integrated when found in the organization's strategy and guiding principles (Barrett 2000). personal brand profiles, increasing staff satisfaction, cultivating leadership or investing in trusted employees to communicate company values (Waeraas and Dahle 2019). It is necessary, therefore, for the company to identify the needs, the aspirations. Of course, this change of strategy of the human resources departments has its challenges. Most of the time, organizations preferred to send messages through a single voice (of the CEO, the Board or the spokesperson) in order to have absolute control over the messages sent (Argenti and Forman 2002). However, the hypothesis that human resources become pillars of the company's reputation is configured to be an interesting one to investigate, especially in commercial areas where employees are interfacing with the customer who creates their own judgments and perceptions.

2.3   Methodology

Out of the desire to analyze the stage of involvement of human resources management in building reputation, we undertook a qualitative research on the financial-banking system in Romania. We considered that this sector is relevant for our research, for several reasons, as we will detail in the following lines. First of all, as we showed in the first part of this paper, reputation is an essential concept in creating added value for an organization and the financial-banking system is no exception to this goal. On the contrary, the industry is particularly cautious in terms of how it operates, especially since, in Romania, the sector is not one of the most popular and requires sustained action to regain the trust of the population (Oprescu 2015). Second, in financial institutions, employees are the company's interface with customers and these daily, repetitive interactions are an important part of the process of shaping the general perception of the company. And this for reputation is formed over time based on what the organization has done or how (its employees) have behaved (Balmer and Greyser 2003). In conclusion, I consider that the financial-banking field is one that will be relevant for the topic analyzed by us, in this article. Next, we selected the top five banks in Romania, companies that together hold approximately 60% of the market share in our country and a total assets of 350,000 (million lei) as we can see in the image below. Also, these companies are particularly important in terms of the number of employees (approximately 30,000 in total) (Fig. 1).

1	BANCA TRANSILVANIA	103.376	18,46%	▲	17,72%
2	BCR	79.538	14,20%	▼	14,43%
3	BRD-SOCGEN	61.635	11,01%	▼	11,28%
4	ING BANK	53.487	9,55%	▲	9,01%
5	RAIFFEISEN BANK	51.283	9,16%	▲	8,66%
6	UNICREDIT BANK	45.446	8,11%	▼	8,99%
7	CEC BANK	41.298	7,37%	▲	6,64%
8	ALPHA BANK	17.912	3,20%	▼	3,60%
9	OTP BANK	14.843	2,65%	▼	2,68%
10	EXIMBANK	11.795	2,11%	▲	1,57%
11	CITIBANK	11.068	1,98%	▼	2,06%
12	GARANTI BBVA	10.685	1,91%	▼	2,19%
13	LIBRA INTERNET BANK	7.319	1,31%	▼	1,32%
14	FIRST BANK (Piraeus)	7.315	1,31%	▲	1,30%
15	BANCA ROMÂNEASCĂ*	6.467	1,16%	▼	1,34%
16	INTESA SANPAOLO	6.460	1,15%	▼	1,33%
17	CREDIT EUROPE BANK	4.155	0,74%	▼	0,81%
18	VISTA BANK (Marfin)	3.449	0,62%	▲	0,52%
19	PATRIA BANK	3.430	0,61%	▼	0,64%
20	IDEA BANK	2.707	0,48%	▲	0,47%

SURSA: BNR

Column 1- Total assets, Column 2- market share 2020, Column3- market share 2019.

Fig. 1 Top 20 biggest banks in Romania. *Source* www.ziarulfinanciar.ro

I conducted in-depth semi-structured interviews (Leech 2002) with 30 employees from the most important banks in Romania. Half of them are advisors who work in branches and are the ones who represent the banks, in front of the clients and other commercial partners, every day. The other half are middle managers (business executives) but also top managers (human resources, communication, marketing). We used this form of interviewing to give us some flexibility in our approach. Thus, if in terms of the execution staff (those who work in the banking units), we emphasized the part of personal experiences and awareness, in terms of managers, the interview focused on methods of control and stimulation to build an adequate reputation for the company. Therefore, the objectives of the qualitative research are to analyze the way in which the human resources from the financial-banking system in Romania are involved in the "reputation management" process. One-on-one discussions with them highlighted a wide range of opinions that we will briefly present in the following. I specify, from the very beginning, that the results of a qualitative research, as well as the in-depth interview, are not representative at the level of the entire mass of employees in the Romanian banking system.

2.4   Results and Conclusions-Data Analysis

The main topics I researched revealed the following:

Reputation as an assumed goal

The employees in the financial-banking system with whom I interacted were open to develop the subject of the interview. We did not perceive situations that would give us the feeling of possible distorted answers. Thus, the human resources with executive functions are not very aware of the role they have in building the company's reputation and do not exercise their profession under this independent principle. For the most part, bank advisers said the mission to build a good reputation is the function of the institution's communications departments and top leaders. However, once they were introduced to the concept of reputation (as defined in the first part of this paper) and its implications for the company's performance, advisors admitted that they were working on their "image" in an informal or informal manner without knowing it. Two of the respondents stated that "their professionalism is important and makes their clients stay in the system or leave". A middle manager said he was "concerned to get involved in community activities in order to be perceived positively by the partners he could attract in the business." Of course, many of the respondents emphasized that they are constantly acting in order for customers to trust them. However, executives in the banking financial system do not understand clearly what is expected of them when it comes to reputation.

On the other hand, for the top managers of companies, "pursuing a good reputation" is a principle that governs their actions and behavior. They also claim that they consider this aspect "in all areas of management". A human resources director showed us that, by virtue of this objective, in the last 5 years, he has recruited staff to deal only with the bank's reputation, in the big cities in Romania. "We will be socially involved so that stakeholders consider us an important player in the development of communities" or "reputation was an attribute that we lacked focus and our bank lost enormously because of this". Another human resources manager explained how he develops various programs to build formal and informal leaders in the company he leads. At the same time, sales managers, fully understand and assume the importance of the concept of reputation: "I encouraged my employees to promote the bank's values, including on their social media channels, so that their good reputation is transferred to the company and vice versa."

Although, among the financial-banking institutions in Romania, an assumed goal has been set for building a good reputation, there is a significant difference in understanding and mastering this goal between the level of management and the level of execution.

Diffuse employee branding policies

The top executives interviewed described, in a complex way, the processes and projects they created for employees. "We have devised a program for the bank's ambassadors and they are encouraged to communicate on social networks, as

bankers." Another respondent told us that he "organizes public speaking, leadership or linkedin content courses" so that human resources have strong skills in this area. I was also informed that "during the pandemic, we intensified internal events so that all colleagues had notions about the bank's actions, ideals and values so that they could then become more involved." At the same time, human resources managers have devised internal and external volunteer programs to develop the individual social prestige of human resources. "by our bank: education and technology". However, although the actions of managers are assumed and well defined, they fail to be transmitted and implemented, in a uniform and clear way, from top to bottom. This is acknowledged even by one of the respondents in the human resources department: In the internal survey analyzing employee involvement, only 65% of evaluators agreed with the statement "I feel motivated to go beyond what is required in my job to make my company successful (65%)."

On the other hand, five of the employees with executive positions told us that they do not believe in the bank's values because they are established only formally, "to grow the brand" and are contradicted by the lack of tools and trust given. Another interesting perspective was given to us by an employee of the communications department who suggested that "there is no single strategy or approach to practices so the projects have limited impact." In this regard, we can conclude that the policies of "employer branding" or "employees voice" are being outlined and do not have a well-defined structure and conduct, although there are optimistic initiatives and approaches in this direction.

Formal and controlled communication

Both the executives and the top managers agreed, for the most part, that the voice of human resources is strictly controlled in the Romanian banking system. Even the actions of encouragement are managed internally, very carefully: "The program of ambassadors of the bank involves each of us to send the same message written by the communications department." Coercive attitudes are also very common: "I was critical of the COVID-19 vaccine and my manager apostrophized me because I did not agree with the company's values." A middle manager confirmed to us that he is "concerned with avoiding and isolating as much as possible the reputational risk that employees may pose." To this end, he acknowledged that he systematically monitors the social media profiles of employees so that there are no positioning slips. At the same time, the discussions with the respondents revealed that there are clear specifications in the company's codes of ethics and complex procedures regarding the way in which employees can express themselves, especially outside the organization (with media, social media, blogs, etc.). Regarding the financial results of the company, there is a strict custom by which they are transmitted only by key representatives of the Board of Banks (chairman/vice-chairman or spokesperson).

3   Conclusion

Following the discussions with 30 employees from the financial-banking system in Romania, we can say that, within the organizations, there are concerns to value the human resource and turn it into "corporate ambassadors", but they are in an early stage and quite of superficial. On the one hand, employees are encouraged, through internal methods, to become creative and add value to the company and, on the other hand, they are considered a vulnerability and there is a lack of confidence in their abilities and many procedural and substantive limitations. Also, an important conclusion derived from the interviews is related to a human resources management of the "bottomless form" type through superficial processes, established from top to bottom without internal consultation and without being internalized by employees. The values, principles and messages of the organization often seem to be detached from those of individuals and vice versa. "Creating a company culture is a two way street: only top down will never work (van Marrewijk et al. 2003)". Therefore, an important discussion that may arise from our research is related to the way in which the direction that the company wants should be established, from the perspective of reputation. Here, a solution would be for managers to act in both directions: to align the values of the staff with those of the company. Barrett (2000) and to attract/retain superior human resources (which transfers a sustained competitive advantage to the company (Lado and Wilson 1994) based on the reputation propagated internally (judgments of their own employees) and externally (perceptions of the labor market).

In any case, our conclusion is that Romanian banks still practice a conservative human resources system when analyzing employee voice management, a system that is based on limitations, restrictions and procedural patterns rather than creativity and leadership cultivation. Of course, our research has substantial limitations because it has been based on employee interviews and these can often be highly subjective because they include personal experiences, emotions and assumptions about the organizations they belong to. In this case, the discussion remains open and the analysis can be developed through a number of other topics such as: the study of internal procedures related to how employees can express themselves inside and outside companies, how human resources are promoted on channels communication of banks or, why not, the complexity and differential of messages transmitted in the media by bank employees. In the end, we believe that our research has achieved its goal and drew attention to a resource that has huge potential in building a healthy reputation for Romanian banks. Each employee can contribute to restoring trust in the banks by assuming the assumed values of the company in the context of the accelerated development of communication through alternative channels.

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Analysis of the European Union's Energy Dependence on the Russian Federation. The European Resilience in Gas Supply in the Context of Russian-Ukrainian Tensions

Ioan-Cătălin Murărașu

Abstract The military conflict between Ukraine and the Russian Federation requires a prompt and balanced response from the European Union, which must support Kiev's Western course, but also has to manage its energy industry's dependence on Russian natural gas. A Munich syndrome in Brussels' foreign policy would be a real failure, just as a set of uninspired or inefficient economic sanctions would cause irreparable losses for the Member States. The main objective of the article is to analyze the evolution of the European Union's dependence (EU-27, after BREXIT) on the natural gas delivered by the Russian Federation during 2000–2021 period. The study will identify the causes that made it impossible to reduce this dependence and will formulate opinions on the factors that have affected Europe's energy security over the last two decades. EViews12 (Hodrick-Prescott filter) and PSPPIRE (Pearson correlation coefficient) software were used in the research. The results of the research show an upward trend in the European Union's dependence on Russian gas imports, mainly due to the year-on-year decline in the Member States' domestic production. The assessment indicates a medium-term continuation of the evolution presented, but the inclusion of investments in the gas sector in the European taxonomy on sustainable financing can relaunch the domestic upstream sector, reversing this trend.

Keywords Energy security · Natural gas · European Union · Russian Federation · Energy dependence

1 Introduction

As the dissolution of the Soviet Union marked the end of the last century, the annexation of the Crimean Peninsula by the Russian Federation, twenty years after the signing of the Budapest Memorandum (1994), annoyed the public opinion by raising questions about the capacity of international alliances to continue to maintain the

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security in Europe. Even if the violation of Ukraine's territorial integrity—even by the state that has pledged to respect the integrity of its borders in exchange for renouncing its nuclear power claims—discredits the foreign policy of the Russian Federation, Moscow seems willing to take on these image losses again.

Still seemingly guided by the old Heartland Theory (Mckinder 2020), Russia manifests its revisionist interests once again, threatening the stability and the security of some of the states that were part of the comprehensive Soviet Union. Although the Kremlin's efforts to keep its old sphere of influence intact may throw Europe into a new era of the Iron Curtain, Russian leaders are not willing to give in to the West. Moreover, they express their intention to block, at any cost, the attempts of the former Soviet states to turn their eyes to the West.

If in the last century Moscow has claimed the status of the world's leading military power, the resounding failure of the Soviet strategy has forced Russian leaders to identify other methods to control the neighboring states—less expensive but certainly just as effective and, perhaps, even profitable. Thus, since the 1990s, the Russian Federation has speculated on the economic benefits of its impressive territorial size, which provides access to the natural resources that both Europe and Asia need (Tompson 2005).

In the century of technology and speed, Moscow benefits from the most important weapon—energy—which is the basis of every economic sector and cleverly combines it with its military power. Thus, the Kremlin administration uses the power position of the Russian Federation as an exporter of energy resources, especially natural gas, both as a "lasso" for the states that want to get out of its sphere of influence, and as a weapon against those who challenge its regional supremacy.

The purpose of this article is to analyze the evolution of the European Union's dependence (EU-27, after BREXIT) on natural gas delivered by the Russian Federation in the period 2000–2021—a stage marked by Moscow's hostilities against Ukraine. The article also aims to assess the capacity of the European Community to compensate the abandonment of imports from its main energy supplier in the context of the new tensions in the Eastern Neighborhood.

The data used for the study are provided by Eurostat and Enerdata. The Hodrick-Prescott filter was used to determine the trends required for the analysis, using the EViews12 software. The PSPPIRE program was used to calculate the Pearson correlation coefficient between domestic EU gas production and the imports of Russian origin. In addition, the "TREND" function, available in Microsoft Excel, was used to forecast the EU-27's consumption, production of natural gas and its dependence on Russian imports in the period 2022–2024.

The increase in the European Union's dependence on natural gas imports is mainly rooted in the significant decrease of the production of the Member States. This situation was created both by the entry into a period of revitalization (Mihalache 2016) for some of the European fields that were exploited for decades, and by the European environmental policies, which discourage the investment in the energy production from conventional sources, including those based on natural gas.

However, a major shift in the European Commission's perception of this industry can be seen in early 2022 by including the investment in the gas sector in the European

Union Sustainable Finance Taxonomy (European Commission 2022). This change could revitalize the domestic upstream segment and reduce Member States' dependence on imports. Another factor that could contribute to the reversing of the upward trend in gas supplies from the Russian Federation to Europe is the completion of the Trans Anatolian Natural Gas Pipeline project, through which Azerbaijan, that has a growing production, can export natural gas to the West (Agayev 2021).

As the COVID-19 pandemic has exposed all the vulnerabilities of the European medical system, a crisis situation such as an open military conflict in the Eastern Europe would highlight all the vulnerabilities of the contemporary European architecture, from lack of unity in foreign policy decisions to its very low self-defense capacity. Regarding to the energy sector, the most acute shortcomings are created by the rapidity with which Europeans have abandoned the conventional technologies, correlated with the too slow speed of their replacement with the green ones.

2   Literature Review

The current security context flagrantly illustrates that the transition from totalitarianism to democracy of the most states that were part of the former USSR is not complete yet. To the same extent, the recent evolution of the territorial disputes in Ukraine shows the impossibility of the former Soviet states to decide their international course on their own. Ekiert (2010) considers that the role of the international factors in the transition of the former Soviet republics to democracy is much more important than for those who have chosen this path before the fall of the USSR. In the case of Eastern Europe, these factors decisively shaped the stages of the former communist countries' transition, from the change of regime to the consolidation of the new state.

In the case of Ukraine, the easing of territorial disputes with the Russian Federation is being discussed internationally, often without the involvement of the Kiev authorities. Against this context, the Kiev state is engaged in a military conflict whose settlement depends the most on bilateral negotiations between Western leaders and the Kremlin administration, which has a strong advantage because of the European countries' vulnerability to Russia's energy "weapon" (Ellyatt 2021).

Kagan et al. (2021, pp. 12–13) argue that, in addition to blocking Ukraine's aspirations to become a NATO member, one of Russia's interests in the created military crisis is to restore the former Soviet Union's spheres of influence. Russians often demonstrated after 1991 that they intended to control the domestic and foreign policy of the former Soviet countries. However, the latest developments—the largest military invasion in Europe since World War II—show that the Kremlin administration even wants to occupy Ukraine militarily, not just to control it politically and administratively.

This point of view is also acknowledged by Adomeit (2007) who argued, even before the Crimean crisis, that the Kremlin's declarative adherence to Western values

did not imply their implementation and the Russian Federation's deviation from the Western European principles is an important destabilizing factor.

Until now, the Russian Federation has successfully used its advantage as the main energy exporter in Europe, managing to establish a whole network of supply contracts, usually non-transparent, with European states and companies. The inability of the former Soviet countries to identify new sources and routes of energy supply has helped Moscow to maintain its sphere of influence, blocking the westernization of Eastern Europe (Proedrou 2018).

Although the occupation of the Crimean Peninsula by the Russian Federation has raised questions about the reliability of Gazprom's transport routes—whether or not they transit Ukraine (Luciani 2016)—European states have failed to counterbalance their dependence on Russian imports either through their domestic production or by identifying new sources in countries with less revisionist regimes.

Moreover, the "perfect storm" in the energy market (Asthana 2021) has increased the Russian Federation's ability to use its energy leverage in its relations with Europe and makes it impossible for the Kiev authorities to negotiate with Moscow for a solution in the military and diplomatic conflict. The crisis in Ukraine faithfully illustrates that there is a close link between geopolitics and energy, and the access to natural resources is a key factor in winning a war, whether it is military or otherwise (Pascual 2015).

As in the last decade of the last century, the Baltic republics, proclaiming their independence, faced military repressions and, also, economic and energy constraints imposed by Moscow to block their western course (Kahn 2008, p. 89), Ukraine is threatened by the successor of the Soviet Union, which is guided by the same imperialist visions as its predecessor. Liuhto (2010, p. 42) argues that energy business often has geopolitical goals. Also, the exporting status of the Russian Federation provides to Kremlin an important weapon which could be used at any time, with serious consequences for importing states, but without legal consequences for Russians.

Thereby, Moscow has the control over the energy component in a hybrid war started since the last century, the end of which is not visible (Ruhle and Grubliauskas 2015). The indebtedness of Eastern European states for the purchase of Russian natural gas and the impossibility to identify new sources of supply maintain the influence of the Russian Federation in Eastern Europe and diminish the capacity of the European Union and NATO to co-opt new members. As for Ukraine, it has not yet been able to combat the dependence on Russian energy imports, even if this has been a strategic commitment since 2015 (Mara et al. 2022).

Another point of view supported by experts is that the Russian Federation is also equally dependent on the European market because most of the energy and raw materials produced are destined for exports to this region. Thus, both parties have an interest in maintaining reciprocal trade (Jääskeläinen et al. 2018). Whether if it is true or not, given that the EU's domestic natural gas production is declining faster than the Brussels authorities have estimated (Pashkovskaya 2019), the balance of interdependence between Member States and the Russian Federation is tilting in favor of Kremlin.

In the context of the conflict between Kiev and Moscow, the European Union and the United States have naturally chosen to support Ukraine, primarily financially and humanitarian, whereas military aid is impossible to grant without violating the international treaties and creating a military conflict with Russia (Masters 2021). They have also threatened the Russian Federation with economic sanctions, but the effects of the Western soft power strategy do not seem to be enough to prevent the escalation of the conflict. Moreover, European states could face a new energy crisis—which would be difficult to manage—in the event of a possible blockade of imports of Russian energy raw materials (Ambrose 2022).

3 Methodology

In order to predict the direction in which the annual production and consumption of natural gas in the European Community will evolve in the period 2022–2024, we will use the linear function "TREND" in Microsoft Excel, based on the available data from the period 2000–2021. The same method will be used to identify the direction of evolution of the dependence on Russian natural gas in the next 3 years. Subsequently, we will apply the Hodrick-Prescott filter to establish the trend of natural gas imports from the Russian Federation and the dependence of the Community space on this source.

To analyze the link between the evolution of the domestic production of the EU-27 and that of Russian imports, we will calculate the Pearson correlation coefficient between the two variables, using the PSPPIRE software.

Furthermore, to test the hypothesis that the Russian Federation's natural gas production is dependent on deliveries to the European Community, we will calculate the percentage of Russian exports to the EU-27 of total annual production in the period 2000–2021 and we will analyze its evolution. The author should make references to some previous research similar to the present one, if that is the case. Also, the author should mention the software programs used for processing statistical data if it is the case.

The calculation formula used by EViews 12 to apply the Hodrick-Prescott filter is:

$$\sum_{t=1}^{T} (y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1} [(s_{t+1} - s_t) - (s_t - s_{t-1})]^2$$

where: y_t represents the initial series, s_t represents the trend, and λ represents the value that adjusts the deviations from the trend (its value is 100).

RF's dependence on the EU-27 market is calculated according to the formula:

$$\frac{L_{EU}}{P_{RF}} \%$$

,

Where: L_{EU} represents the annual natural gas deliveries to the EU-27, and the P_{RF} represents the total production of Russian gas in one year.

4 Results and Discussions

Both consumption and production of natural gas in the European Community are on a downward trend, one of the main reasons being the EU's policy on combating climate changes and promoting renewable energy sources, which has diminished the attractiveness of investments in natural gas-fired power capacities. However, both current trends could be reversed as a result of the European Commission's decision to include the investments in production facilities that use this raw material among sustainable ones (see Fig. 1).

Although the amount of natural gas imported by EU-27 countries from other sources than Russian Federation has slightly increased since 2000, the dependence on Russian natural gas has also increased since 2010. This situation is mainly due to the continuous decrease in the domestic production of European countries, reduced from 24% of consumption in 2015 to 9% in 2021 (see Fig. 1) (Fig. 2).

The amount of natural gas imported by the EU-27 from the Russian Federation is not fully consumed by the Member States, some of which is traded by European suppliers in other non-EU countries, such as Serbia, Switzerland, or the United Kingdom, which use EU transmission infrastructure for the supply with Russian
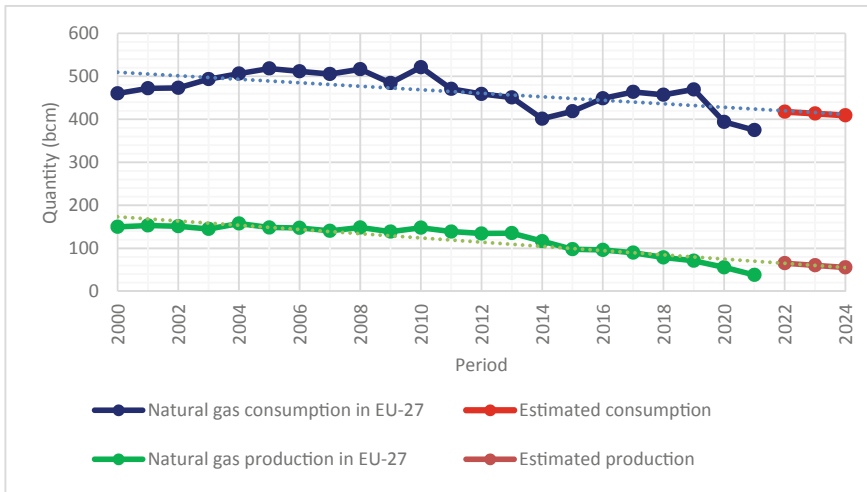
Fig. 1 The natural gas consumption and production in EU-27 (*source of data* www.ec.europa.eu, www.bruegel.org, www.statista.org)
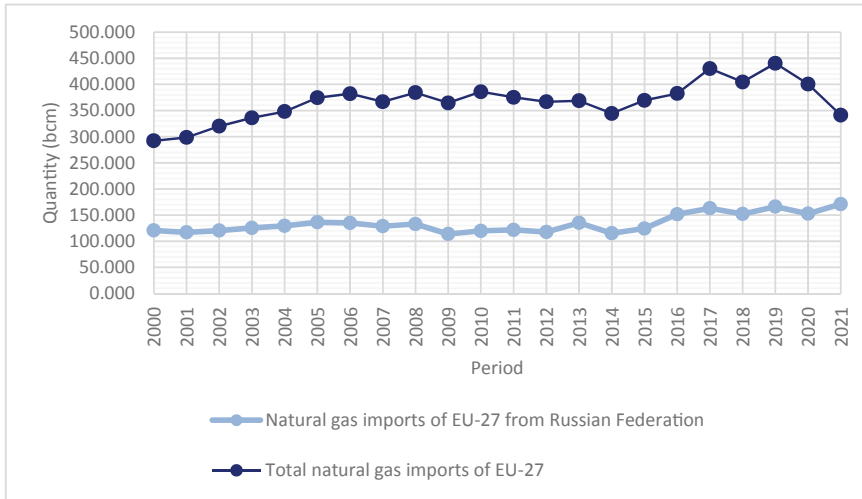
Fig. 2 Natural gas imports in EU-27 (*source of data* www.ec.europa.eu, www.bruegel.org)

gas. It can also be used to balance the national transmission systems. Thus, even if not all the imported quantity is consumed in the Community, the companies in the supply and transport segments and, implicitly, the European countries receive considerable revenues as a result of the transit of gas on their territory.

Using the EViews12 software to apply the Hodrick-Prescott filter, we identify an upward trend in imports of Russian origin in the period 2000–2021, and since 2010 we have seen an acceleration of it, to which the reduction of domestic production of European countries has mainly contributed to (see Fig. 3).
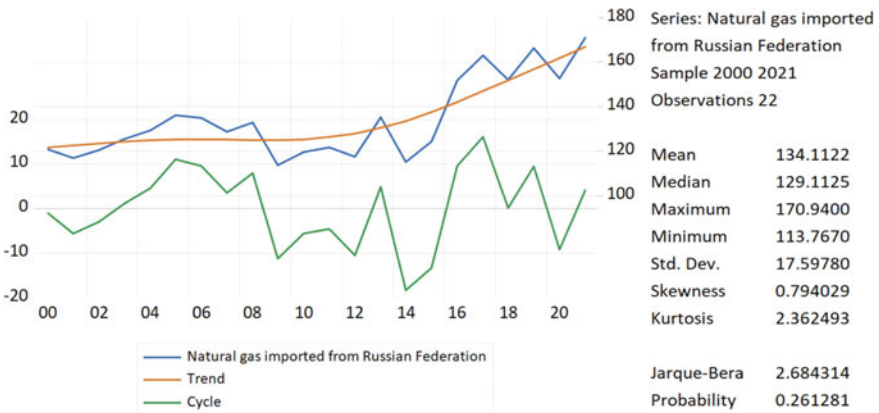
Fig. 3 Hodrick-Prescott filter (lambda = 100) for the natural gas imported from Russian Federation between 2000 and 2021 (*source of data* www.ec.europa.eu, www.bruegel.org)
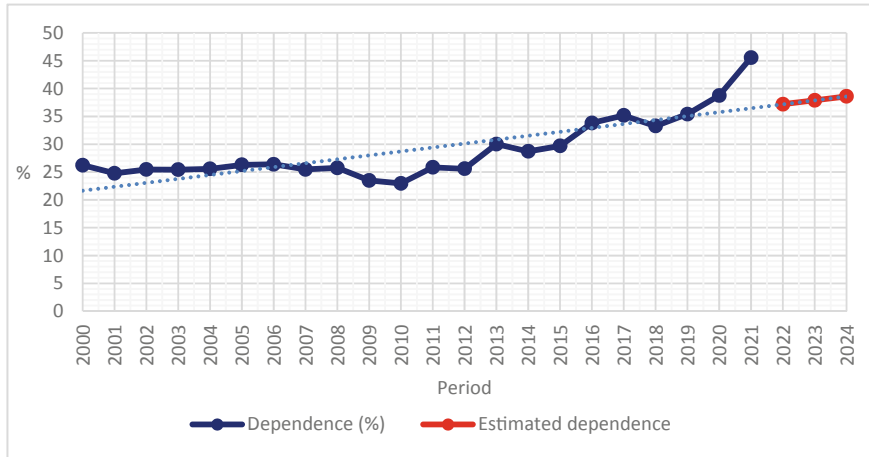
Fig. 4 EU-27 dependence on Russian gas imports

The decline in domestic production of European states, as a result of declining productivity and even the closure of some deposits, already exploited for decades, have led to a gradual increase in dependence on Russian imports. The inability to identify enough new sources of supply has made it difficult to reverse this trend (McWilliams et al. 2022).

During the period under review, the natural gas supplies from the Russian Federation to EU-27, as a percentage of its production, were steady, representing on average 20.5% of annual Russian production. However, their share of EU-27 consumption has followed a growing trend, accelerating since 2019, even if the European leaders have been aiming to diversify their import sources and reduce their dependence on Russian supplies since 2009 (see Table 1) (Fig. 4).

Using the EViews12 software to apply the Hodrick-Prescott filter it has been identified an upward trend in dependence on Russian gas, similar to that of imports from this state. The result could indicate an inability of the EU-27 to find new sources of supply fast enough to offset the declining domestic production (see Fig. 5).

Using the PSPPIRE program to establish the link between EU-27 production and Russian imports, it revealed a strongly negative Pearson correlation coefficient (-0.81) between the two variables. The results indicates that Member States had to compensate for the decrease in their natural gas production by increasing imports. In the context in which they did not identify enough alternative sources of supply to the Russian Federation, the operators in the supply segment turned to Russian producers to supplement their demand (see Fig. 6).

The graph in Fig. 7 illustrates the fluctuations in the supply of natural gas to European countries depending on the time of year and also its cyclicality. The sinusoidal structure is given by the increase of the consumption demand in the cold season and its decrease in the warm season and also due to the recovery of the production of electricity from renewable sources after the end of winter. Under these conditions,

Table 1 Dependence of Russian Federation (RF) natural gas production on the EU-27 market (*source of data* www.ec.europa.eu, www.enerdata.net)

Reference year	RF natural gas production (bcm)	RF natural gas deliveries to EU-27 (bcm)	RF dependency on EU market (%)
2000	573	121	21.1
2001	570	117	21.5
2002	584	120	20.6
2003	608	125	20.6
2004	620	130	21
2005	628	136	21.7
2006	640	135	21.1
2007	635	129	20.3
2008	651	133	20.4
2009	583	114	19.6
2010	657	120	18.3
2011	673	122	18.1
2012	658	118	17.9
2013	675	135	20
2014	647	115	17.8
2015	638	124	19.4
2016	644	152	23.6
2017	695	163	23.5
2018	738	152	20.6
2019	751	166	22.1
2020	705	153	21.7
2021	773	171	22.1

Series: DEPENDENCE	
Sample 2000 2021	
Observations 22	
Mean	29.07267
Median	26.26087
Maximum	45.55860
Minimum	22.95511
Std. Dev.	5.688281
Skewness	1.377213
Kurtosis	4.305514
Jarque-Bera	8.516962
Probability	0.014144
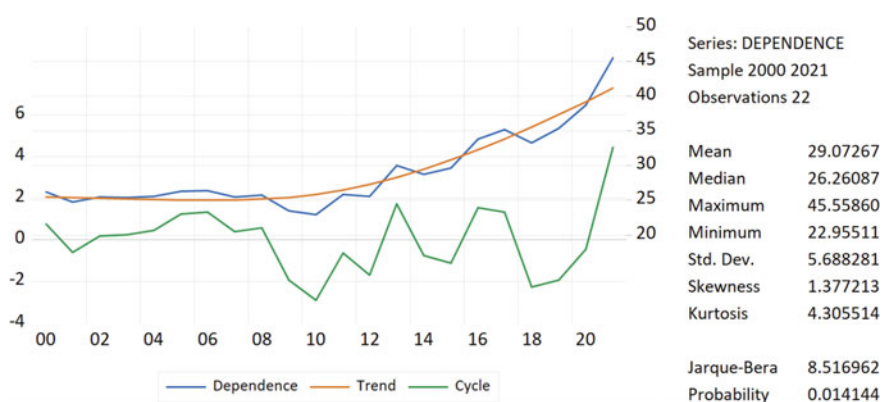
Fig. 5 Hodrick-Prescott filter (lambda = 100) for the dependence on natural gas imported from the Russian Federation in the period 2000–2021

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CORRELATION
    /VARIABLES = Imports_from_RF Production_EU27
    /PRINT = TWOTAIL SIG.
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Correlations

		Imports_from_RF	Production_EU27
Imports_from_RF	Pearson Correlation	1.000	-.810
	Sig. (2-tailed)		.000
	N	22	22
Production_EU27	Pearson Correlation	-.810	1.000
	Sig. (2-tailed)	.000	
	N	22	22

Fig. 6 Pearson correlation between natural gas production in the EU-27 and imports from the Russian Federation (*source of data* www.ec.europa.eu, www.bruegel.org, www.enerdata.net)
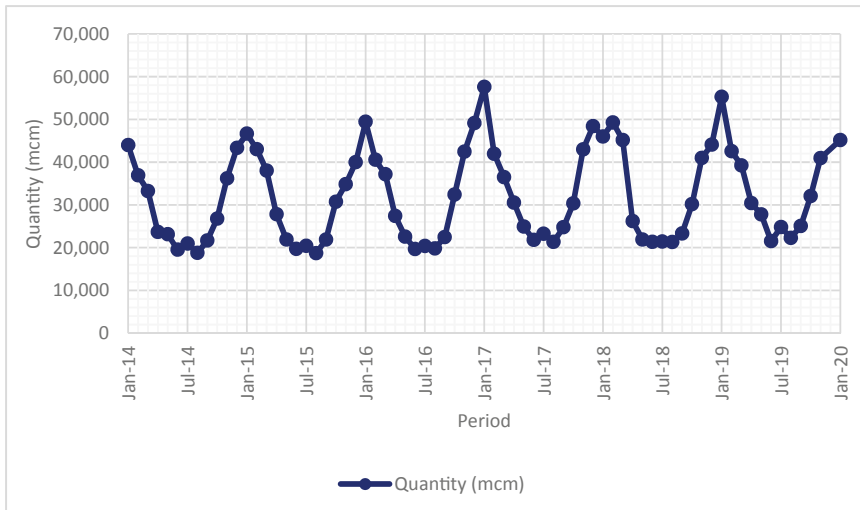
Fig. 7 Monthly evolution of gross inland natural gas delivery in the EU-27 (*source of data* www.ec.europa.eu)

we can anticipate, based on previous developments, a decrease in consumption from February and a further increase in September.

5 Conclusion

Aging of fields in the territories of the Member States and their decrease in profitability are the main factors in the decline of the natural gas production over the last ten years. The European Union's policy of discouraging investment in the gas

industry and in the fossil fuel-based electricity generation capacities has further aggravated the decline of this energy segment. Applying the Hodrick-Prescott filter to the EU-27's annual dependence on Russian gas in the period 2000–2021, we see an accelerated increase in the second half of the analyzed period. The highly negative Pearson correlation between annual natural gas production in the European Community and Russian imports also indicates a close link between them and highlights the difficulties faced by the Member States in trying to identify supply alternatives.

The Russian Federation, which has always been the main supplier of natural gas and energy in Europe, has increased its influence over the EU's energy sector year after year. Also, this power position, often used like a hybrid weapon in its wars with the states that challenge its supremacy, became more effective. This development did not increase the dependence of the Russian Federation on the gas exports to the European Union. The percentage they represent in the annual production of Russian companies has remained constant in the last two decades, due to the increase of the amount of this raw material extracted nationwide.

The trend in annual gas imports from the Russian Federation will remain a "bullish" one for the next three years, all the more so as the gas industry seems to be gaining ground in the European negotiations on financing sustainable investments. On the other hand, the financing of this energy sector by the European authorities could mean the reversal of the "bearish" trend of the European gas production, which means the most efficient alternative to Russian imports.

In case of a possible short-term cessation of Russian natural gas supplies to the European Union, the data presented in Fig. 6 suggest a lower impact of such an event during the warm season, when the consumption is declining. Thus, we can assess that Member States could overcome a crisis situation in the short term by heading for alternative sources (Norway, Libya, Azerbaijan, the existing reserves or liquefied natural gas imports), even if those are more expensive, and reducing consumption by rationalization measures. However, the blockade of imports during the cold season would make it significantly more difficult to meet consumption needs, which are at least double in December-February than in the opposite part of the year.

In the long run, the cessation of Russian natural gas supplies to the European Union would deprive the Community space of about 40% of its natural gas needs, a quantity that is difficult to completely replace. On the other hand, the Russian Federation would have to identify alternative sources of income to offset the sales of about 21% of its annual natural gas production. This deficit would be even more difficult to cover if the Russian army were to engage in a long-term war of attrition, similar to that in Chechnya, but on foreign territory and with an adversary official and unofficial supported by Western powers.

Although both sides would be severely affected by a possible blockade of natural gas flows from the Russian Federation to the West, the European Union's high dependence on Russian gas makes it much more prone to a crisis situation. Thus, for European leaders is hard to combat the Moscow's aggression against Ukraine through sanctions on natural gas imports because their effect would be more pronounced on the European states and it would not discourage Russia in the military field.

In the unstable security context of Eastern Europe, the European Union must fight against Moscow's hard power policy using soft power tools, the only ones it possesses and can be engaged in the hybrid war it is facing. Although the economic sanctions imposed by Brussels have often proved to be effective, in the case of the Russian Federation they can hardly be applied even in the area where they would have the most drastic effect, the energy one.

The European Union's inability to reduce the impact of the Russian Federation's energy weapon and to maintain the European path of the former Soviet states is caused, to a considerable extent, by the vulnerabilities created by its policy that was meant to combat climate change. Brussels, sometimes, uninspired measures have led to an increased dependence on the Russian gas and a weakening of the EU's energy sector, which has failed to keep up with the new regulations, making the conventional energy sources unprofitable without ensuring that the renewable energy sources can cover the gaps that were created.

The disruption of natural gas trade between the Russian Federation and the European Union would greatly affect both sides economically, for which reason it is not in the interest of any of them to consider the option of medium and long-term cessation. However, the extended military conflict in Ukraine, whose territory is transited by the main gas corridors between Europe and Russia, could make critical transmission infrastructure unavailable, with serious consequences for the entire continent.

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The Composite Development Drawback Index for Romanian Counties

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Abstract The regional development and potential are influenced by various factors. There are regions with different levels of drawback generated by factors such as existing economic development, demography, multiculturalism, education etc. The main concern the researchers had was identifying the development gaps and the economic convergence ways at regional levels. We consider that proper policies could be designed having as starting point the drawback level of the region and the structure of the brakes. Could we evaluate a drawback rank that is acting as a burden for regions to access even the convergence programs? Could the health model of drawback rank be applied to the region's development? The present research is proposing a composite development drawback index (CDDI) for Romanian counties using three sub-components: economic development, demography, multiculturalism, for a first stage. This 3D index applied to Romanian regions is a pilot study from nD (multidimensional) CDDI to be applied at European regions. The result of the pilot study highlighted the 2 ranks of CDDI identifying the main vulnerable regions, with lowest and lower potential of implementing tools of economic development and convergence. The public decision makers should design special push and pull tools to overlay the drawback and to give them a chance to compete with the regular units.

Keywords Regional development · Drawback · Ranking · Convergence · Multilevel governance

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1   Introduction

Territorial cohesion can also be understood as a process of territorial convergence, expected to take place over some time, for a broad set of indicators of territorial development, representing several components and dimensions. If most of these indicators follow a convergent trajectory for a given territory in a period, then we can say that there is territorial cohesion, or in its absence, we can signal a process of territorial exclusion.

Romania has heterogeneous geographical features at territorial level. The geographical diversity of the territory largely explains the differences in economic performance, the standard of living, and finally, the partial presence of convergence processes, at different levels NUTS1, NUTS2 or NUTS3. Territorial differences can offer competitive advantages, but sometimes they can represent barriers, limits in development, meaning to a certain extent a drawback. Starting from the model used in medicine to determine the degree of handicap according to the severity and the limitations generated by the existence of the disease concerning a status considered normal, the research aims to identify an aggregate index to determine the degree of territorial drawback.

The questions we aim to find answers for are:

- Could we evaluate a drawback rank that is acting as burden for regions to access even the convergence programs?
- Could the health model of drawback rank be applied to the region's development?

In our research, we paid special attention to the identification of territories that have characteristics that prevent the development of locations and have a permanent character, and we can classify them as areas with a drawback.

The territorial convergence analysis profile consists of differentiating characteristics and particularities that may have negative effects on development or that require specific actions to be removed or diminished. Three such distinguishing dimensions were considered in the pilot research:

- economic:

    – areas affected by the industrial transition;
    – regions affected by a permanent natural drawback;

- demographic:

    – regions affected by a severe and permanent demographic drawback;

- ethnic, multicultural:

    – regions with a heterogeneous ethnic composition: concentrations of ethnic Hungarians, Roma, other ethnic groups.

The result of this analysis comes to complete the profile of the counties with decisive characteristics in understanding the set of factors that act at territorial level. The

complex profiling of the territory is an element of novelty that allows the development of policies aimed at local needs, much more efficient and with a much greater potential for training, multiplication, with synergistic effects. Knowledge of this type of profile helps to adapt and increase the effects of sectoral policies. The drawback profile offers a unique character at county level, alongside other visible factors such as the cross-border position or the sectoral specialization profile of the county.

The methodology of profiling the counties according to the drawback characteristics represents a complex spatial analysis tool that allows obtaining results that meet the needs of decision-makers, especially those in public administration. Although this tool was designed as a useful component in the methodology for assessing the process of territorial cohesion at national level by measuring the variation of GDP/capita in the period 2010–2018, in the new context, it offers clear benefits and is welcomed. The result of applying the County Profiling Methodology by drawback characteristics reflects relevant differences for public policy areas. These differences are diagnosed at county level, respectively at NUTS 3 level based on the spatial statistical analysis of the indicators at NUTS5/LAU2 level.

The research question is: Which counties have economic, demographic, and ethnic differentiation and multiculturalism characteristics with negative effects on development or which require specific actions?

The research hypothesis is Counties with distinguishing characteristics (economic, demographic, and ethnic and multicultural) have low performance in terms of economic cohesion expressed by GDP/capita and require the development of personalized public policies with different degrees of impact.

2 Literature Review

Europe's Cohesion Policy is strongly linked to the 2030 Agenda for Sustainable Development Goals and has a tangible impact on the lives of millions of Europeans. More coherence between EU policies to build a tailored cohesion policy for all regions becomes an important issue [1].

Jouen [2] makes a policy and institutional review of the territorial cohesion concept and concludes that this concept is used a lot, even if it is a bit fussy. The author proposes a clear definition: "*territorial cohesion designates a state of the European space in which the differences between territories are reduced or are at least made acceptable, for all European citizens to be able to enjoy comparable lifestyles and sustainable development, and in which ties between territories are likely to create a sense of belonging to the Community*".

The tremendous importance of territorial cohesion is confined by the 174th article of the Lisbon's Treaty, namely: "Among the regions concerned, particular attention shall be paid to rural areas, areas affected by industrial transition, and regions which suffer from severe and permanent natural or demographic handicaps such as the northernmost regions with very low population density and island, cross-border and mountainous regions" [3].

Jouen [2] clearly specifies what is desirable and The Lisbon Treaty makes a list of territories with dissimilarities under the risk of drawback, especially with their peoples under the risk of marginalization or becoming vulnerable. The cohesion policy stands at the core of European strategies with focus on: rural development, transportation, smart specialization, and lately, on green economy [4]. The territoriality of the cohesion policy represents one of the main critics of cohesion policy. The greatest concern is regarding the success of cohesion policy if its result lead to economic convergence [4].

In this analysis, we used definitions and basic concepts established based on the legislation in force, such as counties with 1st degree drawback, counties with 2nd degree drawback, areas affected by the industrial transition, regions affected by a permanent natural drawback.

2.1 Defining Drawback Counties at First and Second Degree

We mark the presence of the drawback by creating an Aggregate Drawback Index (CDDI) with values from 1 to 100%. The higher the weight associated with the index, the higher the risk of problems, barriers in the development of the location and implicitly increases the demand for specialized actions and interventions to overcome them. For counties that have high aggregate weighting characteristics of differentiating features with negative effects on development or that require specific economic, demographic, or ethnic actions, we determined two drawback classes according to the ESDA classification method in Jenks natural intervals [5]:

- The counties with a 1st drawback are the counties that have the level of the CDDI with values included in the first class (class with the highest values).
- The counties with a 2nd drawback are the counties that have the level of the CDDI with values included in the second class (the class with relatively high values of the index).

2.2 Defining Economic Drawback Profile for Counties

- *The disadvantaged areas defined as areas affected by the industrial transition and the calculation of the economic drawback sub-index.*

The areas affected by the industrial transition are the areas that are characterized by high levels, rates, densities, agglomerations, and perennial unemployment. The areas characterized by high levels, rates, densities, agglomerations and perennial unemployment are the areas affected by industrial transition. We used the SOM101E and SOM101F indicators provided by TEMPO INS at the LAU2 level. This approach is based on Government Emergency Ordinance (GEO) 24/1998 on the regime of disadvantaged areas. This document defines:

1. *By the nature of the present GEO, the disadvantaged areas are represented strictly by* territorial geographical areas that meet at least one of the following conditions:

    a. "The share of unemployed people in the total labor resources of the area should be at least three times higher than the share of unemployed people in the total labor resources at a national level, in the last 3 months preceding the month of drawing up the documentation for declaring the disadvantaged area.

    b. the isolated areas without means of communication and areas with poorly developed infrastructure".

2. The share of unemployed people in the total labor resources is a statistical indicator, registered monthly, expressed as a percentage, and calculated by dividing the number of registered unemployed to the total population aged between 18 and 62.

3. Regarding the share of the unemployed people in the total labor resources, we used the number of the ones with a permanent residence in the respective geographical area, registered at the end of the reference month and the number of the stable population of the area, aged between 18 and 62.

4. At the national level, the share of the unemployed people in the total labor resources will be calculated using the same method, by dividing the number of unemployed people registered at national level to the total stable population aged between 18 and 62.

5. The share of the unemployed people in the total labor resources at the area and national level is established by the National Commission for Statistics, based on data regarding the number of unemployed, provided by the National Agency for Employment and Vocational Training.

The areas affected by industrial transition are identified in Table 1, being counties with the highest unemployment rate in 2019 (variable name rsom2019) in High-High (HH) clustered LAU2 locations (locations with high levels of unemployment rates surrounded by locations with high levels of unemployment rates) and were included in the calculation of the CDDI as the economic drawback Subindex.

- *The disadvantaged areas defined as regions affected by a permanent natural drawback and the calculation of the economic drawback sub-index.*

Regions affected by a permanent natural drawback are identified by using the terminology defined in the indicator Area of less-favored areas: code 1.4.5. (V_ZD_UAT_145) disadvantaged areas may be in the: Ministry of Development, Public Works and Administration (MDRAP) terminology represented by:

"Currently, the disadvantaged areas declared according to the agricultural criterion are divided into three categories (according to the National Rural Development Plan):

(1) Disadvantaged mountain area (DMA) overlaps almost entirely over the Carpathian Mountains and consists of 657 administrative-territorial units (county seat municipalities, municipalities, cities, and communes).

(2) Significantly disadvantaged area (SDA), completely overlapping the Danube Delta Reserve.

(3) Areas disadvantaged by specific natural conditions (ADS), the delimitation criterion being that of lands with a credit rating below a certain established threshold."

The indicator with the same name (Area of disadvantaged areas) is included in the calculation of the Drawback Index, as Economic Drawback Subindex marked in yellow in the Table 1.

2.3 Defining Demographic Drawback Profile for Counties

We also identified the regions affected by a severe and permanent demographic drawback, following an iterative process of ESDA—type spatial exploratory analysis and clustering Local Indicators of Spatial Autocorrelation LISA (Anselin, 2010).

The following 8 indicators were analyzed in detail at the LAU2 level:

(1) Population by residence on July 1, 2020 (Statistical Source is the Territorial Observatory of Ministry of Regional Development and Public Administration in short OT) (OT code 2.1.1.), Variable name: Pop/ESDA representation area.

(2) Population growth rate (OT code 2.1.3.), Variable name: rcrPop, ESDA density representation.

(3) Natural growth (clusters) (OT code 2.1.6.), Variable name: SporNat density. LISA analysis. Selection for concentrations of negative levels.

(4) Migratory spore (OT code 2.1.8.), Variable name: SpMigrNg. ESDA Density Representation and LISA Analysis. Selection for concentrations of negative levels.

(5) Home departures including external migration (OT code 2.1.10.) Variable name: Departures. ESDA Density Representation and LISA Analysis. Selection for concentrations of negative levels.

(6) Number of permanent immigrants (OT code 2.5.2.) Variable name: Immigrant. ESDA Density Representation and LISA Analysis. Selection for concentrations of positive levels.

(7) Birth rate (code OT 2.1.4.) Variable name: rnatalit. ESDA Representation and LISA Analysis. Selection for concentrations of negative levels.

(8) Mortality rate (clusters), (code OT 2.1.5.) Variable name: rmort. ESDA Density Representation and LISA Analysis. Selection for concentrations of positive levels.

The last six, out of these, iterated in Table 1 (marked in green) were included in the Drawback Index calculation, respectively were aggregated under the Demographic Drawback Subindex.

We remind you that demographic phenomena are deep and complex. This analysis is simplified but provides a referential territorial image. We specify that the

phenomenon of population aging is with a uniform degree at the territorial level (LAU2), an aspect reflected by the decrease of the population growth rate slightly differentiated at the territorial level, which determined us not to include this indicator in the model. In this context, when we analyzed the convergence indicators, we also took this aspect into consideration.

2.4 Defining Ethnic and Cultural Differentiation Drawback Profile for Counties

In the analysis of the spatial distribution of the ethnic composition at the regional level, we used the indicator Stable population by ethnicity, (OT code 2.2.2.):

– Clusters of Hungarian citizens. Variable name: Magh. LISA analysis.
– Clusters of Rroma citizens. Variable name: Rroma. LISA analysis.
– Clusters of citizens of other ethnicities. Variable name: AltEtn. LISA analysis.

We, also, identified regions with a heterogeneous ethnic composition: concentrations of ethnic Hungarians, Roma, other ethnic groups, locations that host clusters with agglomerations of populations of another ethnicity. We applied the LISA method (Anselin, 2010). The 3 iterated variables in Table 1 (marked with light brick color) resulted and were aggregated in the Drawback Index under the Ethnic Differentiation Index.

2.5 Defining Development Through GDP/Capita at Territorial Level

To validate the chosen hypothesis, we used GDP/capita, the main indicator used in the analysis of territorial convergence. We use the indicator "Gross domestic product (GDP) at current market prices by NUTS 3 regions [NAMA_10R_3GDP__custom_1843659] provided by EUROSTAT, at current market prices in Euro, normalized, at NUTS3 level. For the calculation of GDP/capita, we weighted GDP/county with population by the indicator" Average annual population to calculate regional GDP data (thousand persons) by NUTS 3 regions [NAMA_10R_3POPGDP $ DEFAULTVIEW] also provided by Eurostat.

Cohesion is strongly linked with development, more visible than ever on the background to 2030 AGENDA [6] and of the Sustainable Development Goals [7]. The main objective of cohesion policy is to produce convergence, meaning that any European citizen should have access to a sustainable lifestyle, regardless the territory where he or she lives.

Especially in genetics literature, the "*similarity-based mating scheme to dynamically control the balance between the diversity of solutions and the convergence to the Pareto front*" is a topic of the evolutionary multi-objective optimization [8]. Convergence and diversity are two main goals in multi-objective optimization modeled through the optimization evolutionary algorithms (MOEAs) [9].

Even if the evolutionary concept is translated to evolutionary economy we identified by exploring the convergence gap versus diversity in the economy, regardless its branch. The cohesion policy is successful if it produces convergence (sustainable lifestyle for everybody) and the measure for diversity is the dissimilarity analyzed in our paper, in a synthetically manner under the Aggregate Drawback Index.

It's important to remember two theories when it comes to judging the sustainable lifestyle through a territorial lens: the center-periphery model and the evolutionary economy model. The core-periphery model of [10, 11] initial a monopolistic competition model, spring the new economic geography theory formulated by the famous trio Fujita, Krugman and Venables [12], developing the spatial version of the Dixt & Siglitz model.

Heblich [13] emphasizes that Ron Boschma and Ron Martin, synthetically defined the aim of evolutionary economic geography, as "the processes by which the economic landscape—the spatial organization of economic production, circulation, exchange, distribution and consumption is transformed from within over time".

Both theories explain the dissimilarities development and evolutions resulted from the interactions of natural completion processes. On the policy side, the failures of the "free economy" should be overpassed through policies interventions. But these policies interventions should optimize the *convergence* and *diversity*, under the cohesion desiderate of sustainable development.

3   Methodology

3.1   *Exploratory Spatial Data Analysis (ESDA)*

The preliminary data preparation suffers a spatial analysis of the indicators. From the ESDA techniques, we use the Choropleth Maps, which represents "Counterpart of Histogram, where are values/attributes for discrete spatial units with associate colors palette [14]. The maps use geocoded data provided by the OT.

As a first step, we analyzed the spatial pattern of the selected indicators used in the drawback concepts. We represented the variables using five classes Natural Breaks [5] Classification or Quantile representation to distinguish behaviors. Natural Breaks [5]

Classification technique is an optimization method for Choropleth Maps, minimizes variation in each group, applied in Arc GIS desktop 9.3." [15]. The persistency of the drawback is assured looking at the spatial distribution at two moments in time: in 2010 and in the most recent data in a Quantile representation (as we mentioned before). In a Quantile Class classification, each class contains an equal number of features. A quantile classification is also a classification technique, suited to linearly distributed data. Quantile assigns the same number of data values to each class" [15]. We use 5 classes and then the interval is 20% and it is called Quintile.

As a second step, we mapped the clusters in order to apply the Local Moran's I identified with the Local Indicators of Spatial Association (LISA) technique. With the help of this technique, we found the answer to the question whether the identified pattern is random or clustered [14]. We applied the Queen Contiguity weight rule of the first order. Moran's I Spatial Autocorrelation Statistic is a cross-product statistic with inference based on permutation estimation [14] knowing that a Moran's Index value near $+1.0$ indicates clustering, while an index value near -1.0 indicates dispersion. We selected only drawback indicators levels, that proved to cluster either LL (Low-Low: locations with low level of the attribute data having in neighborhood locations with low level of the same indicator) or HH (High-High: locations with high level of the attribute data having in neighborhood locations with high level of the same indicator), as a measure of the undesirable situation.

As a third step we overlaid maps build for selected indicators [16]. The map resulted spatial integrates the drawback index with the trans-frontalier and rural profile over the GDP/capita performance.

3.2 Building the Aggregate Drawback Index—CDDI

The process of identifying the NUTS3 level locations of the counties with drawback is the result of an ESDA analysis—Exploratory Spatial Data Analysis applied to LAU2 level indicators (NUTS5 equivalent) provided by MDRAP in the Romanian Territorial Observatory and TEMPO INS. Drawback locations are characterized by selecting a set of 12 indicators at LAU 2 level.

We used the Decision-Making Tools at Work steps from the Multi-Criterial Decision Analyse (MCDA) Methods according to [17] and apply the following 4 steps methodology:

M.1. Selecting the best value

*Each criterion has different values.

*Criteria analysis—scale representation for qualitative values.

We selected the indicators (Table 1) that reveal the presence of perennial and persistent disadvantages in 2010–2019, with spatial variability at the LAU2 level. This process is iterative and included ESDA by Quantile representations with 5 intervals—useful for comparison in time, in 2010 and the most recent year available

(2018 even 2020), class representations established in Jenks natural intervals, and verification of spatial autocorrelation by applying analysis LISA.

M.2. Building the Decision Matrix

Xij = performance value for alternative i to criterion j.

*Beneficial criteria the desirable values are the high values.

*Non-beneficial criteria the undesirable values are small values.

We built the decision matrix and allocated performance levels using the following drawback criteria: (see Appendix, Table 2):

– absolute or relative undesirable levels (high or low):

  • Unemployment rate 10,120 (rsom1020) as a share of unemployed people registered at the end of the month in total labor resources at LAU2 level with persistent values over 9.3% in 2010 and 2020. We have allocated the following points for counties at LAU2 that registered persistent levels of unemployment selected based on ESDA by Quantile representations with 5 intervals—useful for comparison over time: very critical 5; predominantly critical 4; criticism 3; partially critical 2; lower1.
  • Area of disadvantaged areas (Szndef)—we allocated the following points starting to the highest values of weights related to the total area: for 3.20% we allocated 4 points, for 2.70% we allocated 3 points, for 2.20% we allocated 2 points, and for 2% we allocated 1 point.
  • Home departures including external migration (Departures)—high departure rates from LAU2.
  • Number of immigrants (Immigr)—high rates of immigrants.

  Note: it seems that the last two indicators are in a logical contradiction and each other requires sustained efforts formalized through specific public policies: local development policy to maintain the population, including labor, and policy to attracting human capital, an especially high-human capital. This policy must be addressed not only to the individual, but also to his/her family.

– densities, represented by ratios between indicators and the surface of LAU2, with absolute or relative levels (rates) undesirable (high). The selection threshold is represented by the lowest level of the first class determined by Jenks natural intervals with 5 intervals, ESDA representation:

  • Migratory/surface increase (SpMigrNg): predominantly negative and constant migratory increase in 2019.
  • Change in the density of unemployed registered in 2019 compared to 2010 less than 5.15 unemployed/km^2 (Fdm_deficit)—1 point allocation for counties.

– perennial agglomerations or clustering phenomena—locations with high or low levels but undesirable surrounded by locations with high or low levels, similarly undesirable. LISA analysis was used to identify undesirable and persistent clusters/agglomerations [14].

- Natural growth (clusters), (SporNat)—selection of LL clusters: 2—points allocation for counties with locations characterized by low rates of natural growth, surrounded by locations with low rates of natural growth.
- Birth rate (rnatalit), LL agglomerations with very low birth rates.
- Mortality rate (rmort), HH agglomerations with very high birth rates.
- Population by Hungarian ethnicity (Magh) HH agglomerations, with high densities.
- Population by Roma (Rroma) HH agglomerations, with high densities.
- Citizens of another ethnicity (AltEtn), HH agglomerations with high densities.

M.3. Normalization of criteria's

$$\text{Drawback criteria} = \text{Xij}/\text{SUM(Xij)} \tag{1}$$

M.4. Building the standard drawback performance decision matrix

[Cij] with 3 drawback criteria's: Economic, Demographic and Ethnic is presented in Table 2 and is built as follows:

$$\text{Drawback Economic}_k = \text{Fdm\_deficit}_k + \text{rsom2019}_k + \text{Szndef}_k \tag{2}$$

$$\text{Drawback Demographic}_k = \text{SporNat}_k + \text{SpMigrNg}_k + \text{Plecari Imigr}_k \\ + \text{rnatalit}_k + \text{rmort}_k \tag{3}$$

$$\text{Drawback Ethinc Differntiation}_k = \text{Magh}_k + \text{Rroma}_k + \text{AltEtn}_k \tag{4}$$

where $_k$ county, k simple aggregation of the scores

$$\text{Drawback} = \text{Drawback Economic} + \text{Drawback Demographic} + \text{Drawback Ethnic} \tag{5}$$

4   Results and Discussions

Based on these results, the identification of counties with drawback (economic, demo-graphic, and ethnic), cross-border counties, and rural counties define the general socio-economic context. Because the cross-border counties are visible without special markings, in the synthesis maps provided, we marked in the legend the counties with 1st and 2nd degree drawback and rural counties (according to the three typologies of predominantly rural, intermediate, and predominantly urban character).

4.1   Cross-Border Counties

We highlight the situation of the territorial profiles of the counties in Romania based on the two specific components mentioned above: cross-border and sectorial special-ization. The cross-border position of the county is visible on the map, by overlapping the national state border over the territorial administrative border of the county. The consequences of geographical positioning are crucial in the plan of differentiation of political, administrative regime with direct economic effect and impact, manifested by various advantages (economic exchanges, access to resources, labor mobility, etc.) or difficulties (differentiated connection to global/regional markets, economic costs, a long distance from the center, etc.), not least the occurrence of exceptional situations (armed conflicts—the war in Ukraine, natural disasters, etc.).

Romania's territorial profile, according to the cross-border criterion, includes 20 counties that are Romania's border counties, out of which 12 counties are EU border counties. These present a risk of marginalization, the most exposed counties being Timiș, Suceava, Caras-Severin, Tulcea, Arad, Bihor, Dolj, Constanta and Maramureș (Fig. 1).

The effects of being at the border with the EU (12 counties), but also with non-EU states (8 counties) are now highlighted by the geopolitical context, which has become extremely tense due to the conflict in Ukraine, one of the neighboring countries.

The pressure for fast reactions as well as for strategic coherence resilience, when it comes to the level of public administration—no matter how high or low—increases enormously.

4.2   Economic Specialization Counties

The character of sectorial specialization is determined by the perspective of the existence within the territory, mainly based on some economic sectors. The special-ization in agriculture/forestry/fish farming is specific to human settlements with low densities and corresponds to the EUROSTAT GISCO classification of counties with predominantly rural profile, named by new rural counties. (Fig. 2).

Fig. 1 Border counties. *Source* Map created by the authors in Arc GIS 9.3. *Data* MDRAP Territorial Observatory

The areas with sectoral specialization in agriculture/forestry/fish farming, respectively sectors of activity-dependent on extensive land use are rural counties. Recently, the OECD has cleared the errors induced by the statistical method by introducing the new typology of classification of regions at the NUTS3 level. This method is based on the share of the rural population at grid/cell level with an area of 1 km^2.[1] Thus, clusters of urban cells delimited according to the criterion of population density of, at least, 300 inhabitants/km^2 and a total population of at least 5000 inhabitants are identified. All cells outside these urban clusters are considered rural cells. The cells thus classified are grouped in areas less than 500 km^2. In this study we classified NUTS3 regions [18], using the same principle mentioned above. The criterion to be applied is represented by the share of the rural population, such as: predominantly urban (PU), regions that have a share of less than 20% of the population living in rural areas; intermediate (NI) regions with a share of more than 20% and more than 50% of the rural population; predominantly rural (PR) regions that have a share of more than 50% of the population living in rural areas.

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[1] The 1 km $grid^2$ is already available for Denmark, Sweden, Finland, Austria, and the Netherlands (see European Geo-Statistical Forum (EFGS)), and the new typology is based on the actual grid in these Member States. For the other Member States, the new typology is based on the population breakdown grid (version 5) created by the Joint Research Center (JRC), based on the LAU2 population and the CORINE land cover. The 1 km $grid^2$ is likely to become the future standard and has the advantage that it can be easily replicated in non-EU countries.

Fig. 2 Counties specialization. *Source* Map created by the authors in Arc GIS 9.3. *Data* GISCO EUROSTAT

4.3   First and Second-Degree Drawback Counties

In Fig. 3 we are synthetically presenting, the results of the multi-criteria analysis with equal weights by which we aggregated the three Subindexes: Economic, Demographic and Ethnic in a generic index, an Aggregated Drawback Index, named CDDI. Based on this map we will make a layer in Arc Gis Pro in which we will keep the perimeters of the counties that have large aggregate weights of the differentiation characteristics with negative effects in development: Counties with 1st drawback degree and Counties with 2nd degree drawback.

* The counties with values between [4.04–7.26%] in the CDDI are the counties with 1st degree drawback, represented with red in Map 1: Caraş-Severin, Mehedinți, Teleorman, and Tulcea.

* The counties with values between [2.43–4.03%] in the CDDI are the counties with 2nd degree drawback, represented with orange in Map 1: Alba, Suceava, Harghita, Buzău, Călărași, Vaslui.
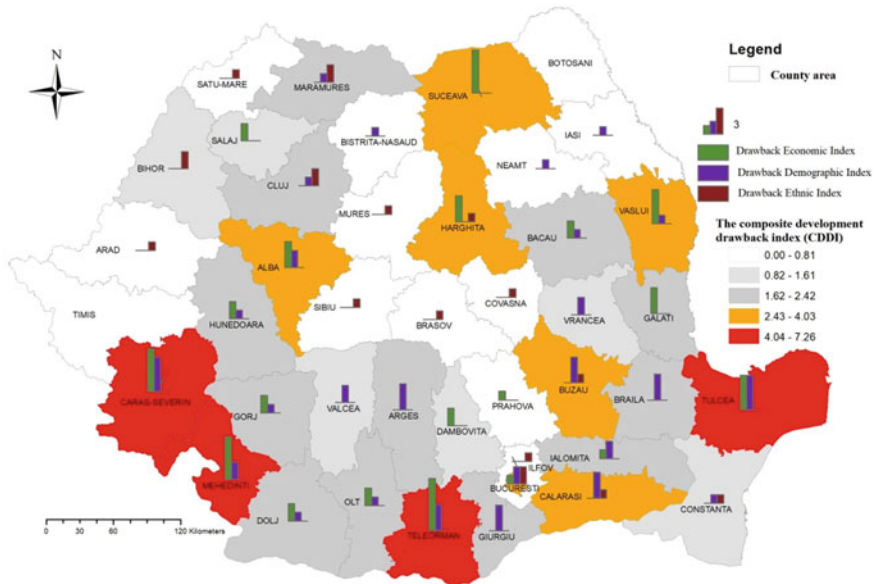
Fig. 3 The composite development drawback index (CDDI) for Romanian counties using three sub-components: economic development, demography, multiculturalism. *Source* Map created by the authors in Arc GIS 9.3

4.4 The Spatial Overlay of the Counties Profile's Drawback and GDP

We turn again to map draw by Quantile classes representations to be able to compare the evolution of the counties by income classes. Given the limits of comparability in dynamics as a level, we propose a visual exploration of the spatial distribution of GDP/capita using ESDA techniques of representation by Quantities in 5 quintile classes in 2010 and 2018.

The absence of convergence is signaled by maintaining the level of GDP/capita in the same quantile (we used GDP/capita data at current prices). Particular attention is paid to the counties that persistently position themselves in the smallest 1st Quintile (counties with the lowest average GDP/capita), in 2010 and 2018, (Fig. 4a, b). These counties are:

- Botoșani, Suceava (county with 2nd degree drawback), Neamț, Vaslui (county with 2nd degree drawback) and Vrancea, most of the Northwest region of Romania.
- Teleorman (county with 1st degree drawback) and Giurgiu (county with demographic disaster) in the Southern Region.

In 2018 compared to 2010 we notice counties that:
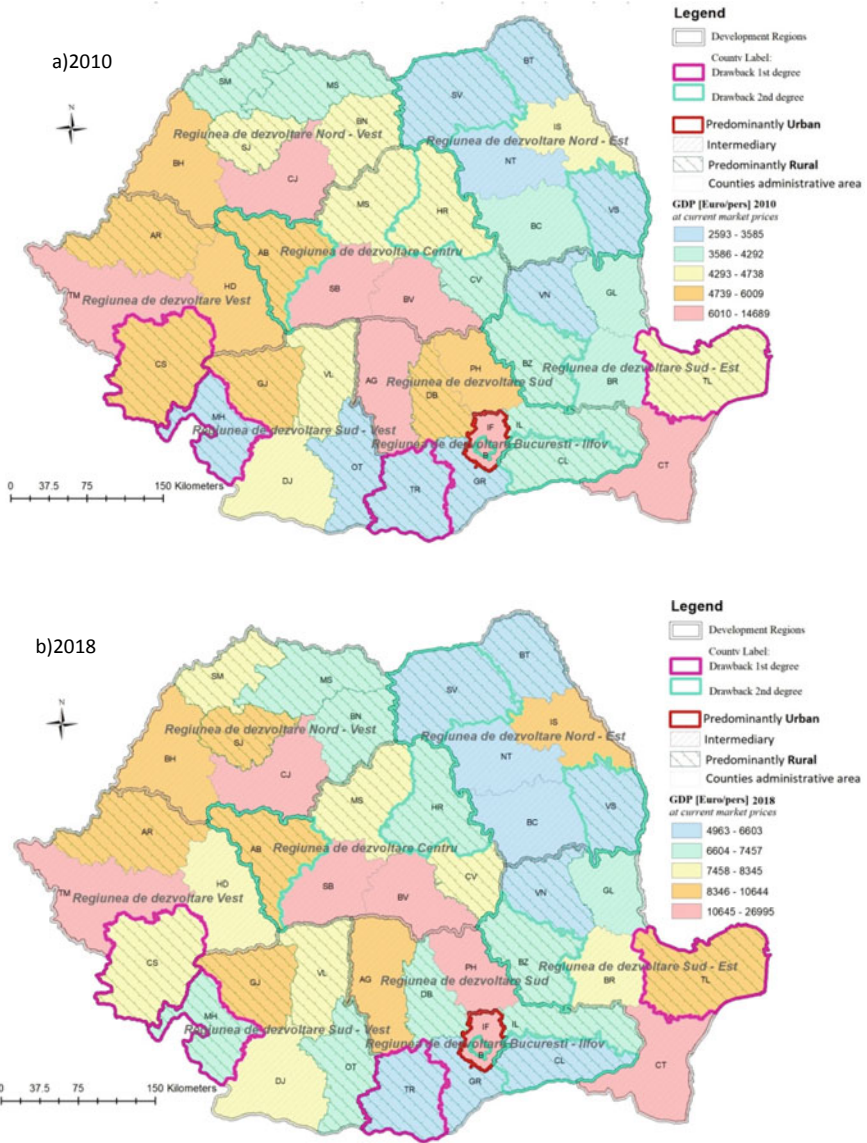
Fig. 4 Mapping CDDI counties, with lowest and lower potential of implementing tools of economic development and convergence on the background of spatial distribution of GDP/capita in 2010 and 2018. *Source* Map created by the authors in Arc GIS 9.3

- They ascended: from 1st Quintile to 2nd Quintile, Mehedinți and Olt; from 2nd Quintile to 3rd Quintile: Tulcea (county with 1st degree drawback).
- They descended from 2nd Quintile to 1st Quintile: Călărași, Bacău; from 3rd Quintile to 2nd Quintile: Caraș-Severin (county with 1st degree drawback), Harghita (county with 2nd degree drawback).

5 Conclusion

Mehedinti, Tulcea and Prahova counties have registered great success, increased by one class their performance in terms of relative GDP/capita. We remind you that Mehedinți and Tulcea counties are both classified by us with a 1st degree drawback. These counties may become subject of good practices studies.

Călărași and Bacău counties require a focused analysis in order to identify divergence factors materialized by negative transitions from 2nd income class in 2010 to 1st class, the lowest in 2018.

The special geographical positioning of Călărași county could be explained by:

(a) The proximity to the Capital—Bucharest, on the one hand, the strong metropolis that attracts resources and labor; the proximity, in this case, is not an advantage, it has the effect of a "black hole".
(b) The fact that, belonging to rural environment of Romania, the economic and social development are delayed, on the other hand.

The special geographical positioning of Bacău county could be explained by the fact that this county belongs to intermediate regions (NI) dominated by old industries facing socio-economic challenges, trying to improve their economic structure in the new context of EU.

Caraș-Severin, Mehedinți, Teleorman, counties with 1st degree drawback index justify the development of public policies profiled by their specific characteristics.

The present research has some major limitations resulted from the big data amount tendency aggregation through subjective score allocation for the chosen criteria. This is the first iteration and could suffer in the future some improvements through extensive data analysis using another statistical method for indicators selection i.e., PCA (Principal Component Analysis) but integrating the results into space.

The hypothesis is validated—the counties that have a high Drawback Index require personalized public policies, as is the case of Tulcea county which benefited from this approach for the Danube Delta ITI area.

The main criterion of GDP/capita used in the convergence analysis as a result of cohesion policy is not enough to provide a clear analysis. Complementary application of the Drawback Index allows a better understanding of the context in which public policies are applied, and finally a better targeting of them—in the case of Tulcea.

One of the main contributions of authors was to fill the gap between the convergence theory and policy optimizing the convergence, measured through the GDP//capita similarity in a diverse framework. The drawback is a measure of the

Table 1 Selected indicators for criterion analysis with qualitative representation

The characteristic that indicates the existence of a continuous and critical drawback	Variable name	Type of drawback / peculiarities	Aggregate variable name level II	Generic feature	Level I aggregate variable
Deficient labor force	Fdm_deficit	Economic	Hp_ec	Drawback	Drawback
1029 unemployment rate (TEMPO INS)	rsom2019				
Surface disadvantaged areas	Szndef				
Natural growth (clusters)	SporNat				
Migratory/surface increase	SpMigrNg				
Home departures including external migration	Plecari				
Number of immigrants	Imigr				
Birth rate (clusters)	rnatalit				
Mortality rate (clusters)	rmort				
Population by Hungarian ethnicity	Magh	Etnic	Etnic		
Population by Roma ethnicity	Rroma				
Citizens of another ethnicity	AltEtn				

Source of indicators MDRAP, Territorial Observatory and TEMPO INS, degree of disaggregation LAU2
Source Authors' own research

diversity of the territory. Better management of the territory is essential to assure the success of the cohesion policy. This three-dimensional index applied to Romanian regions is a study pilot that opens the opportunity to develop future models and methodologies more complex to be applied at European regions.

Appendix

Table 2 Building the standard drawback performance decision matrix

	Jud	Fdm_deficit	Rsom1020	Szndef	SporNat	SpMigrNg	Plecari	Imigr	rnatalit	mort	Magh	Rroma	AltEtn	Hp_ec	Hp_dem	Etnic	Drawback	Hand2	rang
1	Caraş Severin		2	3	2	1			1					5	4	0	9	7.3	1
2	Teleorman	1	5			1			1	1				6	3	0	9	7.3	2
3	Tulcea			4	2	1			1					4	4	0	8	6.5	3
4	Mehedinţi		5		2									5	2	0	7	5.6	4
5	Alba		2	1	1				1					3	2	0	5	4.0	5
6	Suceava		3	2										5	0	0	5	4.0	6
7	Vaslui		4					1						4	1	0	5	4.0	7
8	Bucureşti	1					1	1				1	1	1	2	2	5	4.0	8
9	Călăraşi				2					1		1		0	3	1	4	3.2	9
10	Harghita			3							1			3	0	1	4	3.2	10
11	Buzău				2				1			1		0	3	1	4	3.2	11
12	Olt		2							1				2	1	0	3	2.4	
13	Argeş				2					1				0	3	0	3	2.4	
14	Bacău		2			1								2	1	0	3	2.4	
15	Brăila				2	1								0	3	0	3	2.4	
16	Dolj		2							1				2	1	0	3	2.4	
17	Galaţi	1	2											3	0	0	3	2.4	
18	Giurgiu				2					1				0	3	0	3	2.4	
19	Gorj		2						1					2	1	0	3	2.4	
20	Cluj						1				1	1		0	1	2	3	2.4	
21	Maramureş					1					1		1	0	1	2	3	2.4	
22	Hunedoara			2					1					2	1	0	3	2.4	
23	Ialomiţa		1			1				1				1	2	0	3	2.4	
24	Constanţa						1						1	0	1	1	2	1.6	
25	Bihor										1	1		0	0	2	2	1.6	
26	Dâmboviţa	1	1											2	0	0	2	1.6	
27	Sălaj		2											2	0	0	2	1.6	
28	Vâlcea					1			1					0	2	0	2	1.6	
29	Vrancea				2									0	2	0	2	1.6	
30	Braşov										1			0	0	1	1	0.8	
31	Bistriţa-Năsăud					1								0	1	0	1	0.8	
32	Mureş										1			0	0	1	1	0.8	
33	Neamţ								1					0	1	0	1	0.8	
34	Prahova	1				0								1	0	0	1	0.8	
35	Arad										1			0	0	1	1	0.8	
36	Covasna										1			0	0	1	1	0.8	
37	Iaşi						1							0	1	0	1	0.8	
38	Satu-Mare											1		0	0	1	1	0.8	
39	Sibiu											1		0	0	1	1	0.8	
40	Ilfov										1			0	0	1	1	0.8	
41	Botoşani													0	0	0	0	0.0	
42	Timiş													0	0	0	0	0.0	
	Total	5	14	6	10	10	4	2	8	8	9	7	3	42	42	42	42	124	

Source Authors' own research

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A Continental Rapprochement: Western Balkan's Alignment Toward EU's Common Foreign and Security Policy

Mihai Christopher Marian Radovici

Abstract The article showcases how European institutions, within the enlargement frameworks, proposed a suite of recommendations regarding Western Balkan countries' foreign policy approaches, with a special focus on intra-regional cooperation, socio-political credibility, cross-border interaction predictability, multi-actor, and multi-level omnidirectional reform establishment. As such, the paper analyses WB6's methods and degrees of alignment towards EU's CFSP, especially in terms of shifting international patterns. The first part is an overview of WB6' specificities and how such aspects constitute a bridge or a rift, when it comes to the embodiment of European values, ideals, directions, etc., as prerequisites of ascension into EU's continental family. Decoding their core particularities is fundamental to the analysis, since it serves as a steppingstone for Balkans foreign affairs' extrapolation, interpretation, and comprehension, through in-depth literature reviews, as an enabler of more nuanced and balanced perspectives on the matter, addressing the question of how unitary traits affect systemic conduct. The second part consists of a literature review-oriented in-depth exploration of the six countries' international frameworks and the latter's alignment towards the CFSP. This endeavour draws from the first chapter's deciphering, correlated with extensive data examination, based on the Commission's adhesion progress reports, alongside official documents, respective to each country, as to answer the question of how we interpret progress through juxtaposed interlinkages. Lastly, the main arguments, emanated from the investigative processes, are wrapped up as to form a base for future programmatic, operational and paradigmatic pathways, especially ones requiring an analytical overview.

Keywords Western Balkans · EU integration · Foreign affairs

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209

1   Introduction: Underlining the Western Balkans

Although the Balkans per se represent Europe's easternmost peninsula, a universal consensus, regarding its constituency, has not yet been reached. From a geographical perspective, the area commonly incorporates: Bosnia and Herzegovina, Bulgaria, Montenegro, Albania, Croatia, Kosovo,[1] North Macedonia, Romania, Serbia, Slovenia, and some portions of Greece or even Turkey. Apart of the above delineations, the region is also defined through its common historical or ethno-communal evolutions, an approach which often bears some negative connotations, due to the Balkan's association, in the collective mind, with ethno-religious dissensions, power struggles, political conflagrations or even civil upheavals [3].

Since such matters are beyond this paper's boundaries, it is worth noting that the Western Balkans, in extenso, can neither be treated as a simple mosaic of borders nor as a centripetal nation-state's coagulation, but rather as the peninsula's (or even Europe's) main focal point of strategic interests, especially related to foreign affairs.

As such, the Western Balkan's origin, as an international relations' conceptual framework, can be traced all they to 1996, when the EU introduced this normative approach, as a distinction from South-Eastern Europe [33], and it included all the former Yugoslavian states, but Albania and Slovenia. In this sense, Western Balkan countries were approached by Brussels' institutions through uniformizing regional lenses. For instance, in late '90 s the EU' Stabilisation and Association Process was spearheaded, as an aggregator for WB's regional cooperation matrix, consisting of the area's normative interlinkage, based on normative assemblages, such as the 1999 Stability Pact or 2008 Regional Cooperation Council [23].

Thereafter, the WB's inter-regional integration began to take Europe's centre stage, since even the Council, Commission or Parliament, amongst numerous other organisms, underlined that all of SAA's member states are potential candidates, and overcoming the region's complex dynamisms (often diametral) represents one of the Union's strategic objectives, statements which stem from the 2003 EU-WB Thessaloniki meetings [19, 24].

Despite these (rather) unitary endeavours, Western Balkans' journey towards the grand European family varied for each state, and in some instances from region to region, as there were numerous differences to be accounted for [41]. Thus, the European bloc's initial in-bloc approach to Western Balkans' integration swiftly shifted towards a more nuanced projection, which include individually revised paths, in respect to each state' specificities [40].

Furthermore, due to recent modulations and emergence of alternative patterns, across Europe' security construction, Western Balkans' relevance, as a pivotal node, gained precedence as one of the continental and Atlantic communities' strategic

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[1] Designation made without any prejudice towards positions expressed on the areas' status; furthermore, it does not represent any endorsement or author' standpoint in the matter, as it strictly adheres to the stipulations of UNSCR 1244/99, the ICJ Opinion on the Kosovo Declaration of Independence and Belgrade-Pristina 2012 Agreement regarding the regional representation of Kosovo.

priorities [7]. This attitude was underpinned by the areas' intense and complex rivalries, alongside overtones such as US' diminished involvement in Western Balkans and EU's general enlargement slowdown. When these aspects, amongst a palette of other connex developments, are juxtaposed, within the prism of global multipolar orders, with a reordering of international processes, mechanisms, and elements, it is safe to assume that the WB temporarily became a power void space, as tactical or operational interests started to overlap [6].

Thus, Russian, Chinese, Turkish, or even Gulf States' influence spheres amalgamated, within Western Balkans' relative confinement, with European ones, and started to gradually erode the region's pro-occidental orientations, through the asymmetric instrumentalization of a wide array of financial-monetary, ethno-communal, historiographic, faith, artistic-cultural, digital, or even armed mechanisms [6]. In order to effectively counteract such a status-quo alteration, and avoid either a unitary band-wagoning, with other major regional or global actors, or an individual opportunistic derailing towards self-centred avenues, the western countries, intensified their active interactions with WB and expanded the spectrum of concrete incentives available [34].

Otherwise, Western Balkans' external vectors, internationalised pivotal actors and nodal points of power dispersion have (cumulatively) generated a nexus, of multi-actor and multi-level synergies, that cannot be completely detached of its European undertones. These processes consolidated a pull-over of fragmentary power units, aligning them into a new, relatively stable, modus operandi, albeit their long history of internal decomposition or diametral opposition.

A short incursion, into the hindmost string of events, which overshadowed most of Western Balkans' (or the peninsula's) history, enables a coherent identification of internal nodes, parallel to external forces, that alter these nation-states' ways to gravitate, through acts of transformative balancing, towards Europe's constellation. Therefore, all matters of foreign policy, be it regional or continental in aim or origin, are whereby directly affected, by the Yugoslavian implosion and its immediate socio-political fallout.

Setting the scene, for these non-linear complications, was an acute loss of "power strings from central structures, alongside a ramified authority crisis", that turned the Balkans into a textbook example of cascading anarchic disruptions [27]. These, in addition to Belgrade's initially firm (and rather forceful) attitude, led to a contagion of the area through various radicalized movements, rallied behind their own ideals of independence, state-construction or simply the containment of other groups' expansion. Furthermore, tiny specks of social disarray sparked one another, all to way to open armed conflicts, like the 1998 clash between Serbian forces and UCK, which led to the loss of more than 2.000 lives and dislocation of almost half a million persons, in just a few months, as way of example. These provincial back-and-forth fights often ended in "stalemates, as the autonomy gained earlier would later on be nullified" [14]. Since a coin always comes with two sides, apart of the above-referred confrontations, which form the ice-berg's tip, these events left their mark, through secondary ripples, across both institutions or demos, as they exponentially increased corruption, almost completely reverted living conditions, subjectively ostracized entire classes

or groups, crippled the regional economy, spiked violent and organized criminality, inflated socio-political rifts, etc.; all of which are hardly ever erased entirely, in Balkans' case still representing an intrinsic and vivid part of the collective imagery and region's destiny [8].

All without counting armed conflicts, both between local actors and against external combatants, that complicate, from the demos' standpoint, any pledge of alliance with some of the flags which formed the „other" side just a few decades back. And the area had its share of those, such as 1991 Slovenia's 10 days war; 1991–1995 Croatian independence conflict; 1992–1995 Bosnia's conflagration and NATO interventions; 1998–1999 Kosovo's war and NATO air operations; 2000–2001 South Serbian fights 2001 North Macedonia's battles, amongst a plenitude of smaller ones [38].

In the end, all these evolution patterns constructed a rather frail regional order and power balance, in the absence of any (local) major player, an international carousel of alliances, an array of asymmetric games and a network of inter-state or intra-regional overlapped assemblages, all of which require a lot of strategic joggling, through carefully steered foreign policies, to be properly aligned towards a common avenue. The latter consists, for quite a while now, of a prospective adhesion to Brussel's network. In this sense, apart of all other prerequisite indicators, the clearest way to measure Western Balkan's pulse, through the prism of EU's enlargement, is to comparatively observe how their respective foreign policies are aligned (or in tune at least) with the Common Foreign and Security Policy and its main strategic positions or directions.

2 Literature Review: Comparative Analysis of Western Balkans and EU's Foreign Policies

Since Western Balkans represent EU's (core) periphery, and immediate vicinity for the continent's Eastern mid-point frontier (V4—Mediterranean median axis—which roughly delineates EU's multispeed spaces), all while flanked by member states, they cannot ignore Europe's centrifugal magnetism. Thus, as much as they share a common heritage, be it positive or negative, they also possess a collective future, defined by the same horizon of opportunities and challenges.

Moreover, Western Balkans' difficult categorization as either regional security complexes or sub-complexes emerges, not from above-mentioned reasonings, but rather from the transitory advancements and transformative processes they face. As such, Barry Gordon Buzan, Ole Waever and Jaap de Wilde, amongst numerous other international relations practitioners and foreign policy experts, paradigmatically present four essential checkboxes for a regional security complex, which are programmatically operationalizable in the Western Balkans' space too [10]. Therefore, we can identify the following operations: Status quo maintenance—includes the complex's structural stability, equitable power dispersion and distribution, controlled

patterns of contained dissensions; Internal transformation—the complex' systemic assemblages are changed, based on external boundaries' contexts, through integratory socio-political mechanisms, decisive power dispersions or major cooperation patterns' alternation; External shifts—RSC' forms are changed through its borders' pulsations (based on modulations in intensity, frequency and composition); Coverage—entails a set of actions, exerted by one or several external vectors, across the RSC' range, with the purpose to suppress indigenous security dynamics.

Even if Western Balkans fully or partially met all above-mentioned theoretical conditions with empirical instances, there is credit to be given to the detractor' side too. As for instance, Bogzeanu Cristina's categorization integrates them as one of Europe' security sub-complexes, rather than a standalone formation, and describes the area as being amid a major evolutionary process, which in turn entails a variety of changes [8].

In both cases, Western Balkans' EU adhesion serves the latter' social, economic, political and security strategic objectives, as the cumulative efforts represent a geostrategic investment into a stable, powerful, and united Europe, alongside a puissant soft-power pivotal instrument, through the prism of liberal democracy, rule of law and fundamental rights promotion. A credible adhesion perspective represents an essential factor, to transform the region, and consolidates its collective integration, security, resilience, prosperity, and spills-over into an exponential wellbeing growth, all of which are primordial to Western Balkans' reconciliation and stability [17].

In this regard, Western Balkans' adhesion to the bloc, institutionally set forth by SAP, is strongly tied to TFUE's Art. 49 stipulations and Copenhagen Criteria [18]. Although, Western Balkans' ensemble has not met all prerequisite standards, since 1990 it made some impressive advancements, especially regarding societal reform and post-conflict construction, aspects that do not nullify the need for stronger rule of law, competitivity and regional cooperation reforms [12].

Nonetheless, EU showcased, being an active foreign policy and security actor, across Eastern and Central spheres, that a long-term stabilization, reconstruction, and Europeanization process, based on intertwined normative and operational frameworks, can yield tremendous results, locally, regionally, and continentally.

As such, Western Balkans partners, since Zagreb' Summit in 2000, officially and publicly pledged their option, regarding prospective developmental pathways in Europe, alongside firm engagements for good neighbourhood relations, intersectorial cooperation, adhesion to greater values and ideals, win–win interlinkage, etc. In turn, all these led to the undertaking of major programmatic and operational steps, especially in bilateral formats, some fruitful examples being Greece's Prespa Agreement from June 2018 [26] or Bulgaria's Treaty of friendship, good-neighbourliness, and cooperation [20], which initially set forth proper reconciliation and mediation mechanisms [22].

Alongside connex effects, this partnerships-driven network, led WB6 countries to turn their EU adhesion into their main foreign policy pillars, including the obligation to gradually (and completely) align with EU's CFSP [16, 25]. These endeavours are formally evaluated, based on the Commission's extensive annual progress reports and

other of institutional papers or communications, but can also be, more accurately, underlined based on their foreign policy strategies or self-reported monitorizations.

2.1   Bosnia and Herzegovina

Modern-day Bosnia and Herzegovina emerged in the aftermath of 1992 Referendum and its conflicts, which led to armed confrontations across ethnic lines (their apogee being Srebrenica's Genocide), through the Dayton Peace Agreement of 1995 who established the state' structure [2].

From early on, Bosnia and Herzegovina represented one the first regional players enshrined in CFSP' sectorial approach, primacy due in part to its potential candidate status, acquired in 2003 at during Thessaloniki EU-WB Summit. Afterwards, a cascade of agreements followed close, between Brussel's institutions and the country, such as: Visa facilitation and readmission agreements (2008), Interim agreement on trade and trade-related matters (2008), SAA (2015) and the Framework Agreement on the participation of Bosnia and Herzegovina in EU crisis management operations (2015), by way of example.

Since Bosnia and Herzegovina's adhesion request, in early 2016, and Council's Avis in 2019, regional cooperation and integration in European structures have represented its foreign policy cornerstone. Aspects firmly presented on numerous instances across its 2018–2023 Foreign Policy Strategy [37]. From correlated documents these objectives and priorities are not static descriptions but dynamic trajectories which prove a clear orientation towards the European Union, all interconnected with regional stances. In addition, representatives of almost all structures, with exclusive or share foreign policy competencies, stated that they are constantly making consistent efforts, to adequately face international crossroads and harmonize their positions.

In practice, little change from its 2003 Foreign Policy General Priorities and Directions, as the 2018 document extensively encompasses NATO elements, while keeping a rather diffuse approach towards the European community, with no clear point-by-point projections made, as the rapprochement objective seems to be an opaque ideal rather than a fine-tuned compass.

Furthermore, due to its interests' scope and range, EU still maintains active military contingents across numerous Bosnia and Herzegovina regions, under UN' Security Council aegis. Also, EU's delegation efforts are complementarily enhanced by the appointment of a Special Representative, alongside actions taken by various civil society organizations, private entities, or other institutions, albeit in slight disparity with the country's adhesion pace, since it rather just nominally approached the European bloc.

Regardless of the diplomatic jargons and moderate statements, spread across some of the recent Commission reports, in parallel to Bosnia and Herzegovina's constant status, the de facto reality is that the country does not properly adhere to a vast

majority of adhesion requirements. For instance, numerous European actors emphasized that its decentralized system, which hampered economic transcendence for a long time, requires significant normative, processual, and structural reforms, to become like its European counterparts [16]. Also, juxtaposing the Council's Avis and Commission's reports, we can highlight that Bosnia and Herzegovina is classified as possessing only some degree of preparation to meet membership-related obligations, especially in terms of foreign policy, defence, and security matters, this being the highest assessment level across all 16 domains analysed. Thus, the country is just in part capable of conducting external affairs, not to mention maintaining a capacity and capability projection across borders, needed to abide to EU's positions, actions, or sanctions.

Though there is some light in the tunnel, as Bosnia and Herzegovina, during the past decade, to prove its commitment to CFSP's objectives (also outlined in EU's Global Strategy), has aligned with more than 500 of EU's 800 declarations. On the other hand, there is an entire spectrum of EU measures and decisions to which Bosnia and Herzegovina did not get behind, almost all related to Russian Federation' situation, especially the 2014 measures taken in relation to the Crimean Peninsula events [29]. On the same note, another instance is a suite of bilateral documents, signed in 2003 with the United States of America, through which US citizens are exempted from International Criminal Court's jurisdiction, a complete divagation from EU's position on both the Rome Statue and guiding principles regarding bilateral immunity agreements.

Otherwise, the Commission remarks that Bosnia and Herzegovina needs to efficiently strengthen its diplomatic capacities and expand sustained administrative efforts abroad, similar to both defence and security structures. This emerges, on one hand, from the admission or employment procedures for its diplomatic and foreign corps, in addition to their professional development, and on the other, the need to create new structures across its foreign affairs ministry, for it to become uniformized with EU's international relations sector (as the country did not even possess proper laws regulating its foreign conduct) [12, 19].

On a positive note, EU is content with the country's involvement across a range of international networks, dating even before its SAA ratification, as it actively contributed to global peacekeeping missions (e.g., EUTM in Africa or NATO's Congo operations), international structures (SEECP, RCC, AII, CEI etc.) And regional endeavours (Berlin Process, WB6 Initiative, etc.) [4].

If we extrapolate two of Bosnia and Herzegovina's major external exchanges, within EU's cooperation zones, we can observe that they are diametrically opposite. This foreign affairs dichotomy comes as Turkey has undertaken numerous joint infrastructure projects, trilateral formats and is overall intensifying its closeness to Sarajevo, while Kosovo is not even recognized, in parallel with the contestation of its membership in international formations, by the latter, aspects which attracted EU's intervention [17].

On the demos' side, increased alignment efforts, are widely supported, as the adhesion is perceived to elevate employment, corruption and rule of law challenges, a

trend especially increasing since 2011–2012, when due to a slight spike in nationalist-dogmatic and extremist rhetoric, a majority of the public believed that Bosnia and Herzegovina is closer to a new conflagration rather than EU integration [15].

2.2 Montenegro

Montenegro, as an independent state, surfaced on the globe's political map, after its 2006 independence referendum, concomitantly with its IMF an UN ascension, followed one year later by the World Bank Group. In 2010 Montenegro presented its official EU candidature, immediately receiving the Commission's positive aviso, a position supported, even nowadays, as a national strategy, by all political parties, through their individual programmes.

Despite its rather fast integration across the international arena, the 2017 NATO adhesion divided Montenegro's political parties, including pro-European ones, since the 1999 bombing campaigns were quite fresh in the public's imagery, an aspect which also stained its alignment process to EU institutions.

Another interesting vector of integration was Euro's adoption (after dropping the deutsche marks), even without its membership status, because of '90s Belgrade monetary policies, which enabled unconditional emissions of Serbian dinars, spiking a buy-off properties on Montenegro's Adriatic littoral [9].

From the beginning Montenegro adopted NATO and EU adhesion, good neighbourhood relations and inter-regional cooperation as its foreign affairs' backbone. In mid-2012 it opened negotiations, and eight year later all 33 examined chapters have been opened, amongst which 3 are already temporarily closed [42].

In this context, Montenegro received an encouraging evaluation for its foreign policy perspective, and its diplomatic-administrative structure, of both foreign affairs and defence ministries, is considered ready to meet CFSP's obligations. In parallel, Montenegro completely aligned itself with Council's decisions and High Representative of the Union for Foreign Affairs and Security Policy's declarations and even joined all of Brussel' sanctions, taking an especially firm stance in the actions which targeted Belarus or the Russian Federation [29]. In addition, Montenegro repeatedly demonstrated its engagement, overlapping its stances, across UN's networks and systems, with EU's or those of its member states, endorsing them a great many times. This behaviour is also reciprocal as EU's Global Strategy and European Security Strategy often refer directly or indirectly, in a positive manner, to the country and its efforts [42].

Similarly, to Bosnia and Herzegovina, Montenegro's bilateral agreement with the US, signed in 2007, regarding ICC's jurisdiction exemption, represents one of few spots that are contrary to EU's attitude. Even though there are no signs of changing the above-mentioned point, Montenegro's discourse and concrete end-results, in terms of foreign, security and defence policies, are already entangled with those of European institutions [16]. In respect to the latter, there are numerous arrangements made with EU partners, related to informational security and sharing or handling of confidential

data, hybrid risk survey, apart of the country's contribution to multilateral missions, under the CDSP, EUFOCAR, UN-ATALANTA, UNFICYP, MINURSO, UNMIL, KFOR auspice, across all continents. The operation in Kosovo bear deep symbolic significances, and have generated reverberations in Montenegro, in respect to its ties with Serbia and even its own minorities, although these aspects seem to have been somewhat alleviated through collaborative and co-option flows across RCC, CEFTA, AII, US-Adriatic Charter, Berlin Process, WB6 Initiative, CEI, SEECP, etc.. Also, by overcoming its dissensions with Serbia, Montenegro was able to garner a good assessment of its neighbourhood policies and regional cooperation practices.

2.3 Albania

Albania presented in 2009 its official candidature and achieved the status in 2014, with the 2018 Council decision opening negotiations, and in 2020 starting them. Meanwhile, its NATO allied state status was received as a follow-up of 2008 Bucharest Summit's invitation. Moreover, its international presence is also composed by Albania's involvement in: UN, OSCE, Council of Europe, SECP (receiving, during 2019–2021 mandate, the General Secretariat for the Regional Cooperation Council), Open Balkans and Central European Initiatives, CEFTA, Berlin Process, SELECT and BSEC.

Apart of entering the European communities, Albania's primary foreign policy priorities consist in regional security consolidation, political stability, and economic growth. Albania even instrumentalized soft power techniques, to achieve these goals, as it made an open call towards its diaspora requesting them to adopt and promote European values. Another major pillar of its foreign affairs development consists in the support showcased towards Kosovo's independence, and beyond, in its statal or societal consolidation [5].

Thus, apart of justice, anticorruption, intelligence, civil services and organized criminality reforms, Albania's foreign policy alignment to EU's CFSP seemed to be quite an easy-going process. Aspect proved throughout the Commission's reports, as the documents continuously point out a remarkable capacity to participate in EU's foreign endeavours, through its diplomatic structures, which are seen as advanced enough to face complex global contexts. In this sense, it strictly abided EU's position and easily adopted even Council' sanctions, following in close steps all HR/VP declarations [16].

In concert with NATO and EU, Albania intervened in ALTHEA or EUTM mission, and assumed a readiness to get involved across EU's battle groups by as early as 2024. Regional endeavours like OSCE, SEECP, AII, CEI, Berlin Process, Brdo-Brijuni Process, WB6 Initative, are already a common theme, especially since both Western Balkan Fund and RYCO' seats are in found in Albania, demonstrating, as EU representatives stated, leadership capabilities, timeliness, flexibility and resilience, especially in response to migration or terrorist threats (through innovative formats

such as the Migration, Asylum, Refugees Regional Initiative and Western Balkans Counter-Terrorism Initiative) [5].

Although it showcased a willingness to sometimes go against Europe's vision, when it signed in 2003 the ICC related accord with US, Albania is actively supporting EU-led dialogues between Serbia and Kosovo, spearheading visa liberation, Kosovo's future in NATO and other organizations, and deepening its ties and involvement in Kosovars' future. So much so goes to Albania' solidarity with Kosovo that it went as far as cancelling its participation to 2019 SCEEP Foreign Minister Meeting in Bosnia and Herzegovina, as an initial signal that regional cooperation must prevail in all matters.

2.4 Kosovo

Kosovo represents one of the youngest Balkan states, accumulating 117 diplomatic (and 3 from other entities) recognitions as an independent state, (after it lost 15 throughout the years), as 97 of UN, 26 of NATO, 34 of ICO and 22 of EU's members recognized the Republic [1]. To simplify, from Kosovo's foreign policy priorities there are two major and equally important cores, fundamental to all other endeavours: a stable network across its vicinity combined with prosperous regional cooperation patterns and its EU adhesion.

Apart of the name, which includes an asterisk, and accompanying footnote across all of EU's documents, for Brussel's to avoid getting mingled into a status dispute, and the shift, since Sofia' summit, when referring to WB6, to the usage of partners rather states, Kosovo' SAA itself created an unusual precedent. Firstly, because the document was signed with EU as a single legal entity, rather than its member states, being the only one which has not been ratified by them. Secondly, as it led to as special directive which clarifies that this agreement did not mean its *en bloc* independence recognition by the EU. The document went in effect by early 2016, and one of the recurring bottom lines, across every single annual progression report, is the normalization of relations with Serbia, through EU coordinated dialogues, an aspect taken very seriously by Brussels, as it intensified its involvement into Kosovo-Serbia dispute resolution since 2012 [16]. In addition to these, the Commission identifies the need to implement significant reform for: a good governance, rule of law, competitivity, investments, employment, and education.

Furthermore, EU's 2008 EULEX mission in Kosovo represents one of the biggest civilian missions hosted under CDSP's umbrella, and it emerged from the belief that Pristina's authorities did not possess enough practical experience to properly govern a democratic state, due to its long-term lack of autonomy. Missions, in the likes of above-mentioned one, integrated across Reform Agenda's frameworks, were aimed at stabilizing the region and sustaining a liberal, euro-Atlantic oriented, and multi-ethnic state construction, capable to be autonomous and able to positively conduct cross-border relations [28].

Albeit these grandiose objectives, EULEX, and CDSP's following missions, are often regarded as controversial, since EU's non-unitary recognition of independence overshadowed its collective efforts, all while there are numerous paradigmatic arguments which see the mission as a paradoxical one. This is based on the concept that autonomy recognition and a sovereignty mandate are hard to reconcile with arguments for constant support of state functions, meaning that while such needs exist the area does not yet fully possess the self-governance capacities entailed by a complete recognition [8].

Even if EU stationed a Special Representative and Head of Delegation in Kosovo, a country that surprisingly (unilaterally) adopted euro early on, it also is one of the last countries whose citizens still need a visa scheme to enter Schengen' space, although the EC recognized since 2018 that liberalization prerequisites were fulfilled [39].

Rooted in a 2012 Agreement with Belgrade, sponsored by the EU, Kosovo became a member of SEECP, RCC, CEFTA, MAARI, RACVIAC, Energy Community, Brdo-Brijuni, RECOM, and implements the Multilateral Action Plan for the development of the Regional Economic Area. It even was a chair of SEECP, became a part of RYCO's Governing Board and contributes to WB6 Initiative, Berlin Process and Connectivity Agenda, and should join RESPA in the near future. Through all these multi-actor and internationalized scenes, Kosovo registered significant progress in its cooperation with Serbia, aspect positively assessed even by EU institutions. Notwithstanding, they managed to create meaningful changed on the Community of Serb Municipalities, energy agreement, organized cross-border criminality or even amortised incidents. Nevertheless, as is often stated by EU officials, these steps are often shaken-up, or completely reverted, by a fast-paced internal political rotation, which generates modulations in their rapprochement policies [28].

Some of Kosovo's substantial derailments include the 2018 introduction of tariffs, 100% in net value, against all goods imported from Serbia and Bosnia and Herzegovina, incident harshly critiqued by western institutions, as it represented both a violation of CEFTA and SAA. Moreover, the intensified relation with Turkey sparked a colossal incident when Kosovo controversially arrested and extradited Turkish citizens, who legally resided in the country, which generated both local and international tensions.

Moreover, from Commission's reports we can observe a set of key Enlargement Package's principles, which also targets Kosovo, in relation to advancements towards political credibility (especially in delivering on promised reforms), increased ethno-communal willingness to integrate in Europe, highly dynamic negotiation procedures, stable regional coordination and long-term overall predictability. Also, from the Commission's documents, Council or HR/VP's declarations and communication packages, we can remark that Kosovo registered a rather limited progress, even though Pristina's authorities were unshaken in their engagements towards European integration.

2.5   North Macedonia

Even though it was the first Balkan country to sign an SAA in 2001 (which entered into force in 2005) and second state who achieved candidate status in 2005, North Macedonia still barely started negotiations. Also, it developed a liberal free market economy, registering some progress in terms of commercial competitivity and complexity, but its success rate is still moderate, in part due to its high unemployment rates. Its adhesion is further hindered by its negative relation with North-West provinces' Albanian ethnics, and the country's name, as it had a hefty dispute with Greece, until they signed preliminary agreements on this matter in 2018 [31].

The Commission has often recommended the commencement of negotiations in 2009, 2015 and 2016, under the premise of further progress in compliance with Pržino Agreement and prioritisation of urgent reforms. On a similar note, the Council adopted an Avis (2018) in which it stated it was open to positively respond to North Macedonia's efforts and open adhesion negotiations by 2019, but only based on deep judicial, informational, security and public administration reforms. Furthermore, in the same year it also debated Commission's communication packages and reports and expanded North Macedonia—Albania stabilization and association processes. Later, at the 2020 Zagreb EU-WB6 Summit, enlargement was once again on the table and it finally concluded with the opening of adhesion negotiations, favourably weighting in North Macedonia's historical compromise and reconciliation with Greece alongside a good vicinity reconnection.

Even though it had a turbulent historical development, and even currently its neighbourhood interactions or internal political stability are quite fragile, North Macedonia set itself under the spotlight through a substantial positive leap in pivoting its foreign policy, being regarded as an example of both NATO and EU integration [39]. Thus, its capacity and capabilities, across a rather performant institutional network, led it to be moderately prepared to assume CFSP duties. Furthermore, North Macedonia's alignment with HR/VP's declarations, alongside Council's decisions, ranging from 70 to 80%, with some exceptions being EU's set of restrictive measures against the Russian Federation and Ukraine (balanced by its endorsement of 2014 UNGA resolution in favour of latter's territorial integrity), represent a strong foundation for integration [29].

In its steadily paved way, towards Europe, North Macedonia already embraced EU's Security Strategy and Global Strategy, while also partaking across a palette of arm control and non-proliferation actions. While praised, its international security measures are largely tied to lengthy border control mechanisms, due to illegal migration crisis' escalation [16]. In addition, North Macedonia, under CSDP's aegis, assists ALTHEA's missions and NATO's Afghanistan operations, provides military assets to EU's Battle Groups and KFOR, fosters security through its Host Nation Coordination Centre and wide cooperation with EDA or involvement in the hybrid risk survey. All of which showcase a willingness to proactively be a part of Europe's league, although, like most neighbours, has signed an immunity agreement with US, and sometimes unilaterally engages with tertiary actors.

2.6 Serbia

We can extrapolate core foreign policy arrangements from the National Security Strategy of the Republic of Serbia and Foreign and Security Strategy of the Republic of Serbia, of which we have: maintenance of national sovereignty, territorial independence and integrity; development of peaceful and stable regional systems; and most notably EU adhesion. In this regard, Serbia began shifting towards EU, after the State Union between Serbia and Montenegro collapsed in 2006. Therefore, its candidature was deposed in 2009 and by 2012 the Council approved the status, one year later Serbia adopted its SAA, and in 2014 hosted the first intergovernmental conference, which officially marked the negotiations' genesis. At the present juncture, there were 18 chapters open, out of 35, and it managed to temporarily close 2 of them.

In terms of foreign policy readiness, EU evaluates Serbia as being moderately prepared to undertake its formal obligations, amidst CFSP's adoption dialogues. Even though it appropriated EU's Security Strategy, by 2019 the country's alignment to CFSP's frameworks was slightly above 50%, which represents a de jure downward trend as it lost almost 40 points in just half a decade. One of the main drawbacks being a (rather blatant) disregard for EU's restrictive measures, especially those against Moscow and Caracas, despite the Law on Restrictive Measures and Implementation of International Sanctions, which was adopted in 2016. Based on purely ideological reasons Serbia supported Ukraine's territorial integrity, but hasn't enacted any other measures, nor followed most of Council's decisions regarding: PRC, Bosnia and Herzegovina, Moldova, and Zimbabwe [35].

On top of which, by completely disregarding any EU warnings, Serbia signed a free trade agreement with EEU in 2019, as it insisted it does not contradict EU' stance since the accord is nullified once the country becomes part of the bloc [13]. This manoeuvre drew harsh critiques from EU institutions and member states alike, all while other countries, especially Eastern or illiberal ones, congratulated Belgrade for its balanced stance. A position that was further underpinned by top-level visits and a trend towards increased technological and innovatory cooperation with Moscow, weaponry acquisition agreements with CSTO, cherry-topped by joint exercises and simulations with CIS countries.

Naturally, Serbia's two headed stance could pose at best indirect problems, but in effect we can find direct disparities, as for instance EU has continuously warned that the Cooperation and Joint Action Agreement between Serbia's Internal Affairs Ministry and Russian Federal Security Service is in direct contradiction with EU's Agreement on Security Procedures in Exchanging Classified Information and could severely impair its implementation. On the other hand, Serbia is the only country that respected EU's position and has not signed an ICC immunity bilateral agreement with the US.

Otherwise, Serbia endorses EU's measures, regarding conflict prevention, and cooperates with its partners, across a range of agreements, in respect to arms exports,

anti-terrorism and non-proliferation efforts. Also, it took part in multinational military exercises, with numerous EU members, through the Partnership for Peace framework, and established a Logistic Support Cooperation Agreement, topped by active involvement in CSDP's global missions, and being in the roster for EU's Battle Groups [16].

Serbia's paradox comes from its foreign policy pendulation across East–West spheres, despite its long central European tradition, tending to oscillate towards illiberal democracies or other major players. Similarly, its European route clashed with three major barriers, yet to be fully overcame: disintegration of its structures; limited cooperation with the International Criminal Tribunal for the Former Yugoslavia, Kosovo' status acceptance. [30] As such, its foreign policy operates under the neutrality disguise, albeit its sworn European orientation, for instance intensifying ties within Arab Peninsula's networks or People's Republic of China. These positions bend its adhesion progress, as even EU representatives warned that should any bilateral infrastructure or energy accords be signed with the former (reference to 2016 rather long-term visit of PRC's delegations) they need to stay in line and maintain high compatibility with EU's standards, positions and requirements, since they risk otherwise to alter Serbia's prospective pathways [6].

Thus, we can summarize that Bosnia and Herzegovina must implement profound structural reforms, including constitutional ones, while Montenegro's endeavours are doubled by a strict implementation of public reforms. Also, both Albania and North Macedonia registered constant evolutions, towards European integration, while Kosovo's political incertitude must be compensated, and its pathway to meaningful transformation revigorated. In regard to Serbia, apart of political declarations, the state's institutions must strongly invest in achieving concrete end-results and construct a less ambiguous (non-dual) position towards EU institutions, based on direct communication channels [21].

3   Conclusions

The EU consistently offered WB6 a comprehensive integration perspective, through SAP's platform, which is set in motion based on individualised saas. All these constitute mutually-driven political, economic, and societal commitments, encouraging a gradual transition towards competitive market economies, transnational co-option patterns, regional cooperation mechanisms, flexible mobility opportunities, stable development, etc.. All of the Western Balkan's efforts are fostered through EU' substantial financial-monetary-fiscal incentives [8] Key and Arkan (2015).

If we take a step back, we can see that WB6 were firstly approached through the prism of defence and security, only afterwards, when their contexts where stabilized, NATO and EU set in motion a more nuanced external approach, founded on a suite of normative and political instruments, which primarily act as a check-and-balances system to avoid regional rifts' spiralling into conflict [8].

A new horizon of perspectives, which regard the region as a strategic centre point, makes EU's enlargement a continuous procedure, albeit slow and overshadowed a bit by a plenitude of challenges, including the bloc's internal reforms and slowdown caused by Brexit.

Regardless, aligning with EU's international arena positioning, is not a mere adhesion obligation or way to collectively retain primacy, but a test of Western Balkans' pragmatic, political and societal engagement to unitarily facing larger global contexts. As a direct correlation, when it comes to abiding by CFSP's direction, WB6's overall conformity (even with HR/VP, Commission and Council decisions) seems to vary from case to case, or even from year to year, but for what is worth the only constant, observed from any comparative analysis, is that they do not match the expected levels of alignment.

In respect to both North Macedonia and Albania's negotiations, there are scholars who believe EU's decision was influenced by the pandemic crisis, as Europe needed to prove its community' solidarity in action. Subsequently, enlargement difficulties and WB6 integration carousel led to an internal questioning (or even contestation) of EU's capacity to be a normative continental or global power, alongside the practicality of Europeanization processes [32].

Nevertheless, EU and NATO's gearing towards WB6 represents a vital endeavour, no matter its endgame, numerous friction areas can rapidly deteriorate, which would lead to systemic instability transfers, including other regional actors or even at a continental level [36].

As such, EU's Enlargement Package underlines the principal reforms WB6 need to undertake, one of which is the rule of law through an independent act of justice. In this sense, if Albania and North Macedonia have managed to significantly adapt their legal systems, Bosnia and Herzegovina or Serbia are at the other end.

Consequently, chronic corruption and disruptive organized criminality remains a real problem, especially for economic and social developments, in all WB6 countries, even though initially some promising results were observed [17]. This aspect is linked to the next point, in particular the need for efficient democratic institutions, reformation that is meant to strengthen statal and societal organizations by consolidating electoral and participative mechanisms, establishing check-and-balances, and separating powers in the state.

In terms of economic competitivity and innovation capacity, Montenegro, Albania, and Serbia are almost ready to face the single market, while Bosnia and Herzegovina, Kosovo and North Macedonia have only made slight improvements during their European journey. This was before the Covid pandemic, a time in which, even if the growth rates were higher than EU's median, decalages, in report to the single market, still positioned them far from real convergence. Now their economic prospects lie in post-pandemic recession's duration and severity, as these aspects will vary across the entire region or even at the local levels.

From a standpoint of respecting European standards and norms, Western Balkans countries are moderately ready, as for instance the Commission explicitly remarked

Serbia's strong rapprochement with Eastern actors, while the rest of them generally started to shrink their spheres of interest and relatively matched with EU's international attitudes [11, 33].

Moreover, during EU-WB6 Brdo pri Kranju Summit, held in October 2021, all Balkan partners sent a powerful message that the region's future remains oriented towards Europe, and that their internal or external policies will be rearranged, to transcend existing boundaries and achieve an effective rapprochement with Brussels. Since Western Balkans still have limited power resources and are driven by a suite of internal vulnerability points, to which there are numerous inter- and intrastatal differences, or even dissensions, the region seems to look forward to EU, subsequently its member states, for assistance, especially in terms of overlapping foreign policy practices.

This is revealed by the way they approach member states or international organizations, as WB6 present a rather uniformized and positive proactive integration, or even amongst each-other, where there is a gradual shift towards a deeper understanding of their respective specificities, but mostly a desire to negotiate and secure the region's balance, peacefully co-exist and move forward with collective reconstruction.

The sole problem stays in their approach towards tertiary actors, as here there are some poles of attraction, which seem to diverge their efforts from European avenues [6]. In turn, this aspect cannot be blamed entirely upon regional actors, as it must make Brussel more attentive, particularly to the fact that successfully aligning WB6's foreign policies, especial third-party ones, to CFSP's frameworks, must emerge from Europe, and that the entire process relies on becoming one of the top priorities for the union itself.

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Conceptualization of Resilience.
A Bibliometric Analysis

Sorin Somitca and **Alina Somitca**

Abstract The abstract should summarize the contents of the paper in short terms, i.e. 150–250 words. The economic and financial crises of the last decade, respectively the subprime crisis from the year 2008–2009 with the edge of the current situation caused by the COVID-19 pandemic have generated threats for many organizations around the world. It was created the premises for intensifying research on the resilience of organizations in order to understand in depth the concept itself, to establish the ability of businesses to adapt to various threats and disruptive factors. The concept of resilience is very complex and has an interdisciplinary nature, with a multitude of definitions and approaches in various areas of research. Through this study, a bibliometric analysis of the literature dealing with the concept of resilience was performed, using the WebOfScience scientific database for the period 1979–2021. The aim of the research is to evaluate the scientific output on resilience in order to have a deeper vision for the future directions of research in correlation with the evolution of economic phenomena worldwide. The general objectives are to identify the research directions of the publications in the mentioned database, to identify the articles and authors relevant for the research in the case and to map the countries that have contributed in the development of the scientific production specific to the concept. The results consist in identifying the relevant scientific production so far and the future research directions in studying the resilience of organizations for detecting their weaknesses but also the potential to return in case of a crisis or unforeseen event with major impact on the economy.

Keywords Resilience · Turbulence · Financial crisis · Bibliometric analysis · Future research

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1   Introduction

The concept of "resilience" is a very current and intensely studied term by researchers in the literature underlying the implementation of successful strategies but also the recovery of organizations operating in a difficult environment, subject to change and transformation at a pace very accelerated, unprecedented until now, in which new technologies have a disruptive role at all levels of organizations, economies but also of society as a whole. Although very intensively studied and analyzed, the concept of "resilience" is attributed to several disciplines, from psychology, engineering, information technology, economics, management, human resources, risk management but also sociology, infrastructure and ecology, each discipline offering its own definition, depending on the specifics of each, but all having a common trunk, namely that resilience is the ability to adapt and respond to various unforeseen events, difficult, disruptive and the ability to avoid and get out of crisis situations that would be could lead to interruption of activity.

The main purpose of present research is to develop a bibliometric analysis about the concept of "resilience" and to identify the relevant articles and most influent authors that brought to light this concept and to discover deeply what it really means to be resilient.

For reaching our research goal, several objectives have been considered:

- creating a comprehensive data base with all indexed publication from Web of Science between 1979 and 2021 and selecting our topic of interest, namely "resilience" from economic specter
- analyzing the publication dynamics in time and identifying the most notorious journals that published related research, author affiliation and most prolific author both in terms of citation or scientific performance based on different impact factors.
- ranking the publication based on most the number of citation
- mapping the countries with significant contribution to scientific production related to our topic
- presenting the evolution of scientific research and future directions for deeply investigation to be performed as for support in strategies and decision when unexpected events occurs. Please note that the first paragraph of a section or subsection is not indented. The first paragraphs that follows a table, figure, equation etc. does not have an indent, either.

2   Literature Review

The resilience of an entity or organization is defined in the literature by terms such as survival, recovery, recovery, sustainability. Thus, starting with 2008, with the global economic and financial crisis, the most severe after the Great Depression or the Great Recession of 1920–1930 that shook the system of the global economy, the

great researchers and economists of the world gave special importance to the analysis of resilience of enterprises, this year being a turning point in the development of scientific production dedicated to this concept. In the current stage of economic development, the resilience of organizations has come even more to the attention of economists and even regulators, along with the current economic crisis generated by the health crisis caused by the coronavirus COVID-19. Thus, the European Commission has launched the Recovery and Resilience Mechanism (EUR 723.8 billion of which loans amounting to EUR 385.8 billion and grants amounting to EUR 338 billion) which aims to protect the population and companies directly or indirectly impacted, either by measures imposed by the authorities on free movement, either due to staff shortages, supply or distribution chain problems, and measures to recover the economy from the devastating impact of the pandemic, with the ultimate goal of supporting the economies of European countries to become sustainable, resilient and prepared for future challenges.

Ates & Bititci (2011) show that the resilience of an organization is a vital ability of an organization to survive in a turbulent economic environment and continuous reinvention through innovation makes them more resilient and sustainable over time.

An insight into the resilience of organizations is also provided by Sutcliffe & Vogus (2003) showing that this means how an organization continues to achieve favorable results in the context of obstacles and barriers that suppress its development or evolution. In other words, resilience shows the ability of an organization to absorb the shock of turbulence and to recover or even to improve and move to a higher level as a result of adverse events or adversities.

Another interesting definition issued by Biggs et al. (2015) shows that the resilience of an organization lies in their ability to operate despite the difficulties and crises that affect it, managing to maintain or even increase the level of income and number of employees. Thus, it delimits several factors that were supposed to be associated with the resilience of enterprises, namely the values of the organization, share capital, human capital, financial capital (average income, profit, indebtedness rate—asset to liabilities ratio, and access to finance).

The scientific literature analyzed is quite poor when we talk about bibliometric analysis regarding resilience, most of them focusing more on supply chain management analysis instead of resilience as a big picture and with a much smaller sample than our research. There are several studies related to our research but we will lean on a few that we consider to be going in the same direction with our analysis. Shymon (2020) performed an analysis of economic resilience identifying 4 core scientific schools based on a bibliometric analysis on economic resilience using the software VOSviewer and proving that core indicators of economic resilience assessment are macroeconomic stability; microeconomic market efficiency; good governance; social development.

In a recent study, Raetze (2021) based on a bibliographic analysis of 1,667 articles proved once again resilience is an important concept in organization-related research but there were found some fallacies, meaning that existing conceptualizations of resilience has different interpretations, the author trying to build an agenda for future research.

Last publication, also coming from 2021 by Fernandes is the first research that is centered on systematic analysis of entrepreneurial resilience and forms of collaboration, based on a systematic analysis of the literature with a sample of 97 publications aiming to develop a conceptual framework and finding future lines of research.

3 Methodology

The research begins with the analysis of scientific production over the years dealing with the topic of "resilience", with the stated purpose of obtaining a global and detailed picture of scientific production in relation to the topic studied so far and to outline directions of future research on the topic under analysis. Thus, the database for bibliometric analysis was built by querying the WebOfScience database by searching for the keyword "resilience" and using Bibliometrix as a bibliometric analysis software. Analyzing the studies published over time on resilience, a number of 135,458 search results were generated, mostly in the field of environmental science or studies (24,624) or ecology (8,640). After refining the results, choosing what interests us directly through this study, respectively the fields of Management, Economics, Business or Business Finance, there were 6,888 records left including articles, proceeding papers, books, book reviews or articles, abstract, all these publications between of 1979–2022.

The bibliometric analysis was performed taking into account the database thus obtained, respectively the sample consisting of 6,888 papers published in 1,505 journals, the database which is constantly expanding due to the interest of researchers in the topicality and importance of the topic, being selected every year in which there were indexed works about the topic "resilience", the first year there were found publications is 1979. All types of publications were considered, from the 4 areas related to the economic field, including all institutions of the authors, all the regions, respectively the countries that generated scientific production in connection with the researched topic, which made possible a global mapping of the scientific production and with a high quality of research. Finding research niches, research topics that crystallized around the main pillar analyzed, respectively "resilience", the links that are established between them and their intensity as well as identifying future research niches was possible using the Bibliometrix software.

4 Results and Discussions

4.1 The Main Characteristics of the Authors

The scientific production that analyzes the topic "resilience" begins in 1979, when it was the first publication indexed in the WoS database, and until 2005, the topic

was little studied, the importance given to its research has a significant advance since 2011 and the peak is reached in 2021 with a number of 954 publications. The Fig. 1 illustrates the evolution over time of the annual scientific production indexed in the WoS database which aims at the research topic "resilience". Until 1999, less than 10 research publications on this topic were dedicated annually, sometimes for years completely out of the sights of researchers, without even being a publication dedicated to the topic, the next decade the number of publications did not exceed 100 annually, but starting with 2011, after the great economic crisis of 2008–2009, the topic came to the center of researchers' attention, the number of dedicated articles increasing rapidly every year, which shows the importance and relevance of the research topic. The papers have been published in numerous international journals and conferences, respectively 1,505, in quartiles from Q1 to Q4. Most publications have appeared in the economics and management journals Ecological Economics (193), Disaster Prevention And Management (166) and World Development (129). Other top-ranked journals include Energy Policy (89), Technological Forecasting And Social Change (70), Regional Studies (61), which gives a note of importance to the researched topic and gives the possibility to find new research directions related to the analyzed topic.

At the same time, the affiliation of the authors to prestigious academic and educational institutions at international level, makes the level of quality of knowledge surprised in the published works and which are part of the analyzed sample to have a high scientific level. The University of Stockholm with 113 publications, Cambridge University with 93 publications and Oxford University with 92 publications on resilience. The number of institutions to which the authors of the studies are affiliated is impressive, respectively 4,551, among these there are also top academic
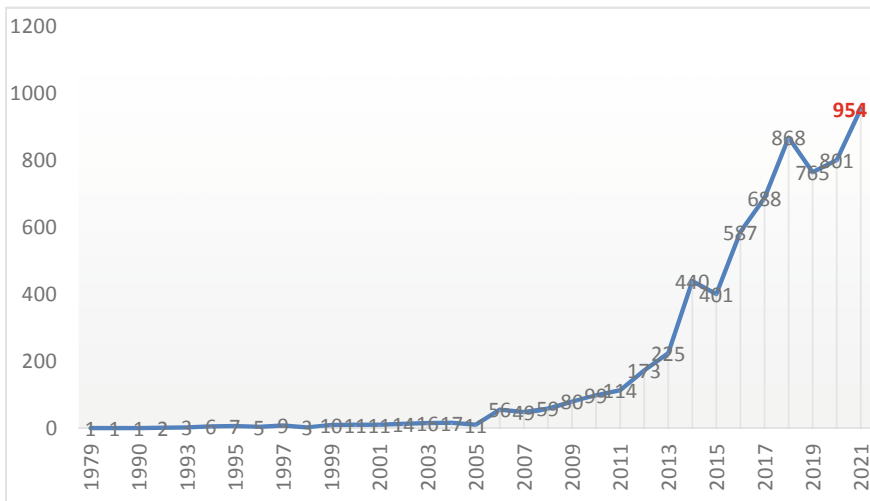
Fig. 1 Annual scientific production. *Source* Own processing based on data obtained from WebOfScience

institutions in Romania, such as the University of Bucharest, the "Babes Bolyai" University of Cluj or the Al. I. Cuza from Iasi. At the same time, important to be mentioned is that the vast majority of journals in the top of the most prestigious business journals, the Financial Times, FT50 ranking of business school journals that are part of the FT Global MBA, Executive MBA or Online MBA they published at least one article related to the researched topic, "resilience". These include the Academy of Management Journal, Academy of Management Review, Econometrics, Administrative Science Quarterly, Entrepreneurship Theory and Practice, Harvard Business Review, Journal of Financial and Quantitative Analysis, Journal of Financial Economics, M IT Sloan Management Review which means that the topic is in an obvious ascent regarding the importance that it deserves in the economic and social life at world level as well as a constant increase of the visibility among the researches ensuring at the same time new research directions related to this topic.

The most prolific authors who have devoted to detailed research on "resilience" and who have published more than 20 papers are in order Amaratunga D. (37 publications), Haigh R. (28 publications), Na Na (23 publications) and Ivanov D. (21 publications). The ranking according to the impact and prestige of the authors who performed research on the studied topic, is presented in the Table 1, in order H Index highest. The author with the greatest impact is Luthans F., with an H Index 17 that has the most citations (6328), starting the research in the field in 2007. His most important work, considering the number of citations (1356) is "Positive psychological capital: Measurement and relationship with performance and satisfaction" and comes from the year in which the author debuted, respectively 2007.

Table 1 Authors' impact

No	Author	H_index	G_index	M_index	TC	NP	PY_start
1	Luthans, F	17	17	1,133	6328	17	2007
2	Avey, JB	11	11	0.733	4531	11	2007
3	Blackhurst, J	11	12	0.733	1296	12	2007
4	Ivanov, D	10	17	–	968	17	–
5	Martin, R	10	11	0.833	2310	11	2010
6	Amaratunga, D	9	14	0.75	278	32	2010
7	Linnenluecke, MK	8	8	0.8	564	8	2012
8	Danes, SM	7	8	0.636	119	8	2011
9	Haigh, R	7	11	0.875	162	2. 3	2014
10	Maler, KG	7	7	0.259	805	7	1995
11	Perrings, C	7	11	0.25	691	11	1994
12	Wang, J	7	10	–	317	10	–
13	Yang, Y	7	9	0.778	157	9	2013

Source Own processing based on data obtained from WebOfScience and Bibliometrix

4.2   The Main Features of the Relevant Publications

The most cited work indexed in WoS and dealing with the subject of "resilience" comes from 1993 by the American author Weick KE, a work that has by far the most citations, respectively 1916 citations and which is called "The Collapse of Sense making in Organizations: The Mann Gulch Disaster". The author, a professor at the University of Michigan, is a well-known researcher of organizational theory, introducing several concepts in the literature, including "loose coupling" or "mindfulness." The Table 2 lists the top 15 most cited. Their impact weighs heavily in the literature dedicated to the concept of "resilience" taking into account that a small number of works, respectively 0.2% have over 11% of the total number of citations.

Next in our research, we will perform a detailed review based on the bibliometric analysis presented above. The purpose of the analysis is to reach a result that ends with a conclusion that describes the intensity of the phenomenon studied. In the Table 3 are analyzed the first 5 most cited articles, selected from the previously mentioned sample, the main results obtained being mentioned in the below in the table.

4.3   Geographic Mapping of Publications

Carrying out the geographical mapping of the countries that contributed to the evolution of research on the topic of "resilience", it can be seen from the Fig. 2 that the United States contributes substantially to global scientific production, thus confirming the supremacy and obvious interest in being an important generator of scientific production, respectively 4050 publications, followed by developed countries such as UK (2872 publications), Australia (1222 publications), Italy (1109 publications), Germany (917 publications) or China (908 publications), all this showing the importance and topicality of the researched topic. Romania is in the top 20 globally with 223 publications, the interest shown by researchers in outlining definitions of resilience and finding the factors that influence in both directions the resilience and resilience of an entity, being generated by the impact it has the theme both at the economic, financial, social level, but also at the level of the environment so that the evolution of the society as a whole has a sustainable and sustainable theme in the long run.

4.4   Evolution of Research Topics

The results obtained by sequencing the database using the bibliometric analysis software Bibliometrix, show that the term "resilience" is the most common. The co-occurrence network presented in the figure below generated based on the keywords "keyword plus" is a conceptual map that illustrates as suggestively as possible the

Table 2 The 15 most-cited articles

No	Author	Year	Paper	Total citations (WoS)	Citation density (TC per Year)	Normalized TC
1	Weick KE	1993	The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster	1916	66,069	2.83432
2	Luthans F	2007	Positive Psychological Capital: Measurement and Relationship with performance and Satisfaction	1356	90.4	14.67079
3	Adger WN	2003	Social capital, collective action, and adaptation to climate change	1214	63.8947	7.49383
4	Moberg F	1999	Ecological goods and services of coral reef ecosystems	1001	43.5217	4.95299
5	Korhonen J	2018	Circular Economy: The Concept and its Limitations	743	185.75	78.17261
6	Gomez-Baggethun E	2013	Classifying and valuing ecosystem services for urban planning	729	81	22.60855
7	Hobfoll SE	2018	Conservation of Resources in the Organizational Context: The Reality of Resources and Their Consequences	723	180.75	76.06836

(continued)

Table 2 (continued)

No	Author	Year	Paper	Total citations (WoS)	Citation density (TC per Year)	Normalized TC
8	Craighead CW	2007	The severity of supply chain disruptions: Design characteristics and mitigation capabilities	698	46.5333	7.55178
9	Youssef CM	2007	Positive organizational behavior in the workplace - The impact of hope, optimism, and resilience	658	43,8667	7.11901
10	Wanberg CR	2000	Predictors and outcomes of openness to changes in a reorganizing workplace	609	27.6818	6.67896
11	Simmie J	2010	The economic resilience of regions: towards an evolutionary approach	608	50.6667	8,94,782
12	Martin R	2012	Regional economic resilience, hysteresis and recessionary shocks	607	60.7	19.74262
13	Sitkin SB	1992	Learning Through Failure - The Strategy Of Small Losses	585	19.5	1.9797
14	Avey JB	2011	Meta-Analysis of the Impact of Positive Psychological Capital on Employee Attitudes, Behaviors, and Performance	585	53.1818	12.73439

Table 2 (continued)

No	Author	Year	Paper	Total citations (WoS)	Citation density (TC per Year)	Normalized TC
15	Luthans F	2007	Emerging positive organizational behavior	584	38,9333	6.31839

Table 3 The synthesis of the main impact studies on the researched field

Author/year	Treated concepts/keywords	Result	Timeliness and impact on research
Weick (1993)	Resilience, vulnerability, crisis, leadership	The author defines 4 sources of resilience of groups or organizations (1) improvisation and DIY, (2) virtual role systems, (3) the attitude of wisdom (4) respectful interaction	Starting with a disastrous fire in Mann Gulch, Montana that was described in Norman Maclean's Young Men and Fire (1992) The author tries to find answers to 2 questions, namely why organizations are falling apart and how can organizations be more resilient. The author extrapolates the reactions and the mode of action of a small group in a crisis situation at the level of an organization The impact is low, the paper tries to be a theorizing of organizational culture and group leadership, without presenting elements that would help define the term resilience or more to draw clear directions for future research

(continued)

Table 3 (continued)

Author/year	Treated concepts/keywords	Result	Timeliness and impact on research
Luthans (2007)	Psychological Capital, Hope, Optimism, resilience, satisfaction,	The results of the study have practical implications for the motivational development and management of employees. Although it is generally invested in financial, human and social capital, the study's findings show that investing in psychological capital can generate substantial profits compared to other forms of capital investment	The article analyzes the resilience from a psychological perspective, as an essential element for increasing efficiency and employees The authors mention four components of psychological capital (eq individual motivational tendencies) namely efficacy, optimism, hope, and resilience Resilience is thus defined as a positive adjustment or dealing with an adverse event that involves a significant risk. Resilience shows a return to normalcy or overcoming a failure or a positive progress or improvement in an individual's evolution The study has a moderate impact and the information is up to date. The positive aspects are that the work defines resilience in several forms but not from an entrepreneurial perspective nor does it find attributes or components of it so that it can be objectively appreciated or synthesized in a specific phenomenon or to find the elements that influences resilience to define a specific index

(continued)

Table 3 (continued)

| Author/year	Treated concepts/keywords	Result	Timeliness and impact on research
Adger (2003)	Social capital, resilience, vulnerability	Research highlights three key elements in adapting to the extreme difficulties that may arise at a given time, taken from specific cases related to climate risks and which can be generalized at the level of organizations, namely: (1) adaptability depends on culture and the specific place (2) the nature of the risk, the institutional context but also the homogeneity of the decision-making group and the benefits to management are important elements in the collective action of adaptation to difficulties (3) theories of social capital allow generalization	The study examines how climate change causes changes in society and adaptation as a dynamic social rock is determined by society's ability to act collectively. Social capital is increasingly applied in the economy being based on trust, reputation and mutual action. The article presents various case studies in which collective actions are carried out in order to cope with the extreme weather conditions in the coastal areas of Southeast Asia and the Caribbean. The case study presented shows the importance of social capital that contributes to increasing resilience to the risks of climate change and by analogy illustrates the nature of adaptation processes and collective action to adapt to future climate change In conclusion, the research is well-founded, current and the influence is medium, the basic idea extracted from the text analysis being that resilience increases when acting concentrated, collectively to overcome the disturbances that occur at a time, given that lead to imbalances

Table 3 (continued)

Author/year	Treated concepts/keywords	Result	Timeliness and impact on research
Moberg (1999)	Management; Biodiversity; Resilience; Valuation	The results of the study show once again that the actions of the external environment influence the resilience and the ability to return in an irreversible way if we do not act in time with complex measures	The study analyzes the impact of human action on coral reefs and the consequences on the loss of their resilience Although, the field it treats is the ecological one, still some conclusions after the analysis of the study can be transposed on the resilience of the business, considering that the ecosystem in which it operates has an influence worthy of being taken into account. Therefore, we can conclude that the study is topical and the impact on our research is medium to high The external environment often irreversibly affects the resilience and thus the return to normalcy is endangered At the same time, although each business has its own specificity, they are similar and act in the same direction, namely to make a profit, but each has its own capacity for resilience and an ability to absorb and react to external disturbances in a completely different way In addition to external causes, the decrease in resilience is caused by inefficient management of resources as well as management decisions inadequate to the moment in the evolution of the business, erroneous decisions or delayed reactions to changes or disruptions to the external environment

(continued)

Table 3 (continued)

| Author/year	Treated concepts/keywords	Result	Timeliness and impact on research
Korhonen (2008)	Circular economy, sustainability	The results of the study are that six directions or challenges are identified that are urgently needed to be addressed and addressed by the states of the world to support global sustainability, thus outlining future research niches so that the circular economy supports sustainable development	The study analyzes the concept of circular economy, which although it is a very popular term both at the level of public administrations (European Union or governments of some countries) and at private level, however the studies do not have a very organized direction and the analysis is quite superficial. The study is delimited in two main directions, one in which it defines the concept from the perspective of sustainable development and sustainability and a directive in which a critical analysis of the concept from the perspective of environmental sustainability is performed The study is very topical considering all the steps taken to combat pollution and reduce the carbon footprint, but the impact on our research is small, the direction we want to explore is different from that of the study
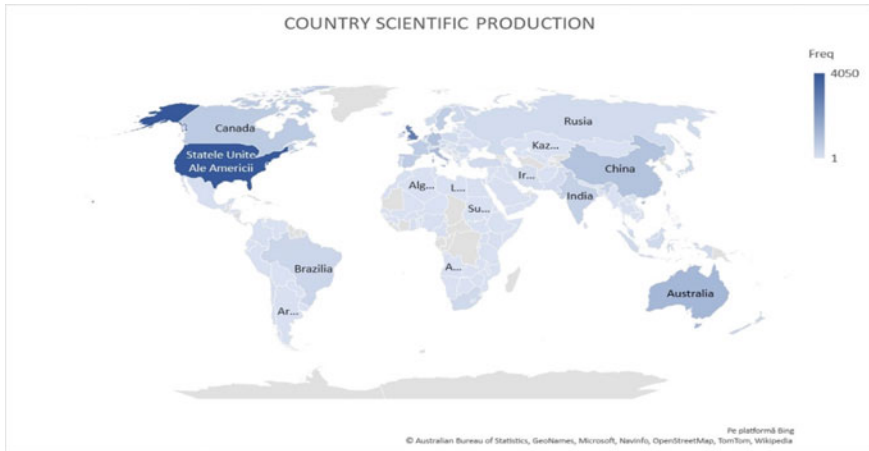
Fig. 2 Mapping of countries with contribution to the scientific production. *Source* Own processing based on data obtained from WebOfScience and Bibliometrix

components of scientific production related to the researched topic "resilience" simultaneously with the cognitive structure of the research, existing three clusters central in which each node represents a semantic concept of different dimensions depending on the frequency of occurrence and the degree of importance of each line between two nodes showing the intensity of the relationship between concepts presented.

At the same time, in order to capture the evolution of research topics in relation to the main topic analyzed, throughout history, a two-dimensional diagram was generated, taking into account as a parameter according to which the grouping of research topics is made, the keyword plus with the most appearances in the reference period 1979–2022. Following the analysis, three such clusters were identified with the help of the Bibliometrix program, respectively resilience, performance and innovation, having as reference axes the centrality (degree of relevance) and the density of topics (degree of development), as we can see in Fig. 3.

The size of the spheres in the diagram it is influenced by the number of keywords plus and it can be seen that in the analyzed period the theme of resilience dominates in the published research papers with 1159 appearances, followed by management with 697 appearances and performance with 635 appearances. The most popular research topic in the analysis period, both in terms of the appearance of keywords plus and the number of keywords plus that are part of the cluster (60 words) is resilience. But the theme of performance is considered as a motor theme having included in its cluster keywords plus among which we can list: performance, impact, model, behavior, health, stress, conservation, disruptions (Fig. 4).

At the same time, the theme of resilience is affiliated basic theme which has a very high density but not very strong links with the other identified themes but which will generate strong links in the next period. All these research topics have evolved over time and have transformed with the emergence of new areas of interest creating links
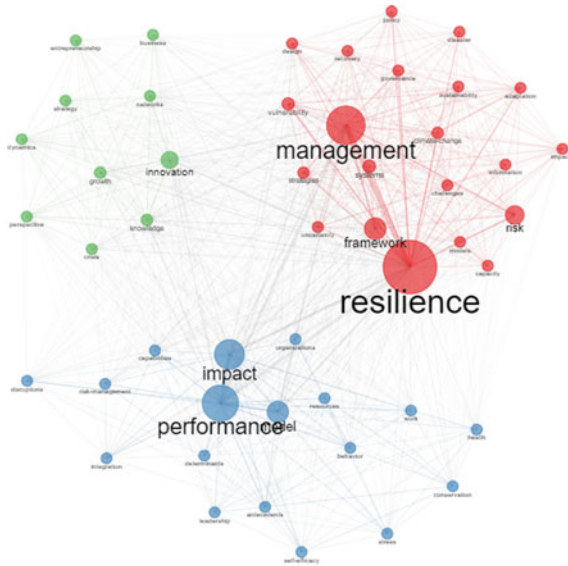
Fig. 3 Co-occurrence word network. *Source* Own processing based on data obtained from WebOfScience and Bibliometrix
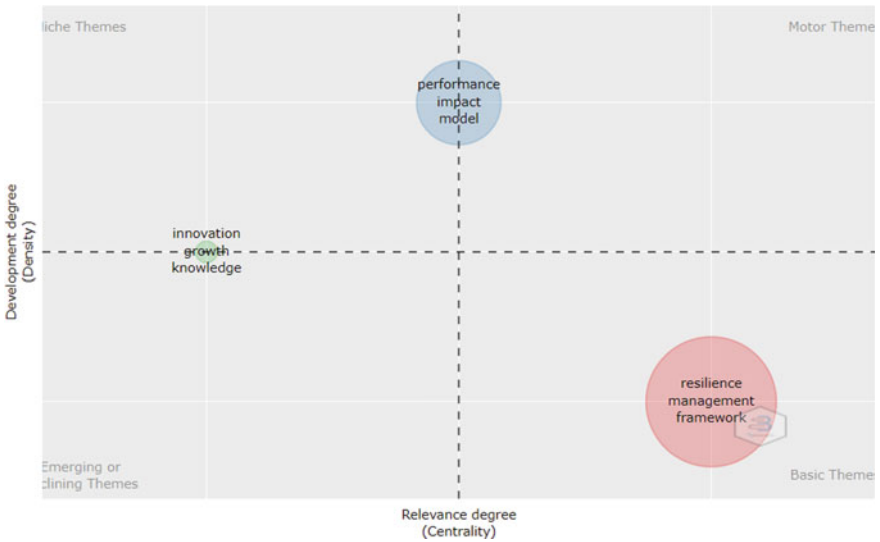
Fig. 4 Thematic map representation *Source* Own processing based on data obtained from WebOfScience and Bibliometrix

of various intensities with other topics with the emergence of some or the occurrence of significant events in local or global economies. Keywords plus that are part of this cluster are topics such as resilience, management, framework, risk, strategies, governance or sustainability.

Innovation is included in the category of niche topics with a development potential for the next period, the research focusing on keywords such as innovation, growth, knowledge, entrepreneurship or even technology.

5   Conclusion

The present paper wanted to carry out a rigorous and detailed research on scientific production that deals with the topic of resilience, with the precise purpose of deepening and substantiating the concept but also to predict the new directions of research in this field. Given the current context but also in order to make relevant comparisons over time, we considered it appropriate to scan the entire portfolio of research papers in the WebofScience database, so that from the first appearances of dedicated works in 1979 and until now, the relevant scientific production is significant, only taking into account the specific fields of economics (Management, Economics, Business or Business Finance) there are almost 7000 publications in a large number of journals (over 1500), which shows the importance and topicality of the topic studied, the peaks being registered mainly after the crisis of 2008–209 and the current economic crisis generated by the COVID pandemic.

The scientific level and quality of knowledge present in the published works that study the concept of resilience is very high, having the prestige of authors who have dedicated works to this concept but also the affiliation of authors to some of the most prestigious educational and research institutions in the world.

In conclusion, the paper aims to present the level of knowledge on resilience so far and to provide an opportunity to answer questions related to future research directions on resilience, research that should focus on topics such as measuring the resilience of organizations, identification of indices to measure the resilience of enterprises, so that differentiated management strategies can be issued according to the weaknesses identified within each organization, all in order to build a sustainable organization capable of absorbing the shocks of any turbulence or adverse events that to continually reinvent oneself and return much stronger after such events.

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The Impact of Artificial Intelligence on Accounting

Gabriela Stafie and Veronica Grosu

Abstract Innovation technology is changing many aspects of our lives. We live in a time of great transformation that predicts that in the coming years, every aspect of human life will be influenced by artificial intelligence. The phenomenon of robotics is a vast one, with popularity in all fields of activity, as the business world tends towards globalization, and the Internet is progressing at a rapid pace and the flow of information becomes particularly flexible, which makes us witness rapid digitization. of the whole society. Accounting professionals need to turn innovative solutions such as artificial intelligence and automation into opportunities, not threats … new technologies will make life easier. Blockchain is an innovative form of application of information technology in the Internet age, seen as a distributed "registry" defined by decentralization, immutability and transparency. The application of the blockchain in accounting is a topical issue, as it is a common accounting record and it is expected that its application could bring significant changes in the practical work of accountants. Therefore, the main objective of this paper is to analyze the existing literature on the importance of cognitive technologies and the possible impact on accounting, from a bibliometric perspective. The bibliometric analysis is carried out both chronologically and geographically with the support of the Web of Science (WoS) and Scopus database. VOSviewer software was used to process the data, with the aim of providing a comprehensive picture of how cognitive technologies are of interest to academic researchers and accounting practitioners.

Keywords Digital accounting · Artificial intelligence · Blockchain · Bibliometric analysis · Web of Science · VOSviewer

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1 Introduction

Accounting has appeared since ancient times, with the advent of writing in the Sumerians, in the years 3000 BC. At that time, people reflected aspects of their daily lives through cave drawings: notches on the bones or walls of caves, engravings on pieces of wood, knotted strings of different colors, notes on clay tablets or papyrus, with which people the ancients wrote down how many animals they hunted and how many they ate, how many skins they skinned and how many clothes they wore. With the advent and use of pieces of papyrus for the recording of commercial transactions, although more detailed, they encountered an obstacle in the development of accounting by the lack of a general unit of measurement for all traded goods. The most important contribution to the evolution of accounting at that time belongs to the Greeks, who began using foreign exchange coins in 600 BC.

Accounting began to materialize as a science in 1494, with the publication of the first book of accounts in Venice by the mathematician Luca Paciolo, "Summa de arithmetica, geometria, proportioni et proportinalita" (All about arithmetic, geometry and proportions), a work that marked the official consecration of the science of accounting. In the ninth book entitled "Double entry accounting treaty", he describes for the first time the defining feature of accounting. In Paciolo's view, accounting is "a set of principles and techniques for the double-entry recording of a merchant's assets and all of his business, in the order in which they are conducted," defining the double entry in terms of the equation of exchange between wealth and capital. respectively what I possess and what I owe.[1]

Accounting, an important component in social practice, has evolved and developed depending on the economic evolution, and as a science it has distinguished itself by exercising its functions. A particularly suggestive characterization of the functionality of accounting was left to us 100 years ago by the well-known scientist Johann Friedrich Schär noting a motto in his work "Buchhaltung und Bilanz": "Accounting is the impartial judge of the past, the necessary guide of the present and the indispensable counselor of the future".[2] Today, through the automation and computerization of the accounting activity, the working techniques have reached a high level of improvement. identified for a long time. It has now become a wide-ranging technique for gathering and processing information, which has managed to detach itself from the simple contemplation of the past and which strives, through scientific methods, to encompass the future evolution of economic activity.[3]

Accounting has been directly affected by the advancement of information technology (IT), starting with general accounting software, used in stock records, employees, followed by the development and introduction of Company Resource Planning (ERP) systems, and reaching the sphere of cognitive technologies, such as machine learning (ML), process automation through robotics (RPA), information storage in the cloud, associated with elements of artificial intelligence (AI).

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[1] Demetrescu (1972).

[2] Schär (1914).

[3] Kraft von Taun (1967).

The Internet and related information technologies such as cloud, blockchain, and AI services, associated with web-based business models such as online platforms, are leading to its fourth economic revolution.

Although double-entry accounting has been used for over 600 years, the digital age marked by disruptive technologies using blockchain and financial technology (FinTech) has led to the birth of a promising new method of accounting: triple entry accounting.

In this context, the work the impact of artificial intelligence on accounting has as a starting point the technological progress, in general, and the accelerated introduction of automation in the accounting, in particular. The changes suffered by the accounting will bring changes in the way of keeping the accounting, reason for which a series of questions have arisen: What will be the accounting in the future?, What accounting methods will be used? Following the emergence of these dilemmas, the purpose of this article is to analyze the progress made in the field of accounting, the impact of the accelerated penetration of information technology and the identification of possible future trends in the context of the digitalization of accounting. The paper aims to analyze emerging technologies that enter the field of accounting, a topic of great interest to both practitioners and academics.

In order to achieve the proposed goal, the following objectives have been set:

- Objective 1—analysis of the evolution of accounting and changes over time through the implementation of cognitive technologies such as AI and Blockchain;
- Objective 2—bibliometric analysis and the current state of research on the penetration of cognitive technologies in the field of accounting, in the period 2015–2021.

The research methodology consists of collecting data with a predominant focus on the challenges facing accounting today and moving from a traditional accounting based on double entry to a triangular accounting called the Triple-Entry method. We also analyzed the literature on the topic: future accounting, focusing on the key concepts of Accounting Digitalization, Artificial Intelligence, Blackchain and their impact on the future of accounting, using as databases the Web of Science platforms. The bibliometric analysis was carried out both chronologically and geographically using VOSviewer and Bibliometrix information processing.

The results obtained from the analysis and interpretation of the information, present the ways in which the accounting activities are or can be subjected to the automation process by robotization, as the AI platforms have the ability to analyze data and establish connections between them. It also determines whether the security benefits of blockchain technology are fully available and provide security in the accounting framework. These results can be applied both to professional accountants, as partners of AI and blockchain users in economic and cyber security, and to professional and accounting regulatory bodies. The study contributes to improving knowledge about the potential of emerging technologies for accounting services.

2   Literature Review

AI is considered a "technology of the future" that has the ability to stimulate intelligent behavior in machines and perform cognitive functions that, until recently, were considered specific only to the human mind: perception, learning, creativity, interactivity, reasoning, problem solving. AI aims to mimic human intelligence as much as possible with the help of technology. The most commonly accepted definition of AI belongs to scientist John McCarthy, "it is AI when a machine behaves in a way that can be considered intelligent, if it were human."[4] The traditional model of an information system is criticized because it leads to a narrow view of the role of information systems (IS) in organizations. Instead, the modern view takes into account neglected functions, such as memory, communications, control, self-regulation, maintenance, self-testing, and other logical functions with which the organization's information system is equipped as an artificial and intelligent system.[5] Before computerization, when accounting data was stored on paper, preparing the necessary analyzes and forecasts for clients was a difficult and time-consuming process for professional accountants. Computerization has largely relieved accountants of the burdens of small and repetitive tasks, and has led to the development of computerized accounting through computer systems capable of providing real-time information to customers.[6]

The ability of professional accountants to use advanced computer technology is considered relevant both to their clients and to society at large. Accounting productivity can be increased by computerization, with the effect of increasing the quality of information provided to their customers.[7] Amplified technological change and a rapid pace of development will lead to profound changes in the labor market. The accounting activity, influenced by the impact of technology, invites the accountant to rethink his activity and leads to the creation of digital accounting platforms. Professional accountants, as information providers and risk assessors, need technology to increase the efficiency and effectiveness of their tasks.

In recent years, there have been many concerns that automation and digitization could lead to a jobless future, fueled by studies conducted for the US and Europe which claim that a substantial proportion of jobs pose a "risk of computerization". According to a study conducted in 2013 by Frey and Osborne from Oxford University, which analyzed the influence of computerization on the labor market in 702 occupational fields, they found that in the next 10–20 years, 47% of all jobs in the US are at risk. high to be adversely affected by automation. According to the same study, professionals whose occupation is "accounting records, accounting and auditing" have an automation risk of up to 98%.[8] Their study has provoked other researchers to this subject, and has raised various controversies, especially the fact that an important series of accounting works are difficult to computerize.

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[4] McCarthy (1995).

[5] Gigch and Moigne (1990).

[6] King et al. (1990).

[7] Wilson and Sangster (1992).

[8] Frey and Osborne (2013).

The Internet and related information technologies such as cloud, blockchain, and AI services, combined with web-based business models such as online platforms, are rapidly transforming the digital economy and industry (now in its fourth revolution—Industry 4.0) and researchers have expressed concern about the future of the accounting profession.[9] Some questions are: how can professional accountants add value to organizations and where can accountants work. "These changes [AI, machine learning, automated robotic processes, etc.] are redefining and expanding the role of accountants and increasing our skills such as data analysis, data visualization, storytelling and strategic management more important than ever."[10]

Research to analyze the benefits of artificial intelligence in accounting and financial reporting processes has shown that cognitive technologies significantly reduce the time required to perform certain accounting activities, reduce the number of errors, improve the real-time reporting process,[11] helps to monitor in real time the assets and stocks, facilitates the audit missions and contributes to obtaining financial predictions with a higher degree of accuracy.[12]

Studies show that every business is influenced by information technology, and companies that can't keep up with technological development will disappear over time. Professional accounting services, more than in other fields, can improve their performance by using AI systems. In addition, as AI systems and machine learning applications evolve and enter the accounting business, they can increase the credibility of the accounting profession and streamline the business at much lower costs.

For a better understanding of the evolution over time, of the interest of practitioners and researchers on technological progress in accounting, we considered necessary a meta-analysis that can be viewed in Table 1, query based on the correlation: artificial intelligence—blockchain.

As we can see from Table 1, emerging technologies have gradually entered accounting, and have provided opportunities for the double-entry accounting system to be extended to triple-entry records. In Inghirami's[13] opinion, the blockchain, together with the distributed register, contributed to the modeling of the Internet in one of its values. It should be noted that blockchain is an accounting technology based on decentralized and distributed data for information consultation, without allowing the possibility of copying or modifying data. This prompted Faccia & Petratos[14] to claim that blockchain is the leading distributed registry technology capable of providing automation, transparency, trust, accountability and immutability to users.

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[9] Moll and Yigitbasioglu (2019).

[10] Bhimani and Willcocks (2014).

[11] Kokina and Davenport (2017).

[12] Stanciu and Rîndaşu (2020).

[13] Ingrirami (2018).

[14] Faccia and Petratos (2021).

Table 1 Meta-analysis of the literature on cognitive technologies: AI and Blockchain

Year	Author	Publication title	Impact on research	
			Artificial intelligence (AI)	Blockchain
2015	Dirican, C	*The Impacts of Robotics, Artificial Intelligence On Business and Economics*	The impacts of AI in economics and business bring a number of benefits, such as: calculated production costs in real time, transmission of information to customers in real time, maximizing sales and delivery hours through robotics in distribution channels, companies will could manage profitability and risk more effectively	
	Monaco, J	*Identifying Bitcoin users by transaction behavior*		It associates Bitcoin digital currency with blockchain technology, favoring transactions with them. The study indicates an inherent lack of user anonymity by exploiting patterns in long-term Bitcoin transactional behavior
2016	Palade, D.P	*Impactul tehnologiilor informaționale asupra sistemelor de contabilitate*	Information technology is an advantage in the business world, which adds value to the organization by increasing productivity in the market. Traditional accounting has evolved into modern IT-based accounting	
	Deloitte	*Blockchain Technology A game-changer in accounting?*		Blockchain technology can be the next step in accounting progress by offering the ability to record transactions in a common register. With this application, cryptographically distributed and sealed transactions cannot be falsified or deleted. This can be compared to notary verification, only digitally
2017	Kokina, J., Davenport, T	*The Emergence of Artificial Intelligence: How Automation is Changing Auditing*	AI is the necessary element to ensure that the most complex modern accounting rules are implemented correctly. This is especially true when accounting interacts with increasingly sophisticated capital market activities	

Table 1 (continued)

Year	Author	Publication title	Impact on research	
			Artificial intelligence (AI)	Blockchain
	Vasarhelyi, M.A	*Toward Blockchain-Based Accounting and Assurance*		Although technology has advanced, accounting methods have remained double entry. With the advent of blockchain technology and implementation in accounting, it ensures the verification and provision of real-time data and the emergence of a new concept of accounting through triple entry. However, blockchain technology is developing and experimenting, but it is expected to be as revolutionary as the Internet
2018	Marshall, T.E., Lambert, S.L	*Cloud-Based Intelligent Accounting Applications: Accounting Task Automation Using IBM Watson Cognitive Computing*	Proposes building a cloud-based accounting application using AI-based machine learning. It presents the impact of automation on the accounting profession and the creation of new opportunities offered by the development of technological innovation	
	Zheng, Z., Xie, S., Dai, H., Chen, X., Wang, H	*Blockchain challenges and opportunities: a survey*		Blockchain benefits from a number of benefits, such as decentralization, auditability, persistence, anonymity, and immutability. Blockchain applications have a wide range of uses, from cryptocurrency transactions, to financial services, risk management, the Internet of Things, to public and social services. The blockchain is recognized for its decentralized infrastructure and the nature of peer-to-peer transactions. However, much research on blockchain is associated with Bitcoin, but blockchain can be implemented in a variety of areas

Table 1 (continued)

Year	Author	Publication title	Impact on research	
			Artificial intelligence (AI)	Blockchain
2019	Peng, Y., Chang, J.S		Accounting practitioners believe that AI will replace manual accounting work, routine and repetitive tasks. Some accounting practitioners claim that they have the ability to cope with the emergence and implementation of AI in accounting and are willing to continue their professional development and are not afraid that they could be replaced. On the other hand, there are accounting practitioners who feel threatened by the level of development of AI because they are not sufficiently prepared to face the new challenges	
	Moll, J., Yigitbasioglu, O	*The role of internet-related technologies in shaping the work of accountants: New directions for accounting research*		There is a need to study the new accounting technologies used in business administration and to establish the new skills and competencies needed by professional accountants to add value to organizations. Access to distributed registries, blockchain applications and big data supported by cloud and AI-based analytics tools will greatly automate decision-making within organizations. These technologies can significantly improve financial visibility

Table 1 (continued)

Year	Author	Publication title	Impact on research	
			Artificial intelligence (AI)	Blockchain
2020	Stanciu, V., Rîndașu, S-M	*Sustainable Professional Training – Challenges and Solutions in Emerging European Countries*	The innovative technologies presented in the study, namely blockchain registries, AI and big data processes, have the ability to stimulate increased transparency in the business environment, to ensure the correct registration of resources and to strengthen the trust of the social environment. Some technologies are considered emerging, while other technologies have already entered the accounting system, which requires the acquisition of new computer skills and competencies by professional accountants	
	Pugna, I.B., Dutescu, A	*Blockchain—the accounting perspective*		Although today, blockchain technology is one of the most revolutionary, in order to be used in accounting, it needs a technical improvement. Blockchain is still an "immature" subject, remaining at the level of experimental theory. With its maturation, the potential for progress of industries and even the economy begins, thanks to the integration of complementary technologies such as the Internet of Things and AI
2021	Faccia, A., Petratos, P	*Blockchain, Enterprise Resource Planning (ERP) and Accounting Information Systems (AIS): Research on e-Procurement and System Integration*	Electronic transactions and IT can improve AIS operations in blockchain and DLT applications. FinTech could become a leader in transforming and integrating IT into various management services and applied sciences. DLT, decentralized finance (DeFi) and FinTech can facilitate the incorporation of AIS and ERP systems into blockchain technology, providing important benefits in the productivity, efficiency and security of organizations	Blockchain is considered the leading distributed registry technology (DLT) and its applicability in various fields is constantly changing, so updating with the latest technologies and applications is essential

(continued)

Table 1 (continued)

Year	Author	Publication title	Impact on research	
			Artificial intelligence (AI)	Blockchain
	Pedreño, E.P., Gelashvili, V., Nebreda, L.P	*Blockchain and its application to accounting*		Blockchain needs technical improvement and development in order to be implemented in accounting and to produce significant transformations in the traditional system. Certainly, blockchain, is an accounting technology, because the data are not only archived, but are also settled and sorted dynamically, and can be viewed with economical content. Its applicability in accounting will follow the same path as the other technologies, which have evolved from the beginning to its implementation

Source Author's own processing

Table 2 Data collection methodology

	Web of science database	
Topic	• Artificial Intelligence • Blockchain	
Inclusion criteria	• Works between 2015 and 2021; • Research areas: business finance, business, economics, management;	
Exclusion criteria	• All other research areas; • For the relevance of the results, to the topic "artificial intelligence", only those documents were selected that had a *perfect match*	
Result	Artificial intelligence	42
	Blockchain	1235
Total articles		1277

Source Author's own processing

3   Research Methodology

In recent years, researchers' attention to digital transformations in the economic field has grown at a rapid pace due to emerging technologies, which has led them to focus on specific topics such as: artificial intelligence, blockchain, process automation by robotics, digital transformation, smart technology,[15] etc. This article aims to examine the concept of digital accounting, focusing on how emerging technologies will revolutionize the field of accounting. As a research method, a bibliometric analysis of the specialized works from the Web of Science (WoS) database, internationally recognized and ensures a high quality of the works, was performed.[16]

3.1   Data Collection

To perform the bibliometric and mapping analysis we used as search terms: "artificial intelligence" and "blockchain". The criteria for filtering the data were: the period 2015–2021 and research areas relevant to the paper, as we can see in Table 2.

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[15] Garanina et al. (2021).

[16] Mongeon and Paul-Hus (2016).

Table 3 Top 5 publication sources

Web of science database	No. articles
Technological Forecasting and Social Change	43
IEEE Transactions on Engineering Management	35
Education Excellence and Innovation Management	21
Journal of Risk and Financial Management	17
Technology Innovation Management Review	15
Total articles	131

Source Author's own processing

3.2 Data Analysis and Interpretation

Bibliometric analysis is a working technique through which we can spatially represent different relationships between keywords, domains, documents or authors[17] and is used in various fields to relate hidden elements such as hidden topics or themes.[18]

After collecting the data, the papers were processed using the VOSviewer program to represent the main clusters and the significant links made up of the keywords in these papers. Thus, figures were made that represent the main clusters in our selection of works, then analyzed and discussed. We also used the Bibliometrix program to map the main research topics in a two-dimensional four-dimensional diagram for the WoS platform, after which a series of conclusions were drawn based on them.

3.3 Results and Discussions

The articles studied on the WoS platform come from 438 scientific journals. In Table 3 the first 5 journals are presented, which published a total of 131 articles, representing 29% of the entire selection. The dominant topic of these journals is blockchain technology. These journals can also be found in the Journal Citation Report (JCR) and Scimago.

The journals with the highest H index are: Technological Forecasting and Social Change (H-Index de 121) and Ieee Transactions on Engineering Management (H-Index de 89), being the most relevant to the subject approached. We can observe the evolution of the number of scientific papers in the period 2015–2021 (see Fig. 1). With regard to WoS articles, we see an annual increase of 95.6%, which was normal, there is currently a great deal of interest in emerging technologies, especially Blockchain, and in the expected effects of the implementation and development of these technologies.

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[17] Small (1999).
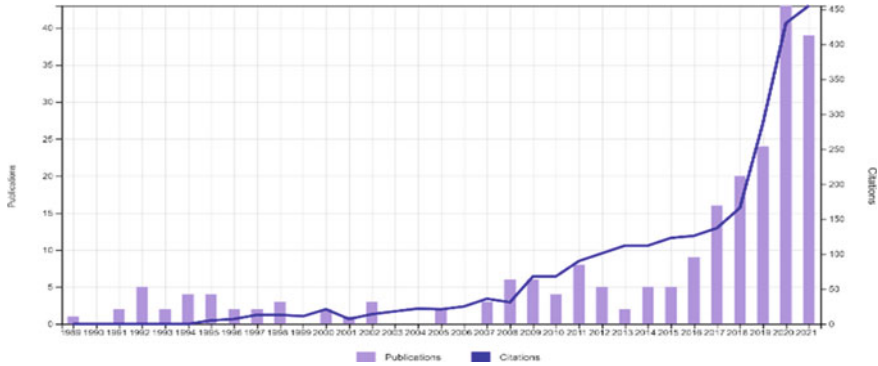
[18] Huang and Chang (2014).

Fig. 1 Evolution of the number of published works. *Source* Author's own processing

Fig. 2 Production of scientific documents on the WoS database. *Source* Author's own processing

We notice that the number of works is increasing, being influenced by the process of digital transformation, and by the fact that emerging technologies are beginning to make their presence felt more and more.

Depending on the country of origin, the situation of the number of articles published on WoS (see Fig. 2).

Most of the scientific papers in our selection from the WoS from 2015 to 2021 were written in the U.S. with 942 works, followed by China with 585 and Great Britain with 441 works. These results confirm the great interest of the world's major economic powers in emerging technologies, with the emergence and use of Blockchain technology being of significant importance, a conclusion reached by other researchers.[19]

With the help of the VOSviewer program, we made a map of the keywords from the specialized works on WoS with the topic "artificial intelligence" and "blockchain". In order to investigate the main research perspectives in the analysis performed, a

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[19] Secinaro et al. (2021).
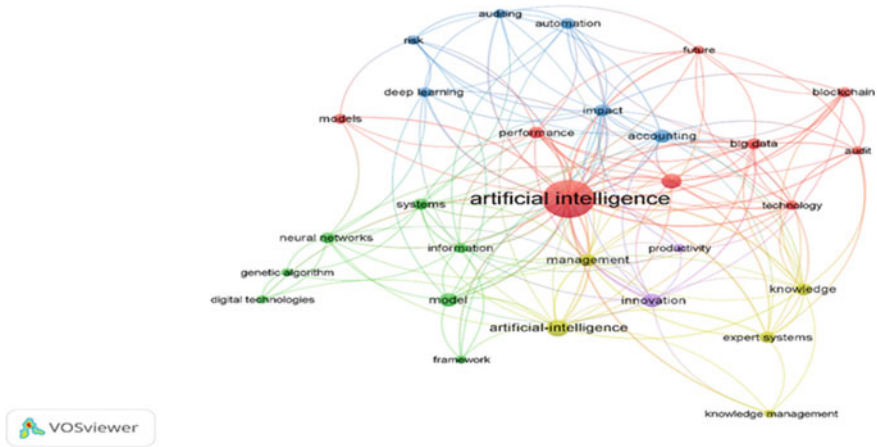
Fig. 3 Artificial intelligence links from the WoS database. *Source* Author's own processing in VOSviewer

keyword research was performed. Following the processing of selected data from ISI WoS using the VOSviewer program, 29 terms were obtained that reached the threshold of at least 5 frequencies (see Fig. 3).

We notice that the network made groups the terms into 5 clusters according to their relevance, and their frequency is highlighted by the size of the circles. The first cluster, but also the most important cluster consists of 9 items and is focused on artificial intelligence, including terms: models, performance, machine learning, big data, technology, future, blockchain, audit. We note that artificial intelligence is closely related to future technologies such as big data and machine learning, blockchain. At the same time, as a result of the implementation of these technologies, an increase in performance is expected; the word performance is close to the center of the network and has links to many other terms, even outside the cluster. Cluster 2 consists of 7 items and has as its theme information in general, how it will be transformed or processed, the terms being: neural networks, framework, genetic algorithm. Cluster 3 consists of 6 items, with accounting as the theme. As we can see in the picture, the terms of this cluster: impact, automation, deep learning auditing are actually the description of the impact that artificial intelligence will have on accounting. Cluster 4 focuses on knowledge and consists of 4 items. The last cluster consists of only 2 items, and has as its theme innovation and productivity, the way society will be revolutionized.

The colors of the words indicate the cluster they belong to, and the size of the sphere shows us their number of occurrences (see Fig. 4). We see in this figure a division into 9 clusters of WoS documents. The keywords with the most appearances of the keywords being blockchain with 869 appearances, followed by bitcoin with 227 appearances, technology 187 appearances, management 106 appearances and artificial intelligence 129 appearances. We can also see that in addition to having
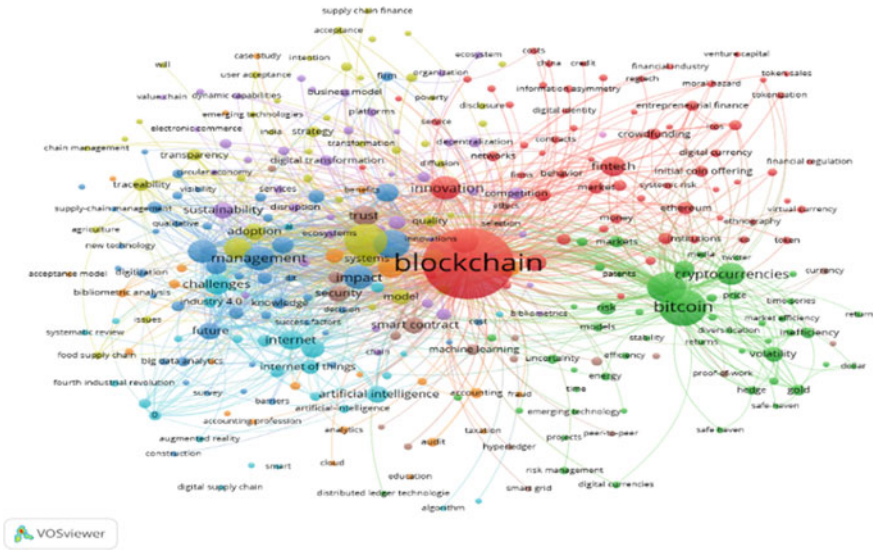
Fig. 4 Production of scientific documents on the WoS database. *Source* Author's own processing in VOSviewer

the most occurrences, the word blockchain is fixed in the middle of the map, which indicates the significant importance of this technology for other research topics.

The most common keywords are related to cognitive technologies, especially blockchain, which shows that researchers consider emerging technology to be the engine of evolution in accounting. We also notice that most words that revolve around words with many occurrences refer to the challenges or applicability of the first ones. At the same time, we notice the existence of a small group of words that benefit from a large number of occurrences, but the vast majority, however, have little connection, often only with the words in the cluster in which they are part, and a small number of occurrences. The word technology also has a high centrality and forms strong links with all clusters (see Fig. 5).

It is noted that among the links of the keyword technology there are strong links with the words: challenges, management, innovation, impact, which demonstrates, once again, the interest of researchers in the impact of these technologies in the future of accounting. There are also strong links between the internet of things and blockchain technology. The Internet of Things is the technology of using the Internet to connect different devices, services, etc., thus forming a network of objects.

For a better understanding of the clusters we opted for their representation with the help of two two-dimensional diagrams, respectively the centrality and density of Callon[20] (see Fig. 6). Centrality indicates the interaction between discovered networks, and density indicates the strength of the network within it, that is, the keywords that are part of the topic.

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[20] Callon et al. (1991).
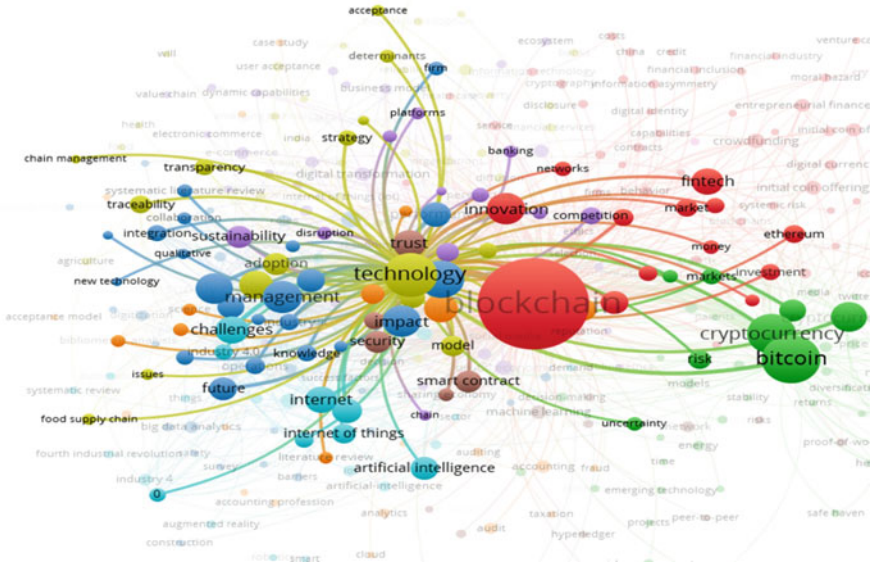
Fig. 5 Technology links from the WoS database. *Source* Author's own processing in VOSviewer
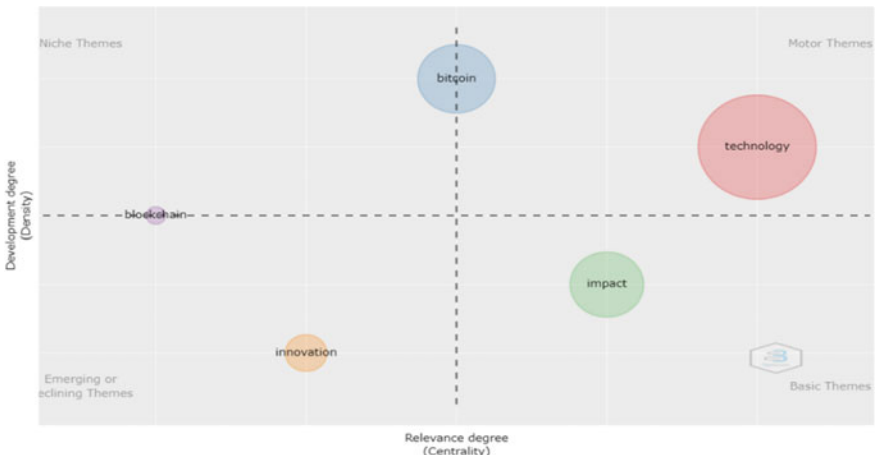
Fig. 6 Theme of works from the WoS database. *Source* Author's own processing in Bibliometrix

The diagram is divided into 4 quadrants according to the centrality and density of the themes. In the upper left quadrant, we will find "niche themes", ie those themes that have a low centrality, but with well-developed internal connections and a high density. As we can see, the themes that are part of this quadrant are: bitcoin and blockchain. The theme of bitcoin has strongly developed internal links, and this indicates that those plus keywords that are part of the theme are very common together.

When we take a look at the keywords plus in this topic, we can say that this is of particular interest to investors in the capital markets, discussing the market, economy, volatility, risk, etc. However, regarding the centrality of the topic, we see that it is in the middle of the diagram, indicating an average centrality, which means that this topic is sometimes found in other research topics, there are external links with other topics. The blockchain theme is found in the niche theme quadrant, with a high density but a low centrality, because even though this technology has major implications, researchers are more interested in the implications and impact of this technology, not the blockchain itself. This will change when the implications and impact of these new technologies are explored and quantified by researchers, the discussion migrating to the blockchain itself, on the development of this technology and the services it offers. The themes in the upper right quadrant are known as motor themes and have well-developed links, both internal and external, ie high centrality and density. These are particularly important for the field of research, benefiting from a great interest of researchers. The theme of technology is part of this dial, indicating that technology and its implications have aroused great interest from researchers as they want to address the implications and challenges of future technology development, aiming to establish a framework for the use of emerging technologies and developing effective methods. adaptation of these emerging technologies in the current environment. In the lower right quadrant, we have the basic topics, which are important but not sufficiently developed, with poorly developed external links. The impact theme is classified as basic theme, and indicates that most of the plus keywords that are part of this theme are common in others, due to the high centrality. This high centrality is due to the fact that many researchers are interested in the impact, performance and integration of various technologies, these terms being brought very often in scientific papers. In the last quadrant, the one on the bottom left, there are themes with poorly developed and marginal links, in our case we find the theme innovation is located in this quadrant. This topic is an emerging one, in today's competitive environment, innovation being extremely important for the well-being of economic entities.

4 Conclusions

When the concept of the modern world is mentioned, we tend to imagine a world in which technology is as essential as air, being present everywhere, helping and guiding people whenever this need arises. This is very close to materializing, and its key driver is the process we call digital transformation. This process will involve a fundamental change in the way economic entities operate on a daily basis. Moreover, it will involve a cultural change that will force economic entities to challenge the traditional way of doing business. In this sense, this paper supports researchers, but also stakeholders in the future of accounting, outlining the general direction of research topics, thus disclosing new developments and applications in this field, most focused on Blockchain technology.

Following the review of the literature and the bibliometric analysis carried out in this paper, we noticed that blockchain technology enjoys a great interest from researchers, who are focused on its challenges and applicability in accounting. Many of them consider this technology to be the future of accounting. This interest in the applicability of blockchain technology is even more evident in WoS research topics, with clusters discovered few in number (interest centered on a few research niches), and keywords plus most appearances referring directly to the technologies of the future. We believe that in the near future these research topics, in terms of emerging technologies, especially blockchain technology, will become extremely important, both for researchers who will focus on the different ways in which these technologies will be able to add value., but also for practitioners who will need to adapt and learn how to use them. Knowledge of these research directions is extremely important, helping professionals to be prepared for the changes that will occur in the field of accounting in the near future, these research topics actually shaping the future of accounting. Blockchain is considered a new technology, but built on existing technologies such as the Internet, private key cryptography, and the protocol that governs stimulation. Together, they lead to a secure process that facilitates digital transactions without the involvement of a third party. In other words, blockchain is an alternative accounting model.

In general, existing studies on blockchain technology and its use in business, especially in the field of accounting, although limited, nevertheless offer prospects for the future. In the near future, blockchain technology will have the capability to integrate the Internet of Things, artificial intelligence and other emerging technologies to provide superior services to organizations. However, the blockchain is still in the experimental technology phase, being applied in some areas on a small scale.

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Achieving Sustainable Performance in Agri-food Supply Chains Through Digitalization

Maria Kontopanou and **Giannis T. Tsoulfas**

Abstract Sustainability is a prosperous field of research for the agri-food supply chain domain. Agri-food supply chain management is currently focused in achieving higher performance of agri-food supply chains. At the same time, sustainability is being promoted as a factor affecting the total effectiveness of agri-food supply chains. The aim of this paper is to examine the practices followed by stakeholders in order to achieve the increase of sustainable performance in the agri-food supply chain domain and proposes ways to implement the existed technology in order to optimize the function of the agri-food supply chains by supporting a holistic framework towards sustainable and efficient agri-food supply chain systems.

Keywords Agri-food supply chains · Sustainability · Sustainable performance · Digitalization

1 Introduction

Sustainability is one of the most important concerns for our planet during the last decades. Meeting the needs of the increased world population has led to radical changes in managing human activities worldwide. In order to manage the environmental, economic, and social crisis, the United Nations have formed the Sustainable Development Goals (SDGs) 2030 Agenda, which includes 17 aspirational objectives with 169 targets about all dimensions of sustainable development [1]. It is estimated that by 2050 food production should increase by 70% in order to cover the world's food demand [2]. For this reason, agri-food supply chain systems play an important role in the worldwide attempts to move towards a more sustainable planet.

Agri-food supply chains are involved in procedures that affect all three pillars of sustainability: environmental, economic, and social. The achievement of the environmental goals of sustainability in agri-food supply chains is an emerging issue that has been set as a target for multiple agri-food supply chain networks. Food

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waste and energy management have been highly implemented in the agri-food supply chains procedures. Companies have started to seek ways to reduce food losses and to upcycle food by-products. Being part of a complex agri-food supply chain network gives them the chance to provide their by-products as ingredients to the production of other products making an important effort to the environmental footprint of the agri-food supply chain systems [3]. At the same time, the reduction of food losses and the good use of food products contributes to the global attempts to reduce hunger, which is a lasting social issue for our planet [4]. The use of new equipment, designed to use less energy and reduce harmful emissions, and the use of alternative energy sources also contribute to environmental protection [5]. The economic dimension of sustainability refers to the costs and profit of the supply chain. The economic growth across the agri-food supply chains should also be enhanced by respecting the individual short-term and long-term objectives of each stakeholder and ensuring the achievement of their economic growth alongside the increase of performance through the whole supply chain network. In terms of sustainability, there has been a new perspective on the economic performance of the agri-food supply chains, as it does not only include the economic profit but also the sustainable outcome. For this reason, the latest research is focused on the sustainable performance of supply chain systems [6].

Achieving sustainable performance in the complex agri-food supply chain systems could be challenging. The evolution of technology has been the key to the modernization of industrial activities, giving companies the chance to produce more and higher-quality products. Even though new technologies have already started to be implemented in various supply chain networks, the agri-food supply chains seem to belong to the late adopters or even laggards in some cases [7].

This paper examines the practices followed by stakeholders in order to achieve the increase of sustainable performance in the agri-food supply chain domain and proposes ways to implement the existed technology in order to optimize the function of the agri-food supply chains by supporting a holistic framework towards sustainable and efficient agri-food supply chain systems.

2   Literature Review

The agri-food supply chains are distinguished from others, mainly due to the products involved in them and the stakeholders participating in the production flow [8]. The agricultural products are characterized by many different properties, such as seasonality and perishability, and their safety and high quality should be assured from all stakeholders through all the stages of the agri-food supply chain [9]. Depending on the end product, agri-food supply chains can be short or long, simple or complex, and include various procedures in all stages [10].

Starting from the field, the agricultural products differ from place to place. Soil fertility, climate conditions, and water availability and quality are some of the factors affecting the quality and quantity of products produced in each area [11]. Not only

do the agricultural products produced in various regions appear to be different from each other, but also the products produced in the same field, depending on the environmental conditions of each cultivation period. As a result, the quality and availability of the primary products of the agri-food supply chains vary from time to time, making the management of the primary production systems challenging. The problems arising in this stage mostly refer to the food losses that occur [12]. The inability to predict the exact weather conditions and the poor forecasting of demand combined with the adoption of outdated cultivation practices leads to an increase in food losses [13]. This leads to a lowered sustainable outcome of the agri-food supply chain together with the decrease of the profit and thus its performance. During the last decades, there have been attempts for the primary production systems to be updated. Precision technologies have started to be applied in the agricultural sector, increasing the efficiency of agricultural activities. As a result, the quality of products is preserved and the production reaches higher levels [7].

Primary production management is the key to achieving a higher sustainable performance outcome for the agri-food supply chain, as the producers become the suppliers for the processing, distribution, and retailing sectors. In case where the products are not disposed of for direct consumption, they enter the processing stage. The main factors that affect the sustainable performance of the agri-food supply chain in this stage are food waste and energy consumption. During the processing of the primary products, some parts of them remain unused, as they do not consist an ingredient of the end product. New ways to use the by-products of the processing procedures have started to be researched in order to decrease the environmental footprint of the agri-food supply chains, by creating at the same time an effective supply chain network [14]. In this area, there has also been a lot of progress and research on using advanced packing and processing equipment in order to avoid additional food losses and reduce energy consumption [15]. Considering the stage of transportation and retailing there has been some research for the optimization of the transportation and storage conditions, achieving the highest product quality and at the same time the lowest consumption of energy [16]. The accurate monitoring of the exact condition of the products though is difficult, as there is no developed technology in order to obtain the necessary information and data for each batch of products during their transportation and until they are purchased by the customers and as a result, the agri-food supply chain system cannot be further optimized.

Consumers are also a part of the agri-food supply chain system. They define the demand of products and their requirements may cause changes through all the stages of the agri-food supply chains. Lately, consumers become more interested in organic products which are produced through environmental-friendly procedures and are integrated into a sustainable and moral framework [17]. A lot of the production plans which have started to be developed target to meet the consumers' needs and demands, leading to the adoption of more sustainable practices. ISO accreditations support the application of high safety and quality production systems by promoting the monitoring of the procedures taking place through the agri-food supply chains and setting up preventive and corrective action systems. These systems contain methods to increase the product quality, decrease the environmental footprint and assure the

integrity of the agri-food supply chain systems. Each stakeholder has the chance to enhance his operation systems with the ISO standards that suit and make the end product certified for the relevant safety and quality factors, providing it with added value [18]. Even though the biggest firms have started to apply these kinds of safety and quality systems, small companies rarely invest in them. The results of the corresponding research vary. Studies are indicating that the performance of a firm is positively affected by integrating ISO systems [19, 20], but on the other hand, research shows that the application of an ISO system cannot ensure high performance, especially in the case of small and medium-sized firms [21]. The limitation of the referred research is that it mostly refers to the analysis of the performance of individual firms, applying one safety and quality system, or a combination of them, as there is no system placed that aims to the preservation of the sustainable performance through all the stages of the agri-food supply chains. As a result, there is no enough information on how the integration of safety and quality systems in each stage of the agri-food supply chain affects the sustainable performance of the whole network.

3   Methodology

Based on the critical review of the literature we aim to detect the gaps in the literature considering the sustainable performance of the agri-food supply chains and the role of the digital technology tools in achieving it. Our aim is to gather information on how the concept of sustainable performance is promoted in agri-food supply chains and how the new technological tools support a holistic framework towards sustainable and efficient agri-food supply chain systems.

Apart from the particularities that agricultural products possess, the agri-food supply chain consists of stakeholders from various fields, with different perspectives and targets. To achieve a holistic approach to the sustainable performance of the agri-food supply chain systems we should consider the relations between the stakeholders as an important factor affecting its total outcomes. Agri-food supply chain management includes all the levels of decision-making and planning processes, including strategic, tactical, and operational planning [22]. In terms of sustainability, agri-food supply chain management also refers to the material and information management across the agri-food supply chain by enhancing the cooperation and coordination between the stakeholders, aiming to ensure its sustainable operation and at the same time protecting the interests of all stakeholders [23]. Cooperation refers to the sharing of resources as a means to execute an operation. Coordination refers to integrated resource management by setting common goals for all stakeholders [22]. Cooperation and coordination systems are approached either as horizontal which refers to the relationships between stakeholders involved in the same stage of the agri-food supply chains or vertical which refers to the connection between the different stages of the agri-food supply chains [24].

The main problem occurring when trying to achieve coordination is that the profit goals of the different stakeholders are not always the same and the level of adoption of new sustainable practices differs between them. Especially in the case of small-sized firms, or firms that use outdated production systems the adoption of new sustainable practices requires a larger investment, which leads to losing short-term profitability [25]. The sustainable management of the agri-food supply chains aims to motivate all stakeholders to align with each other regarding the sustainable procedures that take place in the agri-food supply chain systems, leading to coordination and increasing their sustainable performance.

4 Results and Discussions

The modern agri-food supply chain networks become more and more complex as the demand for food products increases. The recent COVID-19 crisis has indicated that agri-food supply chains have to be quickly adapted to new, and in some cases unpredictable conditions. As a result, agri-food supply chain management should evolve, in order to overcome the new barriers that appear and increase the agri-food supply chains' adaptability. The evolution of new technologies plays an important role in the creation of robust, resilient, and sustainable agri-food supply chain systems.

The recent literature has started to promote the implementation of new technologies as an effective means to achieving sustainable performance in agri-food supply chains. It is highly important that the performance of the agri-food supply chains can be measured from a sustainable point of view. This means that the efficiency outcome of the agri-food supply chain should include more aspects, including profit, environmental footprint, and product safety and quality. The total factor productivity approach, combined with the necessary uncertainty analysis of the factors included is proposed as a means to measure and compare the sustainable performance of the agri-food supply chain systems [26]. With all the necessary information available, the results could be useful in order to shape a more efficient and complete framework towards more sustainable agri-food supply chains.

In the agriculture sector precision technologies and smart agriculture have started to be researched and applied [27]. New technologies in agriculture play an important role in the maximization of the efficiency of agricultural activities, leading to the production of more sustainable and, at the same time, high-quality products, by reducing the food loss that occurs due to bad production practices. Stochastic programming models are also used in order to optimize the production plans by taking into consideration the uncertain parameters involved. Robust optimization systems on the other hand are used in order to reduce the risk and shape a production plan without being affected by the uncertain factors that occur. Stochastic programming and robust optimization systems have also been developed recently in order to manage the uncertainties of the primary production sector [28]. Considering that the agri-food supply chain system's sustainable performance is strongly linked to the management of these unpredictable factors, the research and development of more

stochastic models are necessary in order to shape an optimized framework for the agri-food supply chain system management.

Even though the agricultural sector has evolved lately, it is still difficult for small-scale farmers to invest in new technological equipment. The lack of knowledge on the use of these new technologies alongside the lack of motivation from the government makes their implementation even more difficult. In order to overcome this barrier, there has been some research on the establishment of knowledge networks through the development of knowledge-sharing models and systems in order for all stakeholders to adapt to the new era of digitalization and be part of an updated agri-food supply chain system [29]. A proposed framework that promotes the knowledge sharing across the agri-food supply chains as a means of achieving a higher sustainable performance is the lean K-Mob conceptual framework [10] which was created by taking into consideration an expert's team prioritization considering the lean objectives of the agri-food supply chains. Even though knowledge management tools have started to be implemented in the agri-food supply chains in order to optimize the procedures taking place, less attention is given to parallel support of their sustainable management through them.

The use of simulation models also gives useful information, as the data from this kind of research are used to develop new models and frameworks to optimize the procedures that take place in agri-food supply chains. Moreover, simulation models have started to replace the use of mathematical models in agri-food supply chain studies, as they can process more data and take into consideration the complex factors affecting the performance of the agri-food supply chains [30]. Simulation models are also combined with optimization models in order to shape analytical frameworks towards more efficient and sustainable agri-food supply chain systems [22]. Taking into consideration multiple factors such as safety and quality of products, cost, and environmental footprint of the agri-food supply chains, these models propose alternatives in order to achieve the best combination of efficiency and sustainable performance. A challenge that occurs during the shaping of frameworks by using simulation and optimization models is managing the uncertainty of the factors that affect the agri-food supply chain systems which are mostly related to food production conditions and food demand range.

In the case of the agri-food supply chains, there have been attempts for horizontal cooperation systems, such as the collaborative green transportation system, where farmers from different firms share the warehouses and the transportation equipment, achieving to reduce the cost and gas emissions [31]. There are also frameworks proposing that the supplier selection process and criteria affect the sustainable performance of the agri-food supply chains. More specifically it is shown that a slightly exceeded amount of product ordered could double the food waste, affecting negatively the overall sustainable performance [30]. Considering that the agri-food supply chains aim to achieve a high-performance sustainable outcome and at the same time a competitive advantage the organization of a robust coordinated system is promoted as a necessary action plan [32]. In order to achieve the coordination between the parts of the agri-food supply chains, stakeholders tend to sign contracts between them, eliminating the middlemen and enhancing their communication [17].

The coordination in agri-food supply chains appears to be complex in some cases though, affecting the sustainable performance of the agri-food supply chains [33].

Decision-making is highly important while aiming to optimize the agri-food supply chain systems' sustainable performance. The consideration of sustainability in the decision making processes was less developed until recently as the reduction of material and energy use started to interest the agri-food industry [10]. The use of decision support tools is necessary, as they support long-term strategic planning of the agri-food supply chain systems. The Collaboration Planning Tool (CPT) is a proposed technology system that aims to enhance the classic ERP planning systems [22]. Using CPT, information about the product flow and resources available from all the stages of the agri-food supply chain can be collected and used in order to propose strategic planning alternatives. All this information can be used in order to optimize the agri-food supply chain networks, by evaluating the relations and collaboration between the stakeholders.

All the proposed frameworks and technologies presented are mostly based on information-sharing technologies. There has been recent research on the technologies used in order to support information sharing through the agri-food supply chains. Internet of Things (IoT) traceability systems that use sensor technologies are proposed as a way to monitor the products' condition through all the stages of the agri-food supply chain, giving the customers more information about product safety and quality [34]. Real-time information sharing systems have also been designed in order to achieve better visibility through the agri-food supply chain networks [35]. Big data technology, combined with blockchain technology can also provide stakeholders with more information about the origin and condition of the product by assuring data protection at all times [36].

The agri-food supply chains are considered as a special case of supply chains. The agricultural products differ from others and possess various properties that have to be protected through all the stages of the agri-food supply chain. The safety and quality standards of food products are high as the consumers have started to be more demanding about the products they buy. Setting higher food safety and quality standards affects the way the food supply chains function from farm to fork. Starting from the primary production, agricultural production systems should be well established and technically organized in order to produce higher quality products. Most of the food products, especially in the case of crop production pass through the stage of selection and sorting. With quality and safety standards being strict, an important amount of products is considered inappropriate and is discarded. In this case, this consumer-focused set of standards leads to increased food losses, which negatively affects the sustainable performance of the agri-food supply chain in environmental, economic and social aspects. The case is the same during the next stages of the agri-food supply chains. During processing, distribution and retailing food losses are still high, depending on the standards set from each stakeholder. As food waste is a major issue that the agri-food supply chains come against, there are several solutions proposed, some of them have already started to be implemented. It is noticed that while establishing new procedures in order to achieve the production of safe and high-quality products, there is more focus on the consumer requirements, and

less on the sustainable targets of all stakeholders. The conduction of more organized research on the priorities set by all stakeholders considering all aspects of sustainable performance of the agri-food supply chains by setting panels of experts and the use the results in order to shape frameworks towards the alignment of interests of all parties could lead to the creation of optimized models, approached from a more sustainable point of view [10]. Moreover, proposing ways in order to reduce energy consumption during the procedures taking place could significantly enrich the existed and new models, enhancing the sustainable goals of the agri-food supply chains.

Cooperation and coordination between the stakeholders of the agri-food supply chains is also a matter of interest that affects their sustainable management. The communication and cooperation between stakeholders of both the same and different agri-food supply chains and the creation of sustainable agri-food supply networks is promoted as a way to improve the efficiency of current agri-food systems. In order for all stakeholders to work together and set common goals towards the assurance of the total efficiency of the agri-food supply chain knowledge sharing and information sharing models have started to be established. Especially in the case of agri-food supply chains, the implementation of Big Data technology alongside the integration of IoT platforms is necessary, as there is a lot of important information for food production systems in order to optimize the procedures and facilitate decision-making through all the stages. As food production systems become more complicated, the management of uncertainties is very important in order to make the right decisions and establish a long-term strategic planning. As a result, the acquisition of more data through Big Data Technologies can support decision-making. Blockchain technology can assure data transition through the agri-food supply chain, ensuring their integrity and protection and thus support current Big Data technologies achieving the acquisition of reliable data.

5   Conclusion

Sustainable performance in the agri-food supply chains has become a field of interest for all stakeholders. Environmental, economic and social aspects of agri-food supply chain management are usually researched separately. However, these three aspects are strongly interrelated with each other, defining the sustainability performance of agri-food supply chains. In order for an agri-food supply chain system to be characterized as efficient all aspects of sustainable performance should be in the center of their strategic planning and the agri-food supply chains should be optimized in a way that all stakeholders' goals and interests are considered. New technologies play an important role on the improvement and optimization of agri-food supply chain systems. The optimization of agri-food supply chain networks and the management of the uncertainties involved are linked to the prioritization of the critical success factors affecting sustainable performance. There are further areas of research regarding the prioritization of these factors by experts in order to understand more deeply the ways agri-food supply chain systems are adapted to each case. The ultimate goal

is to align interests, achieve the formulation of more sustainable agri-food supply chain systems and support agri-food supply chain management by the use of more advanced systems that enhance information sharing and ensure data integrity.

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Circular Bioeconomy: A Review on the Current State and Future Opportunities

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Abstract Circular economy is a well know and promising model that has been studied and promoted for important environmental, economic and societal impacts. Bioeconomy is an emerging field, which is regarded as a possible pathway in order to reach a sustainable future. The adoption of the circular economy model for bio-based materials can bring fundamental changes, while shifting from the wide fossil-based production to more natural resources. A significant number of studies have been conducted, which is an indicator of importance, in order to clarify and propose the methodologies that should be followed as well as tools and technologies that can intensify the procedures to reach a sustainable future in all production sectors. Stakeholders have realized the urgency for change and actions have started to be taken. Legislation and technology are working closely in order to accelerate this transition. In this paper, we study where policy and technology stand and how they complement each other to the implementation of such practices at an operational level. Several propositions are outline in order to specify the barriers and locate opportunities to adopt these methods with a focus on the agri-food sector.

Keywords Circular economy · Circular bioeconomy · Agri food supply chain · Sustainability

1 Introduction

On our planet, we are at the moment facing three major challenges: the reduction of fossil fuels; the mitigation of the climate change effects; and the goal to achieve sustainable, adequate and safe food chains [1]. Bioeconomy, according to the Food and Agricultural Organization (FAO), uses the power of bioscience and biotechnology to address various challenges, such as providing food, feed, wood products and furniture, paper, bio-based textiles, bio-chemicals, bio-plastics, bio-pharmaceuticals, and bio-energy for a growing population while conserving natural

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resources [2]. Unlike the fossil economy, which has been primarily utilized, the bioeconomy strives to generate the most essential items for human existence and is based on renewable resources that are mostly dispersed in rural and coastal regions [3]. Switching our economic system from one based on finite fossil resources to one based on biological resources might provide energy security, fewer carbon emissions, long-term socio-economic advantages, and resource growth and availability in a world with a rapidly rising population [4].

If we consider that by 2050, global agricultural output should have to expand by 70% to feed a population of 9 billion people, we can see that the world's agricultural production will have to increase respectively to fulfill demand. The way, with the current data, to meet this number is either for the cultivated land to be extended, which was approximately 37% of the total available surface in 2017, or for the production to be increased to 38% and consume 53% more water globally [5]. Thus we can understand the urgency to change our current state. The main motivation for a shift in political interest and related development of the bioeconomy is observed in policy instruments like the European Green Deal, national bioeconomy strategies, and global climate agreements: the substitution of fossil with bio resources, implying a reduction of several types of air and soil pollutants that are otherwise produced [3].

The notion of "bioeconomy" refers to the utilization of renewable biological resources and their conversion into goods such as food, feed, bio-based products, and biofuels through the use of cutting-edge technologies in food processing, agronomy, and industrial biotechnology [4]. These resources have four distinct characteristics: renewability, carbon-friendliness or carbon-neutrality, a high potential for efficient re- and multi-use degradability and recyclability, and new functions/properties of their products, such as longer lifetime, higher durability and stability, lower or zero emissions, less or no toxicity, and non-flammability [1].

Implementing such concepts necessitates a profound restructuring of our existing economic structure by promoting changes in all levels and across by setting new policies, evolving and innovating in the sector of technology, and shifting the mentality of organizations, social behavior and markets [6]. Bio-economy is directly connected to economic models and concepts such as the Circular Economy, Bio-based Economy, Green Economy, Biomass Biorefineries, Zero-Waste Economy, and Sustainable Development [1].

In a bio-based economy, business models are sustainable and focus on describing, analyzing, managing, and communicating the company's sustainable values and propositions to its customers and other stakeholders, showcasing how it creates and delivers this value, and how the economic value is captured while preserving or regenerating natural, social, and economic capital beyond its organizational boundaries. These core values benefit not only the company, but also its customers and other stakeholders [7].

The bioeconomy has a tremendous worldwide economic influence. Food production consumes a considerable number of biological resources, therefore the bioeconomy and food are intertwined, and food production, like the bioeconomy, must meet sustainability objectives. With innovation driving forward improvements in food production, such as innovative use of side streams in food production and new

product creation, some key principles, such as food safety, must be reevaluated for a sustainable future [8]. Finally, in order to transition towards bioeconomy the acceptance and involvement of society is necessary and to gain an insight on people's perceptions of new technologies, while they tend to be cautious in such major shifts [9]. In this paper, based on the literature, we study where policy and technology stand and how they complement each other to the implementation of such practices at an operational level. Several propositions are outlined in order to specify the barriers and locate opportunities to adopt these methods with a focus on the agri-food sector.

2 Literature Review

2.1 Circular Bioeconomy

Circular economy has gained support over the last years and is currently a popular concept promoted by the European Union, governments, organizations and businesses globally for reasons that have an effect of economy with the possibility of a 600 billion increase in the manufacturing sector, the society by creating job positions and the environment by minimizing natural resources inputs [10]. As outlined in the United Nations Sustainable Development Goals (SDGs) the globe is confronted with unprecedented great challenges, including population growth, climate change, rising demand for food and other commodities, and the need for fossil fuel alternatives [11]. The circular model of production is a model with a variety of possible applications that can tackle these challenges.

The model of circular economy has been in the center of research for application on bio-based materials and is of great importance because it could provide the pathway towards a sustainable future. There are numerous advantages to using these materials as raw materials, including protecting and regenerating the health of ecosystems, avoiding non-essential products and waste of essential ones, prioritizing biomass streams for basic human needs, utilizing and recycling ecosystem by-products, and using renewable energy while reducing overall energy use [6]. The increasing need for energy and resources is driving humanity to transition from a fossil-based linear economy to a circular bioeconomy that is sustainable [12].

The term circular bioeconomy is extensively discussed both from the scientific community but also from a policy aspect, and its implementation is considered to be promising in fixing many current issues. While biomass is an obvious possibility for the development of a circular bioeconomy and provides prospects in generating synergies across multiple policy areas, it also produces inconsistencies, trade-offs, and even conflict claims. Because biomass is generated and consumed by a diverse range of industries, it is controlled by a variety of policy domains at various points along the supply chain [6].

Biorefineries are now the main application of the circular bioeconomy. These are plants that contribute to local sustainable development by adding value to regional

raw resources and making processes more economically feasible. For the creation of marketable products and energy, this industrial model employs a sustainable processing system. These plants provide space for new business models, such as a two-level decentralized production model or a decentralized supply chain that includes biomass depots as an intermediate pre-processing center [7]. In addition, these decentralized small-scale biowaste treatment plants can support causes of recycling and climate goals and socioeconomic benefits by making a change at lowering the transportation costs, maximizing the adaptability to mass changes, creating new high-quality products, lowering the requirements to more simple technologies, change the need to smaller facilities, lower treatment costs and reduce payload-distances, especially when all these are combined with urban farms thus making supply chains smaller [13].

3   Methodology

A critical review on relevant bibliography has been conducted addressing the current status of policy and technology in the application and adoption of circular bioeconomy.

In this paper, we study where policy and technology stand and how they complement each other to the implementation of such practices at an operational level. Several propositions are outlined in order to specify the barriers and locate opportunities to adopt these methods with a focus on the agri-food sector.

4   Results and Discussion

4.1   Policy Level

At the policy level, the circular bioeconomy is seen as one of the most promising solutions to global environmental concerns since it may help to reduce natural resource exploitation by repurposing waste [14]. The importance to tackle these issues has been stated in the Paris Climate Convention, where a target is set to limit global warming below 2 °C in the long term along with 95% reduction in greenhouse gas emissions by 2050 compared to 1990 levels. Moreover, the minimization of fossil carbon is proposed, which led to a shift from fossil to renewable energy. This was voted by 189 of the 197 parties that took part in the Convention [15].

The requirements for implementation, such as the permit acquisition procedure, and the criteria for operational circumstances, such as maximum emissions, are defined by the regulatory environment. These requirements are considered the framework's core structure, and they are designed to preserve the environment and human health, especially when paired with a specific environmental region and high-quality

data [13]. In accordance with the SDGs, the Paris Agreement, and other Multilateral Environmental Agreements, the FAO provides policy guidance and technical assistance to policymakers in developing and implementing national and regional strategies, action plans, and programs to develop a sustainable and circular bioeconomy. The EU Bioeconomy Monitoring System has been developed in order to support the implementation of such practices in the economic, environmental and social dimension of sustainability. By providing these indicators at different levels of aggregation, the monitoring system can provide policy officers with a range of tools and a holistic picture in order to do in-depth analysis [16]. It will also be possible to look at the impacts of the bioeconomy from various perspectives, such as sustainability, ecosystem type, and value chain. Finally, due to its multidimensional structure, it is a flexible system that can be applied both inside and outside of Europe to the 2018 EU Bioeconomy Strategy objectives.

According to their research among businesses located in Europe, [13] explored the limits of a transition towards a decentralized biowaste management systems in the concept of broadening the application of the circular bioeconomy model. In their research they mention the importance behind setting the regulations from the start and throughout the whole project course. This regulatory frame will denote the related activity as legal or illegal. If a system is legal, there are rules that must be followed in order for it to function, however if it is illegal, the activity cannot be carried out under any circumstances without incurring punishment in the event of a violation, such as the landfilling of untreated organic waste. Lack of legislation does not allow the acceptance of these and acts as constraint for implementation of such innovative projects. In waste management technologies a common unregulated issue is the uncertainty and insecurity that means a high-risk investment. They concluded that the main actors that are identified in this case are the costumers, the legislators and the technology developers [13].

In a review paper made by Pyka et al. [17] the models that have been developed in order to support the transition towards a bioeconomy has been made and they have been categorized in economic models; partial equilibrium models; environmental models; integrated assessment models; and specialist models. Their analysis focused on how bioeconomy modeling covers major enabling elements such as climate change; biodiversity; circular biomass usage; biomass and bioproducts consumer behavior; and innovation and technical development. They suggested that there are opportunities to improve existing bioeconomy models and they stated that existing modeling frameworks have a lot of room for additions and considerations when it comes to analyzing short-run implications connected to climate change and circularity, and to a lesser extent, biodiversity.

4.2 Technology Level

Models for the bioeconomy are very promising. Developing new technologies, as well as redesigning existing ones, is a big part of bringing these concepts up to date.

Carbon capture and storage technologies, plants bred for improved photosynthesis, yields, and quality of produce are examples of such opportunities that aim to reduce reliance on the speed of natural cycles, either by lowering resource use and emissions or enhancing the absorptive capacity of ecosystems [6].

To achieve sustainability at the triple bottom line, a transition from a fossil fuel to a bio-based and circular economy necessitates major institutional innovation [3]. In the framework of the circular economy a critical appraisal of biological cycles is required. Several criteria must be met in order to create more circular biological systems, including that biotic resources be sourced at a rate that ensures long-term yields, that they be optimized in a cascading use pathway, and that they decompose at the end of their product life and return to the biosphere to support ecosystem regeneration. If the materials do not degrade, they should be treated as part of another technological cycle and looped back to ensure that their material value is maintained for as long as feasible. Thus, due to the rising demand for biotic resources, technology that can assure their stability must be created in order to ensure that these resources are not exhausted, and the circles of biobased materials should be examined in order to avoid overexploitation and maintain a stable balance [18].

The processing of agricultural byproducts utilizing cutting edge technologies might represent the start of a circular food supply chain. This sort of technology has the ability to create novel food products with specific functions and consequently higher value than the original linear process' output. With this in mind, new food supply chain loops may contribute to value creation while also introducing new hazards. This is why further study is needed using a comprehensive approach that considers both the advantages and hazards of the innovation, as well as forecasting and optimization studies for the entire circular food supply chain [19].

In a biobased system, resource efficiency and sustainability are the core principles but the current bioeconomy shows that there is a nutrient flow from the countryside to cities. This, along with agricultural commerce, tends to lead to nutrient concentration in regions where feed and food are consumed, as well as nutrient depletion in places where feed and food are produced. This repeats the issue of growing biomass consumption to sustain biorefineries and create fuels, electricity, chemicals, and commodities [20].

As proposed by Navare et al. [18] such a system should monitor the biological cycles and assess: sustainable sourcing; cascading use of materials; the degree to which nutrients are able to successfully re-enter biological cycles; and the impact of obtaining biotic resources and carbon fluxes on the ecosystem. The goals include reducing the input of resources; minimizing the amount of waste and losses; increasing the input of recycled materials; and maximizing the value, usability, and longevity of goods. To be considered sustainable, the environmental effect of the creation of these new materials or products must be less than that of existing techniques or procedures. Also, new product quality must be at least as excellent as that generated by a petrochemical resource, and the cost of production should not be higher than that of the petrochemical equivalent [21]. Innovation, technological diffusion, and innovative solutions, particularly novel uses and developments in biotechnology, such as the use of enzymes and microorganisms for the creation of

value-added goods, are driving this in the agri-food industry. Several of the United Nations' SDGs can be met by using biotechnology to approach the issue of food bioeconomy, including Zero Hunger, Industry Innovation and Infrastructure, Sustainable Cities and Communities, and so on, as well as several positive effects on rural areas [19].

Biotechnology has progressed to the point that it can help speed up the transition to a more circular economy. Extraction, incineration, and microbial intervention were all investigated as techniques for biowaste valorization. Biowaste from the agro-industry is a viable source of carbon for microbial fermentation to produce value-added goods. Biowaste collection is both technically and economically feasible, thus it may be used as a source of renewable carbon. Biowastes are routinely bio-transformed into high-value products such bioethanol, bioplastics, biofuels, biohydrogen, biobutanol, and biogas [22].

Every year, the food processing industry generates a substantial volume of organic waste and accompanying effluents. Food wastage may be divided into two categories: food loss and food waste. Food loss is defined by FAO [23] as the loss of food throughout the supply chain, omitting the points where it interacts with retailers, food service providers, and consumers. Food waste is described as the loss of food as a result of customer purchase decisions or actions made by merchants and food service providers that influence consumer behavior [23]. The agricultural industry generates waste from farming and animal husbandry, whereas the food processing and manufacturing sector generates food loss and waste owing to transportation damage, improper storage, and contamination [24].

Microorganisms have been researched for bioconversion of biowaste into biomaterial, although it has not yet been scaled up in most situations. Some biopolymers, such as PHA, can be used to manufacture these types of molecules since they are insoluble in water, non-toxic, biodegradable, biocompatible, and thermoplastic, making them more versatile than synthetic plastics. Agriculture, medical implantation medication delivery, tissue engineering, and food packaging are just a few of the applications. Biosurfactants, which have the advantage over synthetic surfactants in terms of low toxicity, biodegradability, and stability in extreme pH, temperature, and salinity, can also be produced to eliminate the use of surfactants, which are currently produced with petroleum as a raw material. Finally, enzymes, which are molecules found in every living system and can be used to increase the rate of chemical reactions without being consumed and altering the chemical equilibrium between them, can be produced [22].

5 Conclusion

A shift towards a circular and biobased economy requires a big transformation and adaptation of the current policies that support the adoption of developed technologies on circular bioeconomy in order to be able to bring results for the economic, environmental and social aspects that are thought to be positively affected by this

model of production. As mentioned by FAO, the bioeconomy's largest niche is occupied by food systems [2]. Food systems, such as agriculture, forestry, fisheries, and aquaculture, as well as food and feed manufacture, account for 71% of all value added in a bioeconomy in the European Union, followed by bio-products at 28%, and bioenergy at the rest.

In order to go forward with the adoption of circular food supply chains, the entire management structure must be thoroughly rethought, reorganized, and redesigned. Technology, and more specifically biotechnology has made leaps in the exploitation of bioresources in the production of innovative and sustainable materials. The product recycling strategy in food production should not only be designed and implemented inside each individual food company, but also across several enterprises that may complement one another, which is where the largest challenge lies. To increase both efficacy and transparency, a firm that valorizes waste into new food components should be established across all of the entities interconnected inside a circular supply chain. While another important issue is to rethink the framework that sets the rules, methodologies and protocols of how every company should act and should be provided with guidance and support from the authorities. In such complicated matters, it is important for policies to be clear and simple in order for businesses and manufacturers to be able to adopt them immediately.

A truly sustainable circular bioeconomy involves respect for the social base, in addition to the significant environmental advantages. This base protects both people and animals' fundamental rights. Together with this transition it is important to ensure that the farm workers, fisher folk and land managers, who are the people that are in direct contact with the very base of this system and are the front-liners of a circular bioeconomy should be able to live a prosperous livelihood.

The sustainable use of these renewable resources is a positive approach towards waste management and promoting circular economy. When it comes to the use of microorganisms, the production of products with added value should be addressed both in upstream and downstream processes. Biotechnology can be used to improve biowaste conversion processes, such as the adoption of hardy microbial strains that can be cultured in non-sterile conditions or genetic engineering alteration. Engineered and versatile microorganisms can flourish in stressful and polluted environments and with low-cost resources, which is a significant advantage. This form of biowaste valorization technique, as well as the construction of a consolidated pretreatment, microbial fermentation, and extraction process, allows for the long-term use of renewable resources [22].

At the moment, there has been a large amount of research in the field of biotechnology and due to the wide variety of raw materials the perplexity of this is high. Some important barriers, to the adoption of a biobased economy is the supply fluctuation and limitation of raw material resources. The irregular amounts and the abundance of specific materials in specific areas overcomplicates an already complex situation and sets the matter of cooperation between stakeholders in high priority. A lack is mainly found in methods and equipment in order to scale up such processes into actual production which is fundamental in order to build an economy based on biomaterials. The current state of the environment should be an amplifier on how all stakeholders

act in relation to this promising model of production and the economy. Technology always has a starring role to drive the change towards meaningful innovation and computational models can accelerate their implementation.

In conclusion, to foster a sustainable planet and humankind immediate measures should be taken. Processes that are currently established need to be re-evaluated and redesigned in order to meet the current standards on the base set by the SDGs set by the United Nations.

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Impact of Remittances on Income Inequality: Empirical Evidence from Emerging Economies

Le Thanh Tung and Pham Nang Thang

Abstract Emerging economies are becoming increasingly important role and are expected as a new engine of the global economy. The purpose of this report is to examine the impact of remittances on inequality in 18 emerging economies between 1985–2019. The study result confirms that remittances have a negative impact on income inequality, in which, the more received remittances, the lower the level of income inequality in these countries. Besides, foreign direct investment, liquidity of the economy, and trade openness also help to reduce income inequality. However, the increase in GDP per capita, government expenditure, and inflation can widen the income gap between rich and poor people in these countries. Finally, some policy implications are suggested for reducing income inequality in these countries in the future.

Keywords Remittances · Income inequality · Income distribution · Sustainable development · Emerging economies

1 Introduction

Remittances have been considered as an important external capital in developing countries for three recent decades [1–4]. The statistics from the World Bank [5] showed that the number of remittances transferred to low- and middle-income countries has grown 7.3% and reached \$589 billion in 2021. Although the COVID-19 pandemic has outbreaking worldwide, the remittances only had a weak decline by only 1.7% in 2020 compared to 2019. The investigation of the world economy shows a group of developing countries with high and stable economic growth for recent decades. This group of countries has been known as the emerging economies and they have also received a sharp increase in remittances for years. In emerging economies, remittances also are a necessary source of capital for supporting economic growth. Remittances transferred to emerging economies contribute to increasing

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incomes of individuals and households where remittances are received and have an impact on poverty reduction. When remittances are used for investment, they also have a spillover effect on economic growth in economies. Besides, through households spending, personal consumption, or investment, remittances help to redistribute income in economies and have a potential impact on income inequality.

However, some economists concerned that social challenges have been raised in emerging economies in the near future. In detail, the emerging countries are also facing many risks of slowing growth due to social challenges such as income inequality [6]. The relationship between remittances and income inequality is not clear and can lead to arguments. Remittances are confirmed to have a positive effect on income inequality [7]. However, the effect of remittance on income inequality depends on where migrants account for income distribution in their home country [8]. The recent results show that income inequality also depends on the level of development of the remittance-receiving countries, where migration costs and brain drain are taken into account. Although the impact of remittances on income inequality has been examined in some studies, there is no evidence from emerging economies. Therefore, this study will provide empirical evidence to fill this research gap. The results of this research are useful information for policymakers in emerging economies to efficiently use remittances to reduce income inequality in the near future.

2   Literature Review

Remittances are playing an increasing role in countries and they contribute to economic growth and to the livelihoods of households in the receiving countries [2, 9]. Remittances help economic growth through a spending multiplier model, promoting economic growth and affecting income inequality. There are some empirical studies that focus on the relationship between remittances and income inequality, however, the results are not united or constructive.

Remittances are the second most important source of external financing for developing countries after foreign direct investment (FDI). Based on the data from 10 Asian developing countries in 1981–2014, remittances was found to have a significant impact on the gap between the rich and poor groups as well as the poverty rate [10]. In the same direction, remittances have an impact on economic growth and reduce income inequality in Latin American and Caribbean countries [11]. In Mali, remittances can reduce poverty and inequality [12]. Besides, an inverted U-shaped relationship between remittances and income inequality have been confirmed in the studied countries [13].

On the other hand, some previous studies suggested that remittances could increase income inequality. Remittances have the effect of increasing income inequality in African countries in the period 1960–2006 [7]. Besides, the study result shows that the increase of GDP per capita and inflation can be considered as the driving factors for increasing inequality. Remittances helps to raise median incomes for all households groups but more benefits for richer households than for

poorer people in some Latin American countries [14]. In another approach, remittances from abroad have increased household income and reduced poverty slightly for remittance recipients, on the other hand, increasing income inequality but to a small level [15].

Some other studies suggest that the impact of remittances on income inequality is complex. Using the data from 78 countries, an evidence was confirmed for the existence of an inverted U-shaped relationship between remittances and income inequality. In the early stages of migration history, the increase in remittances leads to an increase in income inequality [13]. However, the opportunity cost of mobility decreases, therefore, inequality tends to be lower. The empirical result also shows that education and the development of the financial sector can help countries reduce income inequality. Furthermore, the short-term and long-term effects of remittances on income inequality may be different [16]. The dynamic relationship between remittances and inequality can be characterized by an inverted U-shaped model. other studies conclude that the relationship between remittances and income inequality is not clear. On the other hand, the effect of remittances on income inequality in the countries of origin of migrants is not significant [8]. Depending on the historical, socio-economic context of countries, the impact of remittances on income inequality much depends on the income distribution style in recipient countries. The effect of remittances on inequality is maybe less obvious in the case of Mexico [17]. On the other hand, the conditional impact of remittances on inequality is related to the number of remittances into the countries [18].

Based on the summary of some recent empirical results, the impact of remittances on income inequality is much varied as well as depends on the characteristics and resources of studied countries or studied regions. To the best of our knowledge, there is no study focused only on the impact of remittances on income inequality in the case of emerging economies. Therefore, in this study, we will try to fill this empirical research gap in the current literature review.

3 Methodology

3.1 Econometric Methodology

Based on the theoretical framework and previous study models [7, 10, 18–23], our research model is presented in two kinds of formats below.

$$\text{Inequality}_{it} = \beta_0 + \beta_1 \text{REMA}_{it} + \beta_2 \text{GDPPER}_{it} + \beta_3 \text{FDI}_{it} + \beta_4 \text{LIQ}_{it} + \beta_5 \text{GOV}_{it} + \\ + \beta_6 \text{TRA}_{it} + \beta_7 \text{INF}_{it} + \varepsilon_{it} \tag{1}$$

$$\text{Inequality}_{it} = \varphi_0 + \varphi_1 \text{REMB}_{it} + \varphi_2 \text{GDPPER}_{it} + \varphi_3 \text{FDI}_{it} + \varphi_4 \text{LIQ}_{it} + \varphi_5 \text{GOV}_{it} + \\ + \varphi_6 \text{TRA}_{it} + \varphi_7 \text{INF}_{it} + \varepsilon_{it} \tag{2}$$

Table 1 The measure of the variables

Variable symbol	Definition	Source
Inequality	Income inequality level (Gini index)	World Bank (World Development Indicators) [24]
REMA	Personal remittances, received (% of GDP)	
REMB	Natural logarithm of personal remittances, received	
GDPPER	Natural logarithm of GDP per capita	
FDI	Foreign direct investment (% GDP)	
LIQ	Money supply (% GDP)	
GOV	Government expenditure (% GDP)	
TRA	Calculated by the sum of exports and imports divided by GDP	
INF	Inflation, GDP deflator (annual %)	

The dependent variable is income inequality (denoted by Inequality) and is represented by the Gini coefficient. In model 1, remittances are denoted by REMA and are measured by the ratio of the number of received remittances to GDP (%). On the other hand, in model 2, the remittances are presented by REMB and are converted to a natural logarithmic form. Other independent variables in the models include GDP per capita (GDPPER), FDI, liquidity of the economy (LIQ), government spending (GOV), trade openness of the economy (TRA), and inflation (INF). Besides, ε and ε are the error terms, t represents time periods and i is cross-sectional units with i ϵ [1, N]. The measurements of the variables in the research models are summarized (see Table 1).

To identify the impact of remittances on inequality in emerging economies, several methods are applied in the quantitative analysis of the study models. First, the Pearson correlation method is applied to explore the linear relationship between the variables in the models. Second, the Pooled-OLS estimation method for panel data will be used to estimate the econometric models simultaneously. Finally, a graphing technique is used to indicate some statistical trends of the database of remittances and income inequality.

3.2 Econometric Methodology

This study uses an annual dataset of 18 emerging economies for the period 1985–2019. The emerging economies are selected for this study because they have robust economic growth and a large number of remittances. The statistics for all variables were downloaded from the World Development Indicators database of the World Bank [24] (2021b). The list of 18 emerging economies includes Brazil, Botswana, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Guatemala,

Table 2 Descriptive statistics of the variables

Variable	Max	Min	Mean	Std. Dev	Obs
Inequality	69.4	24.0	47.02	8.14	387
REMA	22.5	0.001	3.04	4.81	630
REMB	24.38	11.5	20.25	2.22	626
GDPPER	9.49	5.52	8.07	0.78	630
FDI	23.2	-6.89	2.46	2.42	625
LIQ	207.6	10.15	56.16	39.45	626
GOV	30.06	1.98	13.8	4.81	627
TRA	220.4	14.39	71.3	36.9	630
INF	2947	-11.68	28.96	179.1	627

Indonesia, Jamaica, Jordan, Mexico, Malaysia, Paraguay, South Africa, Thailand and Turkey. The descriptive statistics of the variables are presented (see Table 2).

4 Result and Discussion

4.1 Correlation Analysis

The Pearson correlation method is applied to identify the correlation relationship between variables in the study models. The coefficient results show the degree and the sign of the correlations between the variables and help to check the multicollinearity between the variables (see Table 3).

The correlation coefficient between the personal remittances received per GDP (REMA) and income inequality is $-0.27 < 0$ which indicates a negative relationship between the ratio of remittances to GDP and the inequality level. An increase in the personal remittances received per GDP is expected to reduce income inequality (measured by the Gini index) and vice versa. Similarly, the correlation coefficient between the natural logarithm of personal remittances received (REMB) and Inequality of is $-0.20 < 0$ also shows a negative relationship between the natural logarithm of personal remittances and the Inequality level.

The correlation coefficient between GDPPER and income inequality is $0.21 > 0$ which shows a positive relationship between percent of GDP per capita and income inequality. This means that an increase in GDP per capita also means an increase in income inequality. The correlation coefficient between Inequality and INF is $0.17 > 0$ indicating that inequality expectations will increase as inflation increases. The correlation coefficient between inequality and FDI is $-0.17 < 0$, indicating a negative relationship between FDI capital and income inequality. This suggests that a high ratio of FDI to GDP is expected to reduce income inequality.

Table 3 Correlation coefficient matrix

No	Variables	1	2	3	4	5	6	7	8
1	Inequality	1.00							
2	REMA	−0.27*	1.00						
3	GDPPER	0.21*	−0.06*	1.00					
4	FDI	−0.17*	0.27*	0.22*	1.00				
5	LIQ	−0.33*	0.13*	0.08*	0.26*	1.00			
6	GOV	0.18*	0.13*	0.24*	0.13*	0.30*	1.00		
7	TRA	−0.29*	0.24*	0.11*	0.26*	0.40*	0.14*	1.00	
8	INF	0.17*	−0.06	−0.03	−0.10*	−0.02	0.03	−0.16*	1.00
No	Variables	1	2	3	4	5	6	7	8
1	Inequality	1.00							
2	REMB	−0.20*	1.00						
3	GDPPER	0.21*	0.25*	1.00					
4	FDI	−0.17*	0.16*	0.22*	1.00				
5	LIQ	−0.33*	0.34*	0.08*	0.26*	1.00			
6	GOV	0.18*	−0.13*	0.24*	0.13*	0.30*	1.00		
7	TRA	−0.29*	−0.16*	0.11*	0.26*	0.40*	0.14*	1.00	
8	INF	0.17*	−0.08	−0.03	−0.10*	−0.02	0.03	−0.16*	1.00

Notes *significant at 5%

The relationship between the liquidity of the economy and the inequality coefficient is presented through the correlation coefficient between the LIQ variable and Inequality. The correlation coefficient is $−0.33 < 0$. It means that an increase in the money supply leads to a reduction in income inequality. The correlation coefficient between GOV and inequality is $0.18 > 0$, indicating when governments increase public expenditure, income inequality will be exacerbated. Trade openness has a negative relationship with inequality as shown by the value is $−0.29$. This evidence helps the expectation that inequality will decrease when countries are highly open to trade as well as increasing import and export with international partnerships. Finally, Inflation (INF) has a positive correlation relationship with inequality. It means the higher in general prices, the higher in income inequality level in the emerging economies.

On the other hand, the correlation coefficients between the dependent variable and the independent variables can help to conclude the possibility of multicollinearity in the econometric models. All correlation coefficients between the independent variables in the model are quite low and confirm that the multicollinearity phenomenon does not appear. In the next section, panel regression analysis will give estimated coefficients of the variables in the study models.

4.2 Panel Regression Analysis

For panel data regression, we apply the Pooled OLS method to estimate two research models. To examine the validity of the estimated results, the author used the Wooldridge test for examination of the serial correlation phenomenon and the Breusch-Pagan test for checking the heteroskedasticity problem. The test results confirm that there is no serial correlation and heteroskedasticity in the estimated results. Therefore, the panel estimated results of two econometric models are presented below (Table 4).

First, the regression coefficients of the remittances variable (REMA = −0.449 and REMB = −1.149), are negative signs and statistical significance at 1%. They confirm that remittances have a strong negative impact on income inequality in emerging economies. An increase in remittances can lead to a decrease in income inequality levels in emerging economies in the study sample. These results also further confirm

Table 4 The regression results

Dependent variable: income inequality		
Varibles	Model 1	Model 2
REMA	−0.449*** (−5.25)	
REMB		−1.149*** (−4.73)
GDPPER	1.743*** (3.75)	3.250*** (6.07)
FDI	−0.211 (−1.33)	−0.414*** (−2.72)
LIQ	−0.088*** (−8.78)	−0.052*** (−4.68)
GOV	0.623*** (6.65)	0.419*** (4.14)
TRA	−0.013 (−1.22)	−0.05*** (−4.21)
INF	0.004*** (2.85)	0.004* (2.40)
Constants	32.37*** (8.87)	46.29*** (9.35)
R-Squared	0.3570	0.3485
Number of Observations	382	382
Serial-correlation test (Wooldridge test)	F = 1.044 (Prob: 0.3231)	F = 1.108 (Prob: 0.3092)
Heteroskedasticity test (Breusch-Pagan test)	Chi2 = 0.10 (Prob: 0.7578)	Chi2 = 2.01 (Prob: 0.1560)

Note *, **, ***significant at 10%, 5%, 1%. The t statistical values are in parentheses below the coefficients

the important role of remittances in supporting sustainable development in these economies because they can reduce income inequality which is a serious problem as mentioned in previous studies [6].

Besides, the results of the panel regression analysis are consistent with the results of the Pearson correlation analysis in the previous section. Furthermore, for emerging economies in the early years of development, remittances are an important source of income to improve lives, reduce poverty, and narrow the gap between the rich and the poor group compared to the upper-class group. Income from remittances not only directly increases income for remittance recipients but also indirectly increases income for those who do not receive remittances through consumption, savings and investment from the recipients themselves. Our study result does not only expand the current literature made by previous studies such as [10–12, 25] but also concludes the remittances-income inequality which can not identify in Mexico [17] or in Nepal [18].

The GDP per capita variable (GDPPER) has its coefficients are 1.743 and 3.250 with a high level of statistical significance at 1%. These results show that GDP per capita is positively related to income inequality. The results of our study are consistent with the previous study [7] which suggested that an increase in GDP per capita increases inequality in African countries. The foreign direct investment variable (FDI) has its regression coefficient in model 2 of -0.414 at the statistical significance of 1%. This evidence unveils that the ratio of FDI to GDP is negatively related to income inequality [26, 27]. An economy with a large FDI and a huge foreign-manufactured sector has good opportunities to reduce income inequality. FDI can have a direct impact on production and thereby contribute to the redistribution of direct income to workers, suppliers, suppliers of input for the FDI enterprises. Although our results are different fromprevious evidence [28], FDI is still an important source from outside those countries that want to attract to develop their economy and reduce income inequality in society.

The regression coefficients of the liquidity of the economy (LIQ) are -0.088 and -0.052, respectively, at the statistical significance of 1%. This result indicates that the extension of the money supply is negatively related to income inequality in emerging economies. Our results are consistent with the previous studies [13, 29]. When the financial market develops, it has an effect on reducing income inequality, besides, diversified financial services can provide more suitable and advantageous credits for the poor, and then, have the effect of reducing the gap between rich and poor or narrowing income inequality. The government expenditure variable (GOV) has positive signs (0.623 and 0.419, respectively) at the significance of 1%. This result shows that the ratio of government spending to GDP is positively related to income inequality. Government expenditure includes the compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses such as rent and dividends. This evidence can be explained by the expenditure multiplier effect theory. When government spending increases, it will lead to an increase labour demand and other inputs of production, stimulating production development and contributing to income growth. However, government spending can

redistribute income unevenly and its impact exacerbates income inequality. Furthermore, in some low transparency countries, huge government expenditure can be inexactly used because of the corruption phenomenon when public expenditure money flows to a private interest group, which aggravates income inequality.

The trade openness variable (TRA) has a regression coefficient in model 2 is − 0.05 at the statistical significance of 1%. In means that the ratio of exports and imports to GDP has a negative effect on income inequality. It can be affirmed that in emerging economies, a higher openness to trade, through export and import activities, can lead to lower income inequality. Therefore, high open-door policies in these economies are necessary for economic development, poverty reduction and income inequality. Besides, trade openness has the effect of helping to redistribute income between countries and especially reducing income inequality in open countries through international trade enhancement [28, 30]. However, our finding is not in-line with some previous studies such as [9, 31]. Finally, the inflation variable (INF) has a positive impact on income inequality at the 1% of significance. The effect of this variable on income inequality is consistent with previous studies [7, 10, 32].

To further clarify the relationship between remittances and income inequality in emerging countries during the study period, the scatter plot method is used with the vertical axis representing the degree of income inequality and the horizontal axis representing the value of remittances. The scatter graphs are shown in the below paragraph (see Fig. 1). The graphs clearly illustrate the negative relationship between remittances and income inequality in 18 emerging countries in the period of 1985–2019. The results of data analysis made by the graphs have supported and supplemented the results of the Pearson correlation analysis and panel regression analysis in the previous sections.
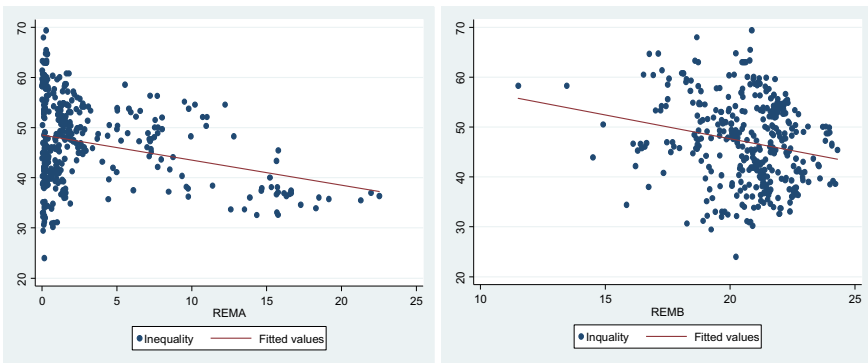
Fig. 1 The relationship between remittances and income inequality

5   Conclusion

This paper aims to determine the impact of remittances on income inequality in 18 emerging economies in the period from 1985 to 2019. By a quantitative research process, using the Pooled OLS regression method, our paper found that besides remittances, there are a number of other macro-economic factors affecting income inequality in these emerging economies. Based on the empirical results, the paper suggests important policy implications for countries.

Our results indicate that remittances are an important factor that has a strong negative impact on income inequality in emerging economies. It means that in the economies that absorb the highest number of remittances, income inequality is narrowed. This evidence notes for policymakers that attracting remittances is a priority and an important policy for economies. In this way, the gap between rich and poor is narrowed and reduces the income inequality in countries. Besides attracting, the usage strategy of remittances in emerging economies is also an issue of concern in the future.

Besides, the policies focus to attract more FDI will have favorable conditions for economic development and narrow the gap between rich and poor groups from income redistribution. Because FDI capital plays an important role, the attraction and usage of this capital require effective policies to promote the role of FDI in poverty reduction and social inequality. Besides, the liquidity of the economy (through the money supply) has a positive impact on income inequality. On the other hand, the economies with more liquidity will have lower income inequality and vice versa. Furthermore, the high opening of international trade also has the effect of reducing income inequality. International trade needs to be located in the center of the strategy development of emerging economies. If emerging economies want to reduce the gap between rich and poor people, they need to integrate more deeply into the world economy. These economies need to support open-door policies and trade liberalization to achieve social goals.

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Digital Transformation in Business During the COVID-19 Pandemic: Insights from a Vietnamese Enterprise Survey

Le Thanh Tung and Le Anh Duc

Abstract Digital transformation is an urgent strategy for enterprises to promote business activities forward the modern direction. The worldwide outbreak of the COVID-19 pandemic has spurred the digital transformation in many areas of society, especially business activities. This study aims to clarify the current reality of digital transformation in business during the COVID-19 pandemic in Vietnam. The study data is collected by an online survey including 82 enterprises from the Vietnamese economy. The statistical analysis shows that these enterprises have implemented digital transformation in their business operations to adapt to the strict social distancing measures caused by the pandemic. In general, digital transformation has helped businesses increase revenue as well as reduce operating costs, however, investment expenditure for the digital transformation of these enterprises has been still quite limited. Finally, business leaders confirm that their enterprises would accelerate in the digital transformation process in the near future.

Keywords Digital transformation · Internet of things · Business intelligence · Business excellence · Business transformation

1 Introduction

Given the prevalence of social activities on online platforms, the Internet of Things (IoT) is booming worldwide, especially in business activities [1–3]. Employed the Internet of Things in business is popularly known as the digital transformation in business [4]. All companies, big, medium and small, can robust transform into digital processes by using an IoT platform able to digitize their physical products. However,

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digital transformation is not understood as one specific technology or one manufacturing process, it includes a series of technological and other components [5]. Digital transformation has also increased dramatically, and the COVID-19 pandemic has also been a strong push to accelerate this process. When applied properly, digital transformation helps to collect source data from the physical business world and converts it into useful information for the companies. The digital transformation helps companies are increasing the smart level of goods and services and better connections between individuals and individuals and between individuals and communities. Therefore, the communication between seller and buyer is faster and more convenient in markets.

Due to having robust economic growth, Vietnam has been recognized as an emerging economy in the Asian-Pacific region [6, 7]. However, despite rapid changes to adapt to the outbreak of the COVID-19 pandemic, Vietnam's overall digital economic environment is still at a limited level when compared to other countries in the region. In the context that the COVID-19 pandemic is forecasted to remain complicated in the coming time, digital transformation in the Vietnamese enterprises' community will bring opportunities for changes in the consumer behavior of customers. In the coming time, the global supply chain's shifting trend and the pandemic's impact will cause digital transactions to increase sharply and become the mainstream in business and the economy. Because of the outbreak of the COVID-19 pandemic, the lockdowns in major cities across the country and the new normal phrase have changed a lot of customers' consumption habits and the ways that enterprises operate. In terms of positive aspects, these are considered as silences for enterprises to rethink the entire operation of their apparatus as well as how to approach customers in the context of the fourth industrial revolution and the internet of things. One of the clearest proofs has been the explosion of e-commerce companies on major online exchanges such as Shopee, Lazada or Tiki in Vietnam during the COVID-19 pandemic period.

When Vietnam changes its stance in fighting the COVID-19 pandemic, from zero-COVID policy to a new normal state, digital transformation becomes a mandatory condition for businesses in applying technology to check information related to vaccinations or to interact in accordance with disease prevention regulations. From a macroeconomic policy standpoint, the Vietnam Ministry of Planning and Investment has issued special regulations to boost the program's implementation to assist firms in digital transformation in the period of 2021–2025 [8]. The program's objective is to promote digital transformation by integrating and applying digital technology to increase the efficiency of manufacturing and business activities and assist enterprises in enhancing capabilities, generating competitive advantages, and establishing core values. This study aims to investigate the current situation of digital transformation in business during the COVID-19 pandemic by an online survey including 82 Vietnamese enterprises.

2 Literature Review

Digital transformation is popularly defined as the initiative process to adopt the new capabilities afforded by digital technologies to transform the strategies and operations of businesses, therefore, fundamentally changing how businesses operate as well as the ways to deliver goods and services to customers in markets [9]. This process is also a structural change that pressures businesses to continually challenge the current status, experiment and get acceptable with failure [1, 4].

Digital transformation is also known imperative strategy for all industries and it opens the doors to promote innovation in business [3]. Digital transformation is being gradually integrated into many elements of industries and companies, including administration, human resource management, manufacture, marketing and after-sales service. Besides, digital transformation helps to increase customers' satisfaction through a rapid analysis process of the current data and allows to understand customers' purchasing behaviors or offers a diverse product portfolio to accommodate purchases better based on recognized demands [1].

On the other hand, digital transformation reduces many types of costs for enterprises and makes all operational processes smarter, using resources more efficiently to minimize resources in the operation of enterprises [5]. Digital transformation enhances the automatic processes of enterprises to reduce input resources while improving production, lowering product costs and increasing competitiveness. Digital transformation places significant strain on organizations' cultures, requiring them to constantly adapt, actively seek new opportunities, experiment with new development possibilities, and grow more comfortable with failure as a necessary component of the process of making systems smarter. The digital transformation is accelerating and opening opportunities for countries to accelerate their race to increase productivity, stimulate innovation and boost national competitiveness [1].

Furthermore, digital transformation is spreading in every field with the boom of new technologies such as 3D printing, virtual reality interfaces, smart sensors, artificial intelligence, quantum computing and robotics that are also likely to cause creative destruction like any traditional industry [2]. Besides, the competitiveness of countries in these technologies will determine how well they will prosper in the coming decades [9]. Shift the focus of digital transformation to enterprise business operations. One of the key points of the digital transformation is that every country emphasizes shifting the digital transformation focus into business processes in enterprises [3]. Some fast-growing economies also vigorously promote digital transformation with four main pillars: the Fourth Industrial Revolution, smart tourism, innovative education, and a safe city, public system, from a public management to tourism support, warn natural disasters, and improve agriculture efficiency [10]. This pressure to urgently transform is not only to the biggest companies but also the small ones. Obviously, the more digital an enterprise, the more competitive it has [4]. The achievements of competitive advantages go to the first movers in each innovation trend in the business environment.

Besides, digital transformation helps improve national competitiveness. The Digital Riser report 2021 shows the competitiveness of countries strongly affected by their own digital competitiveness [10]. The report analyzes the progress (or regression) of 140 countries in the field of digital transformation with comparisons between 2018 and 2020. The world's largest economies (G7 group) and the world's key producing regions (Western Europe, North America and East Asia) are analyzed and compared to objectively find changes in digital competitiveness. The evidence shows surprising information when emerging economies are leaders in digital transformation and digital competitiveness [11]. Countries actively promote digital stimulus packages. The COVID-19 pandemic is considered as a test to emphasize to all countries that digital technology not only determines whether countries develop strongly in the coming time but also determines the degree of concentration of resources of these countries for the strategic redirection of the development model [11]. Digital transformation is being effectively applied in all areas of life, digital technology not only allows education, healthcare and work to move from offices, schools to home but also provides an increasingly effective way to organize resource-minimizing operational processes in companies and governments around the world [3].

3 Methodology

This study has used multiple methods for analysing the current reality of the digital transformation process of enterprises in Vietnam during the COVID-19 pandemic. Firstly, a short literature review is done in order to discuss the digital transformation topic. Secondly, the descriptive statistical analysis [12] is applied to identify the current perspective of digital transformation in business in Vietnam in the COVID-19 pandemic. Besides, a graphing technique is used to indicate some statistics trends of the database. Finally, the thematic analysis approach [13] helps to decompose themes of digital transformation in business in this economy.

For investigation of the digital transformation of companies in the business in Vietnam, we use a primary dataset. This database was collected from enterprises operating in Vietnam through an online survey. After cleansing the data collected from the official survey done by the google.doc platform, the final sample used for the empirical analysis includes 82 enterprises. The survey was conducted from 15 November to 15 December 2021 by the research team of the Vietnam Report Joint Stock Company (Vietnam Report company). The research team chose this period to conduct the survey in order to identify whether enterprises improve digital transformation in business during the COVID-19 pandemic.

4   Results and Discussions

4.1   The Digital Transformation Has Been Promoted in Business Activities

As discussed in the previous section, in order to get feedback from the enterprises' community related to the digital transformation in Vietnam over the past months, the research team of the Vietnam Report surveyed with the participation of 82 enterprises in which questions are designed to clarify the current status of the digital transformation as well as how the results of the process are really reflected through activities of enterprises.

The statistics showed that enterprises applied digital transformation through the application of information technology and digital in all core business activities such as sales, advertisement, freight forwarding (logistics), production, purchasing activity (input), customer care activity (After sales service), human resource management, and recruitment (Table 1). From the perspective of In business administration activity, up to 75.3% of business leaders responded that they had strongly applied the digital transformation to serve the business activities, 22.2% applied at low levels, and only 2.5% of enterprises had not yet implemented digital transformation. The participation of business leaders in management shows that digital transformation has begun to spread strongly with the change in the perception of leaders at all levels in reality.

The survey data showed that most of the key activities in enterprises' business and production value chains had strongly implemented digital transformation. More precisely, when it comes to customer service activities, the top segment in the digital transformation is sales. Up to 63.0% of business representatives believe that the area has benefited significantly from digital transformation. Additionally, 34.5% of business leaders stated that their organizations have implemented digital transformation

Table 1   Main areas have applied digital transformation

Operation area	Non-application (%)	Low-application (%)	High-application (%)
In sales	2.5	34.5	63.0
In advertisement	8.9	34.1	57.0
In freight forwarding (logistics)	21.8	42.3	35.9
In production	14.7	36.0	49.3
In purchasing activity (input)	7.6	60.8	31.6
In customer care activity (After sales service)	10.0	46.2	43.8
In human resource management	6.4	35.4	58.2
In recruitment	14.1	37.2	48.7
In business administration activity	2.5	22.2	75.3

but that activity levels remained low. As a result, the field of sales, followed by advertising, is heavily impacted by digital transformation, with 57% of firms conducting advertising through the integration of digital utilities.

Human resource management is undergoing rapid digital transformation, but half of it is still in the early stages. Similarly, 21.8% of enterprises have not yet applied in logistics activities and 14.7% have not yet recorded digital transformation activities in the production process. In the coming time, many unusual events may occur, so the pressure of innovation and quick adaptation will still weigh heavily on enterprises [14].

4.2 The Digital Transformation Shows the Effectiveness in Practical Activities

The effectiveness of digital transformation is shown through the survey results of the Vietnam Report's research team when the positive signs of digital transformation have begun to appear. Specifically, although doing production and business in the context of strict social distancing due to the outbreak of the COVID-19 pandemic. Up to 43.6% of the enterprises agreed with the question of their contracts increased due to a good adaptation plan, and 15.4% agreed much with such question. In addition, 53.8% of business leaders said they agreed and agreed much with the decreased operating costs thanks to the accelerated digital transformation (Table 2).

Another positive signal is that 58.2% of enterprises said that labour cost has been reduced due to the effective application of information technology in remote working. Therefore, the initial signs show that digital transformation has positively impacted many key activities of enterprises, from sales, production to human resources.

Through analyzing statistics from the survey conducted by the Vietnam Report's research team, it can be seen that most enterprises spent 5% of revenue or less on digital transformation.

Specifically, 34 business leaders (accounting for 41.4% of the respondents) said that their enterprises had spent from 1% to below 5% of the total revenue on digital transformation (Fig. 1).

Table 2 Results in applying digital transformation

Performance indicator	Disagree (%)	Agree (%)	Strongly agree (%)
Sale orders increase because businesses have good adaptation plans	41.0	43.6	15.4
Costs are reduced due to accelerating digital transformation	46.2	42.3	11.5
Labour costs are decreased due to the effective application of information technology in remote working	41.8	49.4	8.8
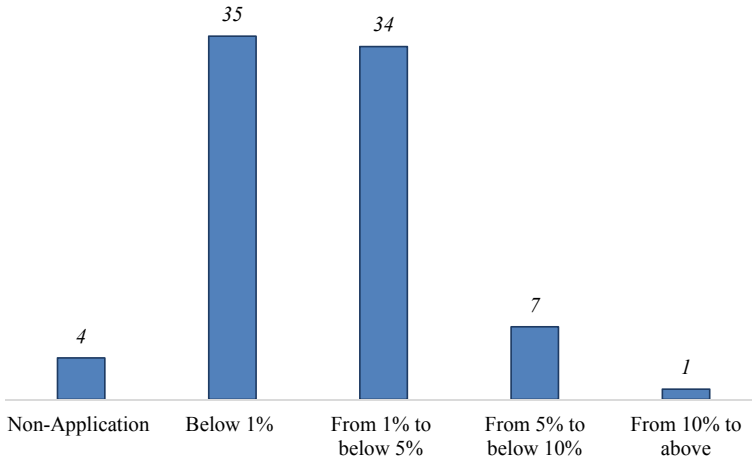
Fig. 1 Digital transformation expenditure per annual total revenue

Besides, 35 business leaders (42.6% of the respondents) revealed that these enterprises had spent less than 1% of the total revenue on digital transformation. Seven firms accounted for 8.5% of the total number of enterprises surveyed in spending between 5% and 10% of total revenue.

Thus, data on the ratio of spending on digital transformation to total revenue indicate that enterprises are increasingly prioritizing activity as a core area of investment to enhance competitiveness in the coming years, rather than digital transformation as a means of adapting to the new normal state in production and business activities caused by the ongoing COVID-19 pandemic.

4.3 The Main Barrier to the Digital Transformation Process

Digital transformation is not a one-time event [15], it requires long-term enterprise efforts to establish a digital transformation platform capable of reducing numerous types of costs and gradually transforming all operational processes to become more innovative and more efficient in their use of resources in supplying goods services to the market [9].

The analysis of survey data reveals that the quality of human resources is a barrier, with 70% of enterprises representatives agreeing and agreeing strongly that their firms lack sufficient high-quality human resources to support the digital transformation. Additionally, there is a lack of leadership consensus on digital transformation, with 46.8% of business leaders citing a lack of a digital technology system development strategy and senior management support as the key hindrance to significant change. In addition, up to 29.1% of the enterprises said that there was no consensus in the leadership team on the need to carry out digital transformation (Table 3).

Table 3 Main barriers to the digital transformation process

Main barrier	Disagree (%)	Agree (%)	Strongly agree (%)
None of the strategies to build a digital technology system and support/leadership from senior management	53.2	32.9	13.9
There is no consensus among the leadership team on what needs to be done for digital transformation	70.9	25.3	3.8
Not enough high-quality human resources	30.0	46.3	23.7
Lack of basic technology infrastructure	50.0	41.2	8.8
Less of businesses providing digital transformation support services	59.5	35.4	5.1
Lack of connection with the university system for cooperation on digital transformation	69.7	27.8	2.5
Business partners not ready to cooperate on digital solutions	36.2	55.0	8.8
Less of tools to ensure network security and data security	35.0	47.5	17.5
Fear of losing control of the enterprise's intellectual property	51.2	41.3	7.5

Thus, the agreement on the implementation of digital transformation of enterprises is a part of the overall development strategy, which is considered as the key for digital transformation to permeate into all production and business activities of the enterprises.

Additionally, the survey data from the Vietnam Report Company indicates that a shortage of investment capital is a bottleneck that firms must overcome in order to encourage digital transformation and capitalize on the business community's potential. Vietnam continues to face numerous constraints. While there are billion-dollar firms in Vietnam, a recent assessment done by the Vietnam General Statistics Office on the functioning of enterprises during the serious outbreak of the COVID-19 pandemic revealed that 98.2% of enterprises are now reducing their revenues and profits. In the class of small and medium-sized enterprises, 99% of companies have capital constraints for expansion and development.

Therefore, digital transformation is still only the desire-in-the-future of these enterprises because of limited resources, causing them to spend modest cash flows to cover operating costs and train employees to serve short-term growth patterns. The survey data of the Vietnam report's research team to clarify the lack of investment capital for digital transformation in enterprises has had an answer that is very relevant to the reality of the Vietnamese enterprises' community when 41.2% of enterprises representatives agreed with the fact that their enterprises are short of investment capital for the digital transformation. This is an obstacle that will not be easy to overcome in the coming time when the COVID-19 pandemic is still complicated with many potentially dangerous variants in the future.

One of the next barriers to digital transformation is that 63.8% of enterprises representatives believe that their partners are not ready for the implementation of digital solutions. Thus, if only one or a few links do not carry out digital transformation, the whole supply chain cannot function even if most enterprises in the chain are promoting digital transformation. In addition, the lack of professional support units for the digital transformation in enterprises was also agreed upon by 40.5% of enterprises representatives surveyed.

Along with the three disadvantages mentioned previously, organizations confront issues linked to a lack of professional support units, losing control over intellectual property, and a lack of technical instruments to assure network security and data privacy during the digital transformation process. Today, as online scams, account takeovers, network sabotage, and cybercriminal activities become more prevalent, there is anxiety about digitizing activities. While the management's production and business are pretty legitimate, this will remain an unsolved problem in perpetuity unless you are motivated to find a solution.

4.4 The Digital Transformation Process Will Be Robustly Enhanced

To discover more enterprises' opinions on the evolution of digital transformation in the near future, the Vietnam Report research team has surveyed representatives of companies, and the results have shown a very optimistic positive. Specifically, 69.6% of enterprises representatives believe that their enterprises will drastically transform business activities based on information technology and digital transformation. Besides, regarding the anticipation of the trend by using customer analysis through modern software tools, 61.5% of enterprises representatives said that the application of extensive data analysis in enterprises will be the primary trend to create breakthroughs in production and business activities at their enterprises in the coming time (Table 4).

The firm's preference for digital transformation in sales, with 76.9% of enterprises representatives saying that this is a key activity that enterprises will promote digital transformation in the coming time. The transformation of the entire internal process through digitization of information security, records management, and data storage is also accelerating, with 72.6% of enterprises representatives indicating that the transition will be carried out vigorously in the near future. Additionally, the firm is committed to enhancing the quality of human resources by integrating digital technology into management and promoting training to increase employees' technology knowledge and abilities [16].

The results of statistical analysis on the survey data have shown that digital transformation has been really promoted in the business environment. However, enterprises are also facing many difficulties slowing down the process, but according to

Table 4 Investment expenditure in digital transformation in the coming time

Indicators	Weak (%)	Average (%)	Strong (%)
Business activities based on information technology	1.3	29.1	69.6
Applying big data analysis in business	2.6	35.9	61.5
Applying digital transformation in sales activities	0.0	23.1	76.9
Using digitization in information security / record and data storage	1.4	26.0	72.6
Developing and applying digital transformation support systems	2.8	35.2	62.0
Integrating digital technology in human resource management	4.1	33.8	62.1
Human resource training on digital transformation	1.3	40.8	57.9

business representatives, digital transformation is forecasted to continue to be prioritized to promote in the coming time with the goal of not only helping enterprises to develop stably in the context of the ongoing COVID-19 pandemic but also helping enterprises develop sustainably through improving competitiveness across the entire value chains.

5 Conclusion

In general, digital transformation is a trend of the Internet of Things era, a revolution in the business community's innovation. However, successful digital transformation requires a unity of thought and action across all personnel of enterprises, from the strategic levels to the doers that are employees. Digital transformation must come from the leaders rather than the technical department or the administrative department. From instilling thinking from the strategic level, enterprises will prioritize budget expenditures for the activity to turn from incentive mechanisms, infrastructure, personnel training, and developing a series of digital transformation measurement tools to continuously evaluate and improve to match with the trend and speed of digital maturity of enterprises.

Indeed, numerous impediments and problems remain when organizations in Vietnam undertake digital transformation, including high investment costs, poor information technology infrastructure, cybersecurity threats, and human limited number change. Thus, despite attempts by both the corporate sector and Government to execute digital transformation activities, both sides require specialized solutions to accomplish digital transformation. There are some policy implications suggested to actively promote digital transformation in business in Vietnam in the near future.

Firstly, mass communication about the benefits of enterprises actively implementing digital transformation needs to be further promoted. As analyzed above, to have a successful digital transformation, the first thing is to create a consensus

in society in general and in the human resources at each enterprise in particular. Digital transformation is not a short-term plan, but it is towards long-term benefits, so digital transformation also consumes many resources of enterprises. Therefore, communication needs to be promoted in the coming time to spread multi-dimensional information to all subjects in society.

Secondly, incentives need to be taken into account to make a difference in digital transformation. Incentive policies are anchored in the adoption rate of digital change in enterprise areas. The incentive policies can be tax reduction for proactive enterprises and have specific achievements in the activity or deploy financial support packages directly to increase the rate of digitization in enterprises gradually. The initial costs may increase budget expenditure, but in the long term, when the number of transactions surges, the budget revenue will grow in the following years.

Thirdly, technological infrastructure obstacles need to be removed quickly in the coming time. Digital transformation is applying and integrating technology and the internet of things into all business activities. It is carried out on the basis of the internet system. Hence, the digital transformation requires national investment in infrastructure serving the enterprises' community and society. It is critical to actively create and expand infrastructure in anticipation of the trend toward enterprise-accelerated digital transformation, which may result in system overloads such as cable breaks, inconsistent internet, or an interrupted system. Meanwhile, Vietnam is still behind the world in terms of technology as Vietnam has not yet mastered core technologies of digital transformation and techniques that create the basic foundation for digital technology. Therefore, digital transformation in Vietnam is required to begin with the change of available technologies in the world into domestic technologies to gradually be proactive in the digital transformation.

Finally, to successfully implement a digital transformation, enterprises must have an information technology infrastructure suitable for various types of enterprises, both on hardware devices and software systems. Owning the correct information technology infrastructure plays a significant role in meeting the increasingly vital needs of Vietnamese enterprises in the short term and the long term. Currently, small and medium enterprises still account for 98% of the total number of enterprises in Vietnam, but due to limited financial resources, this is the group that has the most difficulty in digital transformation. As a result, it will take time for good changes between digital transformation awareness and actual digital transformation actions, which is why it is critical to have a diversity of methods to establish a digital transformation platform in companies in the coming years.

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