



**17th INTERNATIONAL CONFERENCE ON  
ENTERPRISE SYSTEMS, ACCOUNTING,  
LOGISTICS AND MANAGEMENT  
JUNE 19-21, 2023, CORFU ISLAND, GREECE**

**PROCEEDINGS**

**CORFU, GREECE**

## **Business applications of Deep Learning systems**

Panagiota Chatzistavrou, Efstathios Kirkos

Department of Accounting and Information Systems  
International Hellenic University  
giotahatzi@hotmail.com, stkirk@ihu.gr

### **Abstract**

Nowadays the importance of predicting the future financial situation of companies is becoming more and more important, and it is useful both for the companies themselves and for the market stakeholders because it helps in timely information provision and supporting decision-making processes, to achieve their goals and protect them from the past financial losses. The need of predicting the future financial situation of companies led researchers to dealing with the development of automated predicting systems. Until today most studies have applied traditional statistical analysis and machine learning methods, but with several disadvantages due to their limited capabilities. In the last years the technological progress and the ability to manage large amounts of data created the conditions for the development of deep learning methods. It is about an advanced machine learning approach which in fact is already used in many applications covering a wide range of scientific fields with success. The present article provides a literature review of state-of-the-art business applications of deep learning systems which have taken place in recent years to predict the probability of fraud, financial distress, bankruptcy, financial failure and going concern of companies. For this purpose, fifteen research articles which developed innovative deep learning prediction models, have been collected. The proposed deep learning models are presented and analyzed as to the purpose that have been developed, the algorithms they were based on, the data that has been collected, the techniques that have been applied and also their performance results compared to the benchmark models that was chosen by the researchers. The ultimate goal of this article is to assess the effectiveness and reliability of deep learning models over traditional statistical and machine learning models, to identify the benefit of their use and also the opportunities they offer for future research. Finally, we hope that future research will further explore the deep learning method and develop more advanced deep learning models that will also cover more economic issues which more than often concern the stakeholders.

**Keywords:** deep learning, bankruptcy, financial fraud, financial distress, annual reports, corporate failure, going concern.

### **1. Introduction**

Nowadays the importance of predicting the future financial situation of companies is becoming more and more important and it is useful both for companies themselves and the market stakeholders.

For companies, it is important because it helps them in timely decision-making provision and in the development of appropriate strategies so that they can conform to the ever-changing economic and business environment with the aim of achieving

profitability, increasing competitiveness, maintaining their sustainability and meeting the stakeholders' expectations (Papadakis, 2016).

For the market stakeholders, such as investors, creditors, suppliers, employees, regulatory authorities etc., it is also important because it helps them in timely decision-making provision with the aim of meeting their demands and expectations and avoiding fraud (Tsaklaganos & Spathis, 2017).

The main source of information for the financial status and performance of a company is the annual financial statements and they are useful for the decision-making of all market stakeholders (Tsaklaganos & Spathis, 2017).

Nevertheless, the asymmetry of information causes risks, as the administration of each company has got all the information available for the real financial situation while the rest hasn't (Jan, 2021a). Therefore, it is possible for the administration to hide important information for several reasons (like poor financial performance, pressure to meet third-party demands, need to obtain financing, tax reasons etc.) given the fact that the positive financial picture of the company is vital (Craja, Kim, & Lessmann, 2020).

In fact, it has been noted so far that many annual financial statements are not true but falsified (Craja et.al., 2020; Xiuguo & Shengyong, 2022) in order to mislead and deceive the stakeholders for the benefit of the companies. It is considered to be a very serious phenomenon since often not only the administration members are involved but also the audit firms.

Researches in the past have noted that the financial statement fraud causes higher financial losses compared to other kinds of fraud (such as asset misappropriation and corruption), even though its frequency of appearance is much more rare (Craja et.al., 2020).

Typical examples are the financial scandals of Enron and WorldCom companies as well as the global financial crisis of 2008-2009 which led to crises with serious financial losses to all stakeholders and badly damaged the world economy.

As a consequence of the above, the need of predicting the future financial situation of companies came up. Examples of such prediction are the prediction of the probability of bankruptcy, financial distress, financial failure, going concern as well as the probability of financial statements fraud since its purpose is to hide important information. In fact, the financial statements fraud is considered to be precursor of the financial distress and bankruptcy of a company (Jan, 2021a (Alexandropoulos, Aridas, Kotsiantis, & Vrahatis, 2019; Craja et.al., 2020; Jang, Jeong, & Cho, 2021).

The above led researchers to dealing with the development of automated systems in order to provide timely and interpretable prediction with the ultimate goal of strengthening the decision-making processes, improving and accelerating the auditing procedures and having more efficient administration in order to further ensure the stability of markets and economic development (Alexandropoulos et.al., 2019; Craja et.al, 2020).

The object of this paper is the literature review of researches which have taken place in recent years to predict the probability of fraud, financial distress, bankruptcy, financial failure and going concern of companies.

The purpose is to assess the effectiveness and reliability of deep learning models over traditional statistical and machine learning models, to identify the benefit of their use and also the opportunities they offer for future research.

Specifically, fifteen research articles are presented which dealt with the development of innovating predicting deep learning models and which, as part of the research processes, were compared with traditional and machine learning models in order to evaluate their performance and their effectiveness.

The fifteen articles were collected from Scopus, ResearchGate, Google and Scholar databases and were published by Elsevier, Springer, MDPI and Emerald publishing houses from 2019 up to 2022. They were searched with the keywords: “deep learning”, “bankruptcy”, “financial fraud”, “financial distress”, “annual reports”, “corporate failure”, “going concern” and only those that were written in English were chosen.

The rest of the paper is structured as follows. The Section 2 presents the traditional statistical models and the machine learning models that have been applied in previous studies, the Section 3 introduces some basic concepts related to artificial intelligence and deep learning method, the Section 4 analyzes the proposed deep learning models of the fifteen research articles and finally, the Section 5 presents the concluding remarks and mentions some issues for future research for the further improvement of the deep learning method.

## **2. Literature review**

Until today, researches have been carried out on the prediction of financial statement fraud, financial distress, bankruptcy, financial failure, and going concern of companies, most of which developed and applied traditional statistical analysis or machine learning methods. However, during their application, it was noted several disadvantages due to their inability to (a) develop complex financial models, (b) manage imbalanced data and (c) manage big data (Smiti & Soui, 2020). Also, most of them analyzed only the numerical data of the financial statements, i.e. only the structured data, which was not enough (Xiuguo & Shengyong, 2022). Thus, the need of using more advanced algorithms was imperative.

A brief description of the traditional methods that have been used follows:

### **2.1 Traditional statistical analysis methods**

Most researches used statistical analysis methods such as regression analysis, discriminant analysis, cluster analysis and factor analysis methods (Chi & Chu, 2021). Typical examples are the development of Multivariate Discriminant Analysis (MDA) method by Altman in 1968 and later the development of Logistic Regression (LR) method by Ohlson in 1980 with the purpose to predict the financial situation of companies (Alam, Gao, & Jones, 2021; Aljawazneh, Mora, Garcia-Sanchez, & Castillo-Valdivieso, 2021; Hosaka, 2019; Smiti & Soui, 2020). But statistical models were very simple and their limitations led to errors (Chi & Chu, 2021; Jan, 2021b). They analyzed numerical economic indicators that entered the model in a linear combination. They were based on highly restrictive statistical assumptions and did not have the ability to handle a large number of variables, making it difficult to develop complex financial models (Alam et al., 2021; Smiti & Soui, 2020).

### **2.2 Traditional machine learning methods**

Later machine learning methods were used and developed predicting models such as Decision Tree (DT), Neural Networks (NN), Support Vector Machine (SVM), K-Nearest Neighbor (KNN), Bayesian Network (BN), Artificial Neural Network (ANN)

with satisfying accuracy rates (Kirkos, Spathis, & Manolopoulos, 2007; Xiuguo & Shengyong, 2022). Their advantages compared to the traditional statistical analysis models are that they have the ability to handle a large number of variables (Alam et al., 2021), they are not based on the limiting assumptions of statistical methods (Jang et al., 2021), they can effectively handle non-linear problems and have higher classification and prediction accuracy (Jan, 2021a). However, there are several disadvantages as regards the feature extraction process, because it takes place independently from the training phase. Also, the training takes long time and it is difficult to handle big data (Smiti & Soui, 2020), while most of them, such as gradient boosting machines and random forests, haven't been designed to handle panel data structures (Alam et al., 2021).

### **3. Basic concepts**

#### **3.1 Artificial Intelligence (AI)**

Artificial Intelligence is a field of computer science with many practical applications and active research areas, such as machine learning, natural language processing, robotics etc. It studies the human intelligent behavior and deals with its understanding and automation. It is a set of actions performed by computers that imitate human behavior. It deals with the design of algorithms to calculate satisfactory solutions for problems (Keravnou, 2000).

Initially, it dealt with solving problems that were intellectually difficult for humans, with success (Goodfellow, Bengio, & Courville, 2016). And this success is due to the fact that the intellectually problems are easy to be described by rules that computers understand. But the real challenge was to solve intuitive problems. In other words, problems that were easy for humans to solve but difficult for computers, because these problems are difficult to be described by rules that computers understand. Humans have got intelligence, experience, knowledge and abilities, such as the ability to see, learn, speak, make decisions etc. A large part of humans' knowledge is subjective and intuitive.

So, one of the main challenges of artificial intelligence was how computers will get this knowledge so that they can behave intelligently (Goodfellow et al., 2016).

The solution to this problem has been provided by Deep Learning method.

#### **3.2 Deep Learning**

Deep Learning is a type of machine learning method both of which belong to the artificial intelligence field. Deep Learning consists of a progress of machine learning. It allows computing systems to improve with data and experience (Goodfellow et.al., 2016). It uses deep artificial neural networks which looks like human brain and allows computers to learn and act on their own without human help. In other words, computers are able to make intelligent decisions.

The main difference between deep learning and machine learning models is that a deep learning algorithm can determine whether the prediction is correct or not on its own and make corrections without human intervention while human intervention for a machine learning model is necessary (Grieve, 2022).

Artificial neural networks are able to solve all kinds of problems by using the computer. But their operating mode differs from the classic computer.

An artificial neural network combines human way of thinking with the mathematical way of thinking. In other words, a neural network can learn and train, remember or forget a numerical value but also use complex mathematical functions. Their main difference from biological neural networks is that, while they learn through training and experience, they follow predetermined rules in order to perform the procedures for which they have been designed (Argirakis, 2001).

Most people believe that deep learning is a new technology. In fact, it is dated from 1940 but only in recent years its popularity has increased. The main reasons for its popularity are the significant progress in technology and the ability to manage large amounts of data (big data) (Goodfellow et.al., 2016). Due to the increase of digitization of society, all activities are recorded through plenty of applications. Now there is large amount of data, making the training of deep learning models possible. Additionally, the increase in computing power has got important role in the popularity of neural networks. Today computers are more powerful, faster and have more memory. The faster network connectivity and advanced software helped to increase the size of deep learning models as well as to improve their accuracy and reliability.

Today deep learning models are applied in more and more applications covering a wide range of scientific fields. Also, the availability of open source libraries, such as Theano, TensorFlow, PyLearn2, Torch, MXNet, Keras, Pytorch etc., have contributed to the implementation and progress of deep learning method (Goodfellow et.al., 2016; Sun & Vasarhelyi, 2018).

### **3.3 Text representation**

Text representation concerns the conversion of words of a text into numerical form, so that they can be understood by computers and be possible their algorithmically process. So far, many techniques such as Bag Of Words (BOW), Term Frequency – Inverse Document Frequency (TF-IDF), Bidirectional Encoder Representations from Transformers (BERT) and Word2Vec have been developed.

Following there is a description of the Word2Vec that have been used by many proposed models.

#### **3.3.1 Word2Vec**

The Word2Vec technique is a popular natural language processing technique which was developed by Tomas Mikolov in 2013 at Google. It is able to identify semantically and syntactically similar words and suggest additional words to incomplete sentences (Wikipedia, Word2vec, 2022). It is a two-layer neural network which has the ability to create dense word embeddings (Dutta, 2021). It can accept a large corpus of text as input and creates a high-dimensional vector space where every unique word corresponds to a vector.

The Word2Vec technique uses two different architectures in order to create the word embeddings, the Continuous Bag-Of-Words (CBOW) architecture or the continuous skip-gram architecture in which both individual word and the window of context words are considered (Dutta, 2021).

According to the CBOW architecture, the model predicts the target word (the individual word) by taking the window of context words as input, i.e. the words that

surround the target-word. According to the skip-gram architecture, the model predicts the window of context words by taking the target word as input (Dutta, 2021).

Comparing the two architectures, the CBOW is faster and more effective to high-frequency words, while the Skip-gram is better on small datasets and more effective on rare words (Karani, 2018).

The Word2Vec technique is simple to use and easy to understand. It is trained quickly and it is suitable for both small and large datasets. So far, it has been used in data analysis and customer reviews with success and also in recommendation systems, such as Airbnb, Alibaba and Spotify platforms (Devopedia, 2020).

## **4. Analysis of the research articles**

This chapter presents an analysis of the proposed DL models regarding the chosen neural networks types, the prediction purpose of each model, the collected data, the techniques and as well the performance measures and statistical analysis methods that have been applied in order to evaluate and confirm their results.

### **4.1 Types of neural networks**

Most of the studies developed deep learning models based on the Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Convolutional Neural Networks (CNN) and Multi-Layer Perceptrons (MLP) algorithms (see table 1).

#### **4.1.1 Recurrent Neural Networks (RNN)**

Recurrent Neural Network (RNN) is a sequence model which has the ability to capture the time dependence of sequential data with accuracy. It is already successfully applied to the analysis of time series data which concerns texts and videos. The disadvantage is that it is unable to maintain long term memory because of the vanishing gradient problem that prevents the weights from being updated to smaller levels during backpropagation. So, it is about a short term memory model (Chi & Chu, 2021; Jan, 2021a; Jan, 2021b; Xiuguo & Shengyong, 2022).

The Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) algorithms are types of RNN and have been developed in order to deal with the disadvantages of RNN algorithm (Chi & Chu, 2021; Jan, 2021a).

#### **4.1.2 Long Short-Term Memory (LSTM)**

The Long Short-Term Memory (LSTM) algorithm is a recurrent neural network which was proposed by Hochreiter and Schmidhuber in 1997 (Chi & Chu, 2021; Jan, 2021a). It is about a long-term memory model which is used in time series data processing, in prediction and classification. It has the ability to learn long term dependencies in order to solve sequencing problems and control the memory flow by maintaining the necessary information and rejecting the irrelevant ones (Chi & Chu, 2021; Craja et.al., 2020; Jan, 2021a; Xiuguo & Shengyong, 2022; Wikipedia, Long short-term memory, 2022).

The LSTM network consists of a memory cell which is called cell state and three gates which are called forget gate, input gate and output gate (Saxena S., 2021; Singhal, 2020).

As concerns the gates, the LSTM network is divided in three parts where the first part corresponds to the forget gate, the second part to the input gate and the third one to the output gate (Saxena S., 2021). The gates control the flow of information in and out of the cell state. They determine which of the information will be kept, updated or forgotten (Chi & Chu, 2021; Craja et.al., 2020; Jan, 2021a; Xiuguo & Shengyong, 2022).

So far, the LSTM model is an extremely accurate model and it has been successfully used in many applications, such as speech recognition, machine translation, robot control, time series prediction, video games etc. (Wikipedia, Long short-term memory, 2022).

#### **4.1.3 Gated Recurrent Unit (GRU)**

The GRU algorithm is a variation of LSTM algorithm. The difference with the LSTM algorithm is that it has only two gates, which are called reset gate and update gate, while it hasn't got memory cell. Its advantage is that the less number of gates, reduces the number of training parameters and increases the training speed (Chi & Chu, 2021; Xiuguo & Shengyong, 2022).

#### **4.1.4 Convolutional Neural Networks (CNN)**

The Convolutional Neural Network (CNN) is an artificial neural network which has been designed to process pixel data. It is widely used for visual image analysis. It is inspired by the animal visual cortex organisms, where each neuron responds to stimuli in a limited area of the visual field which is called receptive field. The receptive fields of different neurons overlap in order to cover the entire visual field (Wikipedia, Convolutional neural network, 2022).

The architecture is different from the usual neural networks. The network consists of an input layer, the hidden layers and the output layer. The input layer and hidden layers are organized in the three dimensions (width, height and depth), while the output layer is organized in only one dimension (freeCodeCamp, 2019). The CNN network consists of two parts. In the first part takes place the feature extraction while in the second part takes place the feature classification in order to receive the result (freeCodeCamp, 2019).

The main advantages of the CNN network are that it is highly accurate and has the ability to detect the important features by itself without human help.

It is applied successfully in many applications such as visual face and object recognition, image classification, natural language processing etc. (Wikipedia, Convolutional neural network, 2022).

#### **4.1.5 Multi-Layer Perceptron (MLP)**

The Multi-Layer Perceptron (MLP) model is a feed forward artificial neural network which consists of three or more fully connected layers (one input layer – one or more hidden layers – one output layer). It is the most basic deep neural network and for its training is used the backpropagation algorithm (Kirkos, 2015). It is suitable for classification of non-linear problems and it is used in speech recognition, image recognition and machine translation (Wikipedia, Multilayer perceptron, 2022).



## 4.2 The purpose of the research articles

Considering the predicting purpose of each research article, three studies focused on fraud prediction, two studies on financial distress prediction, six on bankruptcy prediction, two on corporate failure prediction and finally two studies on going concern prediction (see table 1).

Table 1: The fifteen research articles

Title	Authors	DL Models	Purpose
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	HAN	Fraud prediction
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguao & Shengyong (2022)	LSTM, GRU, TRANSFORMER	Fraud prediction
Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry	Jan (2021a)	RNN, LSTM	Fraud prediction
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	Li et.al. (2021)	DNN, MA-DNN, Bi-LSTM	Financial distress prediction
Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	3 models CNN+RNN	Financial distress prediction
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	CNN	Bankruptcy prediction
Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	DL-Embedding, CNN	Bankruptcy prediction
A Deep Dense Neural Network for Bankruptcy Prediction	Alexandropoulos et.al. (2019)	DDMP	Bankruptcy prediction
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti και Soui (2020)	DL BSM-SAES	Bankruptcy prediction
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	Jang et.al. (2021)	LSTM-RNN (χρήση τιμής Shapley)	Bankruptcy prediction
Bankruptcy or Success? The effective Prediction of a Company's Financial Development Using LSTM	Vochozka et.al. (2020)	NN+LSTM layer	Bankruptcy prediction

Corporate failure prediction: An evaluation of deep learning vs discrete hazard models	Alam et.al. (2021)	GrNet	Financial failure prediction
Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure	Aljawazneh et.al. (2021)	DBN, MLP-6L, LSTM	Financial failure prediction
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	Jan (2021b)	CART-DNN, CART-RNN	Going concern prediction
Artificial Intelligence in Corporate Sustainability: Using LSTM and GRU for Going Concern Prediction	Chi kai Chu (2021)	LSTM, GRU	Going concern prediction

---

#### 4.2.1 Fraud prediction

**Craja et al. (2020)** developed the Hierarchical Attention Network (HAN) model which combines the information derived from the financial data and MD&A section of the annual financial statements. The architecture of this model incorporates two attention mechanisms both in word and sentence level for the text feature extraction of MD&A section. So, the model has the ability to recognize whether a word within a sentence is important or not. In other words, this architecture allows the differentiation of the content in terms of its importance during the representation process. The experiments showed that it is about a complete DL model approach because it had the best performance in AUC (92,64%) and it is capable of detecting fraud cases correctly, especially by using the combination of FIN+TXT data. Also it provides red flags indicators that are useful for the text interpretation and support the decision-making of all stakeholders.

**Xiuguo and Shengyong (2022)** dealt with the development of a financial fraud detection system using DL models by combining numerical data and textual data from annual reports of Chinese listed companies. The experimental results showed that the performance of the models is better with the combination of numerical and textual data and especially of the GRU and LSTM models, which are based on RNN. So they have the ability to incorporate and extract results from differentiated data. Therefore, the combination of different types of data enhances the performance of DL models and can support the decision-making procedures of all stakeholders.

Finally, **Jan (2021a)** studied the development of a deep learning model using RNN and LSTM algorithms. The purpose of his research was to reduce the losses from a potential fraud and maintain the sustainable development of capital markets. The experimental results showed that RNN and LSTM models are capable of processing large datasets and achieving accuracy more than 85%. But between the two, the LSTM achieved the highest accuracy (94.88%).

#### 4.2.2 Financial distress prediction

**Li et.al. (2021)** dealt with the construction of the Chinese financial domain sentiment lexicon – CFDSL and its application for the financial distress prediction. They combined two approaches to generate the financial domain sentiment lexicon (a)

the dictionary-based and (b) the corpus-based approach. They examined the DNN, MA-DNN and Bi-LSTM models and the results showed the superiority of the MA-DNN model which was used to construct the CFDSL. Afterwards, they calculated the sentiment features of the CFDSL. The experiments showed that the sentiment features have the ability to reveal financial distress in prior time (4 and 3 years prior), providing timely and useful information to stakeholders. In fact, the words of the lexicon are directly related to the financial domain and it can be used to predict also other financial issues, such as bankruptcy and fraud prediction.

**Matin** et.al. (2019) developed three DL models, the architecture of which consisted of a Convolutional neural network and a Recurrent neural network (specifically, the LSTM) with an attention mechanism that allowed models to focus on the fewest and most important parts of the text. In one model, it was used only the textual data of auditor reports, in the second model only textual data of management statements and in the third one the combination of both. Then, the text of each model was concatenated with the numerical variables. According to the experiments, the performance of the models improved with the textual data and especially, of the one that used the textual data of auditor reports. This is due to the fact that auditor's reports are objective and reflect the financial situation of a company impartially unlike management statements which always give a positive image of the company. The above findings indicate that it is more important to include unstructured data in forecasting, and indeed data from multiple sources (such as auditors' reports), rather than building complex models on the same data.

#### 4.2.3 Bankruptcy prediction

**Hosaka** (2019) applied the Convolutional Neural Network (CNN) model by using financial ratios transformed into gray scale images to predict the bankruptcy probability of companies which mainly is a classification problem. According to the experiments, the prediction accuracy of the model was improved by correlated method and especially as the number of layers of the model increased. The advantage of the proposed model is that it can be applied to general numerical data to predict various financial issues and not only to predict bankruptcy. While its disadvantage is that it is difficult to detect the financial ratios that affect the bankruptcy prediction, so as to find the causes of bankruptcy.

**Mai** et.al. (2019) compared the performance of DL and traditional models by using numerical data, textual data and the combination of both. Also, they examined which network architectures improve the prediction performance by combining different neural network layers. The experimental results showed that the prediction accuracy of the proposed model increases when textual data is combined with numerical data. Therefore, the combination of the two types of data can add value to prediction models.

**Alexandropoulos** et.al. (2019) studied the effectiveness of the Deep Dense Multilayer Perceptron (DDMP) model. The selection of the number of hidden layers and the number of neurons in the hidden layers is important for the generalization of the network. They built the model with two hidden layers where in the first hidden layer, the number of neurons was the 2/3 of the number of the feature input, while in the second hidden layer, was the 1/3 of the number. The experimental results showed that the proposed architecture achieved the best results compared to the benchmark models.

**Smiti & Soui** (2020) developed the deep learning BSM-SAES model which combines the Borderline Synthetic Minority (BSM) oversampling technique with the Stacked AutoEncoder (SAE) and Softmax classifiers. The aim of this study was to develop a DL model which includes the feature extraction process in order to reduce the classification time and simplify the decision-making processes. In the first experiment, the BSM oversampling technique was not applied to any of the models while in the second one it was applied to all of them. According to the experimental results, the BSM technique improved the results of all models, while the proposed one had the highest performance and especially, with BSM technique.

**Jang et.al.** (2021) used the Long short Term memory - Recurrent Neural Network (LSTM-RNN) which had been developed in a previous study (Jang et.al., 2019b, Jang et.al., 2020 as cited in Jang et.al., 2021) in order to predict the bankruptcy probability before 1,2 and 3 years. Their aim was to identify the impact of the input variables by using the Shapley value and find the variable that most affects the prediction accuracy of the model. The experiments showed that the House starts (HS) construction market variable as well as the Current ratio (CR) and Debt ratio (DR) accounting variables mostly affected the accuracy prediction. Also, during the years, the effect of the Consumer per index (CPI), Gross domestic product (GDP) and Federal funds rate (FFR) macroeconomic variables increased, while the Return on asset (ROA) accounting variable decreased.

**Vochozka et.al.** (2020) developed an artificial neural network (NN) model with at least one LSTM layer. Their aim was to determine the suitability of the model in the bankruptcy prediction. The results showed that the proposed model can be applied in bankruptcy prediction, can be trained on different datasets, and be used by all companies and also financial institutions, investors and auditors in order to evaluate the financial status of companies. However, its practical application is difficult because of its complex structure. It is difficult to recalculate or program it in an environment other than Wolfram's Mathematica software. So it remains complicated for those who do not have knowledge of information and communication technologies.

#### **4.2.4 Financial failure prediction**

**Alam et.al.** (2021) studied the Deep Grassmannian Network (GrNet) model in order to predict corporate failure. It is a fully connected deep neural network architecture that uses Grassmannian-valued data to capture the panel data structure. It is capable of capturing time dependences and also capable of handling a large sample of companies as well as a large number of variables. During experiments, it was compared with the discrete-time hazard model and the results showed that the accuracy of the proposed DL model is more than 90%, while it outperforms the benchmark model on the sensitivity metric that concerns the type I error rate which is considered very important.

**Aljawazneh et.al.** (2021) studied three DL models, namely the (a) Deep Belief Network (DBN) which is a stochastic neural network, (b) Multilayer Perceptron with 6 Layers (MLP-6L) which is a feed-forward neural network and (c) Long-Short Term Memory (LSTM) which is a recurrent neural network. The performance of the models compared with (a) Random Forest (RF), Support Vector Machine (SVM) and K-Nearest Neighbor (KNN) models which are bagging based ensemble methods and (b) Adaptive Boosting (AdaBoost) and EXtreme Gradient Boosting (XGBoost) models which are boosting based ensemble methods. Also the selected datasets was extremely imbalanced and was applied eight balancing techniques of three different methods

(Oversampling, Hybrid Oversampling-Undersampling and Clustering-based balancing). The purpose of the study was to compare different types of neural network models and different balancing techniques in order to investigate which model has the best performance in financial failure prediction. After the experiments, it was found that the MLP-6L model combined with the SMOTE-ENN balancing technique had the best performance.

#### 4.2.5 Going concern prediction

**Jan** (2021b) used Deep Neural Network (DNN) and Recurrent Neural Network (RNN) methods to develop the proposed models. The purpose of the research was to help auditors to make correct evaluations and issue reliable audit reports. The models were constructed in two ways in order to examine which model achieves the best prediction performance. In the first case, all the variables were used, while in the second case only the most important ones which were selected by the regression tree (CART) algorithm. The experimental results showed that the accuracy of all models was more than 88% and in fact the RNN model performed better than the DNN model. But the performance of the models improved more by using the CART algorithm.

**Chi & Chu** (2021) developed models by using the Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) algorithms. Their purpose was to help CPAs and auditors to issue more accurate and correct audit reports. The experiments showed that the LSTM and GRU models are able to process large datasets quickly and they achieved very high classification accuracy and low type I & II error rates. This means that they are suitable for auditing procedures and they can be considered very effective predicting models.

#### 4.3 Data

The fifteen research articles used different types of data.

The data mainly come from the annual reports of the companies and were collected from databases such as Securities Exchange Commission (SEC), Emerging Markets Information Service (EMIS), Compustat, Nikkei NEEDS Financial QUEST, Center for Research in Security Prices (CRSP), Taipei Exchange (TPEX), Taiwan Economic Journal (TEJ), China Stock Market & Accounting Research, Infotel, National Bank of Greece, ICAP, University of California Irvine (UCI) Machine Learning Repository, U.S. Bureau of Census, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis and Board of Governors of the Federal Reserve Systems. The volume of the selected datasets and the time period of collection varies (see table 2).

Table 2: The data

Title	Data	Time period	Data base
Deep learning for detecting financial statement fraud	financial & textual data	1993 - 2019	SEC, L&M word lists by Loughran and Mcdonald (2011), Readability ratios by Humpherys et.al. (2011) & Li (2008)

An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	financial, non-financial variables & textual data	2016 - 2020	China Stock Market & Accounting Research
Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry	financial, non-financial variables	2001 - 2019	Taiwan Economic Journal (TEJ)
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	textual data	2012 - 2018	NTUSD, HowNet, TSING & DUTIR
Predicting distresses using deep learning of text segments in annual reports	financial & textual data	2013 - 2016	
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	financial ratios	2012 - 2016	Nikkei NEEDS Financial QUEST
Deep learning models for bankruptcy prediction using textual disclosures	accounting & market variables, textual data	1994 - 2014	Compustat North America, CRSP & SEC
A Deep Dense Neural Network for Bankruptcy Prediction	financial variables	2003 - 2004	National Bank of Greece & ICAP
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	financial variables		University of California Irvine (UCI) Machine Learning Repository
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	accounting & construction market and macroeconomic variables	1980 - 2016	COMPUSTAT, U.S. Bureau of Census, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis and Board of Governors of the Federal Reserve Systems.
Bankruptcy or Success? The effective Prediction of a Company's Financial Development Using LSTM	financial variables	2014 - 2018	Albertina
Corporate failure prediction: An evaluation of deep learning vs discrete hazard models	accounting & market variables	2001 - 2018	COMPUSTAT & CRSP
Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure	financial, non-financial variables	1998 - 2003, 1999 - 2009, 2007 - 2013	Infotel, Taiwan Economic Journal, EMIS
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	financial, non-financial variables	2002 - 2019	Taiwan Economic Journal (TEJ)

Most studies used only financial variables. Financial variables show the economic status and results of a company. Previous research found that they are strong indicators for evaluating the financial potential of each company (Alam et al., 2021).

**Jang** et.al. (2021) combined accounting variables with construction market and macroeconomic variables which are critical for prediction. The market construction variables affect the decision procedures and activities of construction companies and any fluctuation macroeconomic variables affect the financial status of constructors as well as the financing capacity of consumers.

**Alam et.al.** (2021) and **Mai et.al.** (2019) used a large number of accounting and market variables. It is believed that market variables capture the financial picture of a company faster, reflecting even very small changes in its financial status. In contrast, financial variables are based on historical data, they are published in the annual financial reports later and moreover can be manipulated by the administration.

Also the researches of Aljawazneh et.al. (2021), Chi & Chu (2021), Jan (2021a), Jan (2021b), Xiuguo & Shengyong (2022) used additionally non-financial variables which are also known as corporate governance variables and they are related to ownership structure, management structure and auditor's opinion (Xiuguo & Shengyong, 2022; Chi & Chu, 2021).

**Hosaka** (2019) used as data numerical financial indicators which were transformed into gray scale images. Each indicator corresponded to a specific pixel, the brightness of which was determined by the value of the corresponding financial indicator.

As regards the textual data, several researches combined numerical data with textual data mainly from the MD&A section to examine how much the performance of the models is affected, considering that the language of MD&A section can reveal very useful information for prediction.

Craja et.al., (2020), Mai et.al. (2019) and Xiuguo & Shengyong (2022) used textual data from the MD&A section of the annual reports of listed companies combined with quantitative data. While **Matin et.al.** (2019) combined quantitative data with textual data from both the MD&A section and auditor's reports. **Li et.al.** (2021) proposed a new approach to construct a new Chinese sentiment dictionary for the financial sector by combining textual data with general Chinese dictionaries.

The experiments showed that the best performance of the models is achieved with the combination of financial and textual data. Therefore, the usage of DL models with different types of data provides improved performance in prediction and effectiveness in the making-decision processes.

#### 4.4 Balancing techniques

The datasets are usually imbalanced which means that the number of the majority class is bigger than the number of the minority class. This is because the number of bankrupt, failed or distressed companies is smaller than the number of healthy companies. So, the collected datasets are extremely imbalanced. This problem affects

the prediction performance of the models because they tend to predict the majority class and ignore the minority (Aljawazneh et.al., 2021).

The researchers used various methods to deal with this problem (see table 3).

Table 3: The balancing techniques

Title	Author	Model	Balancing technique
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	HAN	Undersampling
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguao and Shengyong (2022)	LSTM, GRU, TRANSFORMER	20 balanced sub-datasets
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	CNN	Interpolation και extrapolation
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	DL BSM-SAES	Borderline SMOTE (BSM)
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	Jang et.al. (2021)	LSTM-RNN (Shapley value)	SMOTE-Tomek link
Corporate failure prediction: An evaluation of deep learning vs discrete hazard models	Alam et.al. (2021)	GrNet	Grassmann points
Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure	Aljawazneh et.al. (2021)	DBN, MLP-6L, LSTM	SMOTE, Borderline SMOTE, SMOTE-NC, SVM-SMOTE, ADASYN, SMOTE-ENN, SMOTE-Tomek και K-means)

**Xiuguao and Shengyong (2022)** created 20 balanced sub-datasets where each contained 244 of non-fraudulent cases and 244 of fraudulent ones considering that other techniques have disadvantages. The oversampling technique creates many extra copies, the undersampling technique uses only a part of the majority class of the data, while the SMOTE uses synthetic data for minority class.

**Craja et.al. (2020)** applied the undersampling technique taking also into account the year and the activity sector of the companies, so as the different economic conditions of each sector to be considered.

**Smiti and Soui (2020)** used the Borderline SMOTE method which is an improved version of SMOTE algorithm. The Borderline SMOTE creates synthetic data only for the minority cases that are closer to the border of the two classes because those are the most important for the classification.

**Jang et.al. (2021)** used the SMOTE-Tomek link technique where the SMOTE technique was first used to create the synthetic data of the minority class and then the



Tomek link technique was applied to the total dataset, i.e. original and new synthetic, to balance the dataset.

**Aljawazneh et.al. (2021)** used five oversampling balancing techniques (SMOTE, Borderline SMOTE, SMOTE-NC, SVM-SMOTE, ADASYN), two hybrid (SMOTE-ENN, SMOTE-Tomek) and one clustering-based technique (K-means), which had applied in three different and extremely imbalanced datasets in order to detect the most suitable one.

**Alam et.al. (2021)** used data panel which was imbalanced since the duration of the life circle of companies is different. To address the problem, the panel data were treated as a set of vectors along the time dimension and the subspace, created by the set of vectors, was used to represent the panel data as Grassmann points.

#### 4.5 Natural language processing techniques

The researches that used textual data applied the Word2Vec natural language processing technique in order for the data to be transformed into numerical form and be possible the algorithmic processing (see table 4).

Table 4: The natural language processing techniques

Title	Authors	DL Models	Natural language processing techniques
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	HAN	Word2Vec
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguao & Shengyong (2022)	LSTM, GRU, TRANSFORMER	Word2Vec
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	Li et.al. (2021)	DNN, MA-DNN, Bi-LSTM	Word2Vec & pre-training BERT
Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	3 models CNN+RNN	Word2Vec (skip-gram)
Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	DL-Embedding, CNN	Word2Vec (skip-gram)

**Craja et.al. (2020)** constructed the hierarchical attention network (HAN) with word2vec embeddings. They found that word2vec technique is superior to the BOW method with which was compared, because it permits the words with similar meaning to have similar vector representations and capture the syntactic and semantic similarities. In other words, it permits the model to understand the meaning of the words. In contrast, the BOW method which considers the frequency of appearance of the words ignoring the word order and grammar (Craja et.al., 2020; Mai et.al., 2019).

**Matin et.al.** (2019) used Word2Vec skip-gram model and the architecture of the network incorporated an attention mechanism so that the model can focus on the fewest and more important parts of text.

Moreover, **Mai et.al.** (2019) used Word2Vec skip-gram model with the negative sampling algorithm and padding normalization, so that the MD&A texts have the same length.

**Xiuguo and Shengyong** (2022), applied a Chinese text mining method which included two procedures (a) the segmentation of Chinese words and (b) the word vector calculation with the Word2Vec technique, so that the important information not to get lost.

**Li et.al.** (2021) used the Word2Vec and pre-training BERT techniques. They found that the models which used the BERT technique had a better performance.

#### 4.6 Feature selection

Feature selection is a procedure of isolating the important features from the rest features of the dataset that contain irrelevant and unnecessary information. Important features are those that contain useful information for the model and essentially affect the prediction performance. The main goals of this procedure are to reduce the computational cost, reduce the training time of the model and improve the prediction performance (Kirkos, 2015). Concerning the fifteen articles, three researches applied feature selection methods and studied the behavior of the models (see table 5).

Table 5: The feature selection methods

Title	Author	Model	Feature selection method
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	Jan (2021b)	CART-DNN, CART-RNN	CART
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	DL BSM-SAES	Stacked auto-encoder
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	CNN	Correlated

**Jan et.al.** (2021b) used the CART algorithm to select the ten most important variables. They studied the behavior of the models and compared their performance by using the entire dataset as well as the dataset with the ten selected variables. They found that the models that used only the selected variables had an improved performance.

**Smiti and Soui** (2020) applied Stacked auto-encoder (SAE) technique for the feature selection. They found that the DL model was extremely accurate compared to the machine learning models. The proposed model can extract automatically useful features during the training process while the machine learning models extract their features independently of the training phase. But it should be noted that the proposed

DL model had the worst performance in training time due to the time it needed to extract the important features.

**Hosaka** (2019) used the Random and Correlated methods in order to match the financial indicators to specific pixels. With Random method the matching is random while with Correlated method the matching depends on the correlation degree of the indicators, which means that indicators with high correlation degree are placed in closer pixel positions. The experiments showed that the correlated method is more suitable since the prediction results were improved.

#### 4.7 Validation

Validation is an important procedure and investigates the ability of the model to correctly classify unknown data, i.e. data that haven't been used during its training (Kirkos, 2015). In other words, the generalization ability of the model is investigated. For this purpose several researches of the examined articles (see table 6) used the cross validation method where the dataset was divided into folds. One of the folds was used as validation dataset and the rest as training datasets (Kirkos, 2015).

Aljawazneh et.al. (2021), Li et.al. (2021), Matin et.al. (2019) used the 10-fold cross validation and Hosaka (2019) the 5-fold cross validation, that is, the datasets were divided into 10 and 5 folds accordingly. While Mai et.al. (2019) used the 10\*10-fold cross validation method according to which the above procedure was repeated 10 times.

Also other researches (Alam et.al., 2021; Craja et.al., 2020; Jang et.al., 2021; Mai et.al., 2019; Smiti & Soui, 2020; Vochozka et.al., 2020; Xiuguo & Shengyong, 2022) used the hold out method (see table 6), where the dataset was randomly divided into training dataset and testing dataset while in three researches (Chi & Chu, 2021; Jan, 2021a; Jan, 2021b) was divided into training, validation and testing dataset.

Table 6: The validation methods

Title	Author	Validation
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	Hold out (training & testing dataset)
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguo and Shengyong (2022)	Hold out (training & testing dataset)
Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry	Jan (2021a)	Hold out (training, validation & testing dataset)
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	Li et.al. (2021)	10-fold cross-validation
Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	10-fold cross-validation
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	5-fold cross-validation

Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	10*10-fold cross-validation
A Deep Dense Neural Network for Bankruptcy Prediction	Alexandropoulos et.al. (2019)	
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	Jang et.al. (2021)	Hold out (training & testing dataset)
Bankruptcy or Success? The effective Prediction of a Company's Financial Development Using LSTM	Vochozka et.al. (2020)	Hold out (training & testing dataset)
Corporate failure preiction: An evaluation of deep learning vs discrete hazard models	Alam et.al. (2021)	Hold out (training & testing dataset)
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	Jan (2021b)	Hold out (training, validation & testing dataset)
Artificial Intelligence in Corporate Sustainability: Using LSTM and GRU for Going Concern Prediction	Chi and Chu (2021)	Hold out (training, validation & testing dataset)

#### 4.8 Interpretability

The DL models are considered to be black box models, because the interaction of neurons is not understandable. So, it is difficult to interpret the prediction result (Kirkos, 2015).

**Jang et.al.** (2021) measured the impact of the input variables on prediction by using the Shapley value. In order to identify the variable that most affected the prediction accuracy, they inserted variants of input variables which were grouped in a high-impact order. This is very important, so that the internal processes of the models become more understandable. Moreover, the selection of only the important variables offers significant benefits since it helps to reduce training time, reduce storage demands and improve the models' performance.

**Mai et.al.** (2019) applied the representation erasure method to find the words that are important for the model. Thus, they observed how the performance of the model changes by erasing individual words from the corpus. For this purpose, they used AUC metric and any decrease of AUC value meant that the erased word was important for the model. Then, the collected words were compared with the words of two sentiment dictionaries (Loughran & McDonald, 2011; Wilson, Wiebe & Hofmann, 2005 as cited in Mai et al., 2019) and it was found that many of them were not included in the two dictionaries, indicating that the DL model considers other words more important than those in the sentiment dictionaries.

#### 4.9 Benchmark models

The fifteen articles compared the performance of the proposed DL models with several benchmark models. The most commonly used benchmark models were Logistic

Regression (LR), Random Forest (RF), Extreme Gradient Boosting and (XGB) Support Vector Machine (SVM) (see table 7). The above models have been used in previous research with very good performance in prediction.

Table 7: The benchmark models

<b>Title</b>	<b>Author</b>	<b>Benchmark model</b>
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	LR, RF, SVM, XGB & ANN
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguao and Shengyong (2022)	CNN, RF, SVM, XGB, ANN & LR
Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry	Jan (2021a)	
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	Li et.al. (2021)	
Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	XGB, Logit & NN
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	CART, LDA, SVM, MLP & AdaBoost
Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	LR, SVM & RF
A Deep Dense Neural Network for Bankruptcy Prediction	Alexandropoulos et.al. (2019)	LR, MP, NB & Cart
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	KNN, DT, SVM, ANN, RF & C5.0
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	Jang et.al. (2021)	
Bankruptcy or Success? The effective Prediction of a Company's Financial Development Using LSTM	Vochozka et.al. (2020)	
Corporate failure preiction: An evaluation of deep learning vs discrete hazard models	Alam et.al. (2021)	Discrete-time hazard model
Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure	Aljawazneh et.al. (2021)	RF, SVM, KNN, AdaBoost & XGBoost
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	Jan (2021b)	
Artificial Intelligence in Corporate Sustainability: Using LSTM and GRU for Going Concern Prediction	Chi and Chu (2021)	

#### 4.10 Evaluation metrics

Prediction is a binary classification problem with four possible results which are (Kirkos, 2015) (α) True positive (TP) (b) False positive (FP) (c) False negative (FN) and (d) True negative (TN). The above results are summarized in the confusion matrix which is a 2x2 matrix and helps to understand the classifications results.

Confusion matrix is suitable for imbalanced datasets because it gives a better picture of the performance of the models by illustrating both correct and incorrect classifications.

It is used to measure the performance of the models by calculating the metrics accuracy, precision, recall (sensitivity), specificity, F-score, error type I, error type II and ROC curve (AUC).

The most commonly used performance measures by the fifteen researches (see table 8) were the metrics accuracy, recall (sensitivity), specificity, F-measures, type I error, type II error and the ROC curve (AUC).

So, it can be concluded that the evaluation of the research is mainly based on (a) the rate of the correctly classified cases in relation to the total dataset (accuracy), (b) the rate of the correctly classified positive/negative predictions in relation to the total true positive/negative predictions (recall/specificity respectively) and (c) the ability of the models to correctly classify the predictions (ROC curve (AUC)).

Also, some researches (Chi & Chu, 2021; Craja et al., 2020; Hosaka, 2019; Jan, 2021a; Jan, 2021b; Li et al., 2021; Xiuguo & Shengyong, 2022) took into account the F-measures in order to evaluate the accuracy of the models in relation to the rate of misclassifications. While others (Aljawazneh et al., 2021; Chi & Chu, 2021; Jan, 2021a) used error rates type I & II, due to the costs they cause and the lower their rates, the better the model's performance.

Table 8: The evaluation metrics

<b>Title</b>	<b>Author</b>	<b>Model</b>	<b>Evaluation metric</b>
Deep learning for detecting financial statement fraud	Craja et.al. (2020)	HAN	Accuracy, Recall (Sensitivity), Specificity, F1-score, F2-score, AUC
An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning	Xiuguo and Shengyong (2022)	LSTM, GRU, TRANSFORMER	Accuracy, Recall (Sensitivity), Specificity, F1-score, F2-score, AUC
Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry	Jan (2021a)	RNN, LSTM	Accuracy, Recall (Sensitivity), Specificity, F1-score, Precision, Type I error, Type II error, Training time, AUC
A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: a Case Study in Financial Distress Prediction	Li et.al. (2021)	DNN, MA-DNN, Bi-LSTM	Accuracy, Recall (Sensitivity), Precision, F1-score

Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	3 models CNN+RNN	AUC, log-score
Bankruptcy prediction using imaged financial ratios and convolutional neural networks	Hosaka (2019)	CNN	Correct estimation rates for each class, F-measure, καμπύλη ROC
Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	DL-Embedding, CNN	Accuracy, AUC, Cumulative decile-ranking
A Deep Dense Neural Network for Bankruptcy Prediction	Alexandropoulos et.al. (2019)	DDMP	AUC
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	DL BSM-SAES	AUC, training time
Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors	Jang et.al. (2021)	LSTM-RNN (Shapley value)	τιμή Shapley, Accuracy
Bankruptcy or Success? The effective Prediction of a Company's Financial Development Using LSTM	Vochozka et.al. (2020)	NN+LSTM layer	Confusion matrix
Corporate failure prediction: An evaluation of deep learning vs discrete hazard models	Alam et.al. (2021)	GrNet	Accuracy, Recall (Sensitivity), Specificity
Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure	Aljawazneh et.al. (2021)	DBN, MLP-6L, LSTM	Accuracy, Recall (Sensitivity), Specificity, Precision, Type I error, Type II error
Using Deep Learning Algorithms for CPAs' Going Concern Prediction	Jan (2021b)	CART-DNN, CART-RNN	Accuracy, Recall (Sensitivity), Specificity, F1-score, Precision
Artificial Intelligence in Corporate Sustainability: Using LSTM and GRU for Going Concern Prediction	Chi and Chu (2021)	LSTM, GRU	Accuracy, Recall (Sensitivity), Specificity, F1-score, Precision, Type I error, Type II error

#### 4.11 Statistical analysis of the results

Statistical analyzes are often applied to test the prediction results in order to statistically check the differences between the results and confirm whether they are statistically significant or not (Kirkos, 2012).

Three researches proceeded with the statistical analysis of their results by calculating p-values (see table 9). Specifically, two studies (Matin et.al., 2019; Smiti & Soui, 2020) applied the paired t-test method while the study of Mai et.al. (2019) used the Salzberg binomial test method. The results of the above studies confirmed the superiority of the proposed DL models.

Table 9: The statistical analysis methods

<b>Title</b>	<b>Author</b>	<b>Statistical analysis</b>
Predicting distresses using deep learning of text segments in annual reports	Matin et.al. (2019)	Paired t-test
Deep learning models for bankruptcy prediction using textual disclosures	Mai et.al. (2019)	Salzberg binomial test
Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE	Smiti and Soui (2020)	Paired t-test

#### 4.12 Summary

According to the above, it is found that each research developed different DL models based mainly on the MLP, CNN and RNN algorithms. The proposed models are suitable for the purpose for which they have been developed and they are superior compared to the benchmark models. The studies collected different types of data from different databases which vary in terms of quantity and time period collection.

Some studies applied different balancing and feature selection techniques with very good results in the performance of the models, while the studies that used text data mainly applied the Word2Vec method.

The validation methods that applied were mainly the cross validation and the holdout methods, in order to confirm the ability of the proposed models to correctly classify unknown data.

In addition, two researches (Jang et al., 2021; Xiuguo & Shengyong, 2022) studied the impact of the input variables on prediction in order to understand the internal processes of the models and be able to interpret the decisions they make.

The benchmark models and the performance measures that were chosen to evaluate the performance of the proposed DL models, vary, while only three studies did statistical analysis to confirm their results.

## 5. Conclusions and Suggestions

### 5.1 Conclusions

The Deep Learning models that are described above are classification methods for the probability of fraud, financial, distress, bankruptcy, corporate failure and going concern prediction. The main goal is to confirm that the proposed models are improved classification methods, the prediction results are of high accuracy and they are superior compared to the benchmark models.

During the experiments, it was noted that the performance of DL models varies according to the type of data that were used and the maximum performance was achieved with the combination of financial and textual data. Therefore, the aspect that



the language of MD&A and auditor's reports can provide useful information for prediction is highly supported.

Also, it is noted that the balancing data, feature selection and natural language processing methods improve the effectiveness and the predictive ability of the models.

The study of the impact of the input variables on prediction is of essential importance since it can help to understand the internal processes of the models and provide useful information for their improvement. So it can help to deal with the problem of interpretability.

According to all the above, the superiority of the DL models is confirmed. The proposed models are powerful tools for prediction and can be used for the purpose for which they were developed with success. They are highly accurate, reliable and capable of providing support to the decision-making procedures of administration and all stakeholders in order to achieve their goals.

## 5.2. Suggestions

Although Deep Learning is a promising method, all researches agree that there are many limitations that must be further investigated. The issues that they mainly refer to concern the data, the variables, the networks' architecture, their usage fields and their practical application.

In more details, the researchers propose that the prediction performance of the models should be studied by selecting and combining more different types of data which should come from many and different information sources, such as stock markets, statistical services, the news or social media and not only from the annual financial reports.

Most researchers point out that the time period of the selected data should be extended (Li et.al., 2021; Xiuguo & Shengyong, 2022). Also, they refer to the imbalancing data problem and they propose the development of new data balancing methods and the study of the ideal proportions of real and synthetic data for more accurate and effective prediction (Aljawazneh et.al., 2021; Hosaka, 2019).

Also the chosen variables should be suitable and according to the company's size, the regulations and the economic status of each country (Alam et.al., 2021; Chi & Chu, 2021; Jan, 2021a; Jan, 2021b; Jang et.al, 2021). They also comment on the importance of studying the impact of each variable on the prediction result (Hosaka, 2019; Jang et.al., 2021). The detection of the most powerful variable will bring many benefits both in building and improving the models and in understanding their internal procedures (Hosaka, 2019).

They suggest that the future research should deal with the improvement of architecture of the proposed models and also study the development of hybrid models by combining different neural networks types. In this way, they will be able to build more improved models capable of dealing with any classification problem.

Finally, they refer to the investigation of the probability of applying DL models in other economic issues, such as mergers and acquisitions that often concern the stakeholders and they point out the necessity of developing user-friendly applications, so as their practical application to be possible without the need of specialized knowledge (Vochozka, Vrbka, & Suler, 2020).

## References

- Alam, N., Gao, J., & Jones, S. (2021). Corporate failure prediction: An evaluation of deep learning vs discrete hazard models. *Journal of International Financial Markets, Institutions & Money*, 75.
- Alexandropoulos, S.-A. N., Aridas, C. K., Kotsiantis, S. B., & Vrahatis, M. N. (2019). A Deep Dense Neural Network for Bankruptcy Prediction. *Engineering Applications of Neural Networks. EANN 2019. CCIS, 1000*, σσ. 435-444.
- Ali, Z. (2019, Ιανουάριος 6). *A simple Word2vec tutorial*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://medium.com/@zafaralibagh6/a-simple-word2vec-tutorial-61e64e38a6a1>
- Aljawazneh, H., Mora, A. M., Garcia-Sanchez, P., & Castillo-Valdivieso, P. A. (2021). Comparing the Performance of Deep Learning Methods to Predict Companies' Financial Failure. *IEEE Access*, 9, σσ. 97010-97038.
- Alto, V. (2019, Ιούλιος 5). *Neural Networks: parameters, hyperparameters and optimization strategies*. Ανάκτηση Αύγουστος 23, 2022, από <https://towardsdatascience.com/neural-networks-parameters-hyperparameters-and-optimization-strategies-3f0842fac0a5>
- Amkiit. (n.d.). *Word2vec vs BERT*. Ανάκτηση Δεκέμβριος 27, 2022, από <https://medium.com/@ankiit/word2vec-vs-bert-d04ab3ade4c9>
- Ankiit. (χ.χ.). *Word2vec vs BERT*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://medium.com/@ankiit/word2vec-vs-bert-d04ab3ade4c9>
- Brownlee, J. (2021, Ιανουάριος 22). *How to Choose an Activation Function for Deep Learning*. Ανάκτηση Νοέμβριος 6, 2022, από <https://machinelearningmastery.com/choose-an-activation-function-for-deep-learning/>
- Brownlee, J. (2022, Αύγουστος 15). *Difference Between a Batch and an Epoch in a Neural Network*. Ανάκτηση Νοέμβριος 5, 2022, από <https://machinelearningmastery.com/difference-between-a-batch-and-an-epoch/>
- Capitalone. (2021, Οκτώβριος 6). *Understanding TF-IDF for Machine Learning*. Ανάκτηση Δεκέμβριος 22, 2022, από <https://www.capitalone.com/tech/machine-learning/understanding-tf-idf/>

- Chandra, A. (2018, Ιούλιος 24). *McCulloch-Pitts Neuron — Mankind's First Mathematical Model Of A Biological Neuron*. Ανάκτηση Αύγουστος 10, 2022, από <https://towardsdatascience.com/mcculloch-pitts-model-5fdf65ac5dd1>
- Chandran, S. (2020, Ιούλιος 12). *Introduction to Text Representations for Language Processing — Part 1*. Ανάκτηση Δεκέμβριος 21, 2022, από <https://towardsdatascience.com/introduction-to-text-representations-for-language-processing-part-1-dc6e8068b8a4>
- Chi, D.-J., & Chu, C.-C. (2021). Artificial Intelligence in Corporate Sustainability: Using LSTM and GRU for Going Concern Prediction. *Sustainability (Switzerland)*, 13(21).
- Craja, P., Kim, A., & Lessmann, S. (2020). Deep learning for detecting financial statement fraud. *Decision Support Systems*, 139.
- Dertat, A. (2017, Νοέμβριος 8). *Applied Deep Learning - Part 4: Convolutional Neural Networks*. Ανάκτηση Δεκέμβριος 28, 2022, από <https://towardsdatascience.com/applied-deep-learning-part-4-convolutional-neural-networks-584bc134c1e2>
- Devopedia. (2020, Σεπτέμβριος 5). *Word2vec*. Ανάκτηση Δεκέμβριος 27, 2022, από <https://devopedia.org/word2vec>
- Dutta, M. (2021, Ιούλιος 13). *Word2Vec For Word Embeddings -A Beginner's Guide*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://www.analyticsvidhya.com/blog/2021/07/word2vec-for-word-embeddings-a-beginners-guide/>
- Free time learning. (n.d.). *Deep Learning Interview Questions*. Ανάκτηση Δεκέμβριος 4, 2022, από <https://www.freetimelearning.com/software-interview-questions-and-answers.php?What-Is-a-Multi-layer-Perceptron%28MLP%29?&id=4161>
- freeCodeCamp. (2019, Απρίλιος 18). *An intuitive guide to Convolutional Neural Networks*. Ανάκτηση Δεκέμβριος 28, 2022, από <https://www.freecodecamp.org/news/an-intuitive-guide-to-convolutional-neural-networks-260c2de0a050/>
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. London: MIT Press.

- Grieve, P. (2022, Μάρτιος 02). *Deep learning vs machine learning: What's the difference?* Ανάκτηση Αύγουστος 2, 2022, από <https://www.zendesk.com/blog/machine-learning-and-deep-learning/>
- Gurucharan, M. (2022, Ιούλιος 28). *Basic CNN Architecture: Explaining 5 Layers of Convolutional Neural Network*. Ανάκτηση Δεκέμβριος 2, 2022, από <https://www.upgrad.com/blog/basic-cnn-architecture/>
- H2O.a. (χ.χ.). *BERT*. Ανάκτηση Δεκέμβριος 27, 2022, από 1: <https://h2o.ai/wiki/bert/>
- Hansen, L. (2022, Σεπτέμβριος 1). *Neural Networks - step by step*. Ανάκτηση Νοέμβριος 6, 2022, από <https://lassehansen.me/post/neural-networks-step-by-step/>
- Hosaka, T. (2019). Bankruptcy prediction using imaged financial ratios and convolutional neural networks. *Expert Systems With Applications*, 117, σσ. 287-299.
- Jan, C.-L. (2021a). Detection of Financial Statement Fraud Using Deep Learning for Sustainable Development of Capital Markets under Information Asymmetry. *Sustainability (Switzerland)*, 13(17).
- Jan, C.-L. (2021b). Using Deep Learning Algorithms for CPAs' Going Concern Prediction. *Information (Switzerland)*, 12(2), σσ. 1-22.
- Jang, Y., Jeong, I., & Cho, Y. K. (2021). Identifying impact of variables in deep learning models on bankruptcy prediction of construction contractors. *Engineering, Construction and Architectural Management*, 28(10), σσ. 3282-3298.
- Karani, D. (2018, Σεπτέμβριος 1). *Introduction to Word Embedding and Word2Vec*. Ανάκτηση Δεκέμβριος 23, 2022, από <https://towardsdatascience.com/introduction-to-word-embedding-and-word2vec-652d0c2060fa>
- Kirkos, E. (2012). Assessing methodologies for intelligent bankruptcy prediction. *Artificial Intelligence Review*, 43, σσ. 83–123.
- Kirkos, E., Spathis, C., & Manolopoulos, Y. (2007). Data Mining techniques for the detection of fraudulent financial statements. *Expert Systems with Applications*, 32(4), σσ. 995-1003.

- Li, S., Shi, W., Wang, J., & Zhou, H. (2021). A Deep Learning-Based Approach to Constructing a Domain Sentiment Lexicon: A case study in financial distress prediction. *Information Processing and Management*, 58(5).
- Lutkevich, B. (χ.χ.). *BERT language model*. Ανάκτηση Δεκέμβριος 27, 2022, από <https://www.techtarget.com/searchenterpriseai/definition/BERT-language-model>
- Mai, F., Tian, S., Lee, C., & Ma, L. (2019). Deep learning models for bankruptcy prediction using textual disclosures. *European Journal of Operational Research*, 274, σσ. 743-758.
- Matin, R., Hansen , C., Hansen, C., & Molgaard, P. (2019). Predicting distresses using deep learning of text segments in annual reports. *Expert Systems With Applications*, 132, σσ. 199-208.
- Paperspace. (2020). *Convergence*. Ανάκτηση Νοέμβριος 6, 2022, από <https://machine-learning.paperspace.com/wiki/convergence>
- Phi, M. (2018, Σεπτέμβριος 24). *Illustrated Guide to LSTM's and GRU's: A step by step explanation*. Ανάκτηση Νοέμβριος 29, 2022, από <https://towardsdatascience.com/illustrated-guide-to-lstms-and-gru-s-a-step-by-step-explanation-44e9eb85bf21>
- ProjectPro. (2022, Νοέμβριος 24). *BERT NLP Model Explained for Complete Beginners*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://www.projectpro.io/article/bert-nlp-model-explained/558>
- Radhakrishnan, P. (2017, Αύγουστος 9). *What are Hyperparameters ? and How to tune the Hyperparameters in a Deep Neural Network?* Ανάκτηση Νοέμβριος 6, 2022, από <https://towardsdatascience.com/what-are-hyperparameters-and-how-to-tune-the-hyperparameters-in-a-deep-neural-network-d0604917584a>
- Saxena, S. (2021, Μάρτιος 16). *Introduction to Long Short Term Memory (LSTM)*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://www.analyticsvidhya.com/blog/2021/03/introduction-to-long-short-term-memory-lstm/>
- Saxena, S. (2022, Οκτώβριος 14). *Activation Function in Neural Networks*. Ανάκτηση Νοέμβριος 6, 2022, από <https://towardsai.net/p/l/activation-function-in-neural-networks>

- Seraydarian, L. (2022, Αύγουστος 18). *What Is a Confusion Matrix in Machine Learning?* Ανάκτηση Νοέμβριος 29, 2022, από <https://plat.ai/blog/confusion-matrix-in-machine-learning/>
- Simplilearn. (2022). *Deep Learning In 5 Minutes*. Ανάκτηση Αύγουστος 2, 2022, από <https://www.youtube.com/watch?v=6M5VXKLf4D4>
- Singhal, G. (2020, Σεπτέμβριος 9). *Introduction to LSTM Units in RNN*. Ανάκτηση Δεκέμβριος 26, 2022, από <https://www.pluralsight.com/guides/introduction-to-lstm-units-in-rnn>
- Smiti, S., & Soui, M. (2020). Bankruptcy Prediction Using Deep Learning Approach Based on Borderline SMOTE. *Information Systems Frontiers*, 22(5), σσ. 1067-1083.
- Sun, T., & Vasarhelyi, M. A. (2018). Embracing Textual Data Analytics in Auditing with Deep Learning. *International Journal of Digital Accounting Research*, 18, σσ. 49-67.
- Vochozka, M., Vrbka, J., & Suler, P. (2020). Bankruptcy or Success? The Effective Prediction of a Company's Financial Development Using LSTM. *Sustainability (Switzerland)*, 12(18).
- Wikipedia. (2022, Νοέμβριος 3). *Bag-of-words model*. Ανάκτηση Δεκέμβριος 21, 2022, από [https://en.wikipedia.org/wiki/Bag-of-words\\_model](https://en.wikipedia.org/wiki/Bag-of-words_model)
- Wikipedia. (2022, Δεκέμβριος 25). *BERT (language model)*. Ανάκτηση Δεκέμβριος 28, 2022, από [https://en.wikipedia.org/wiki/BERT\\_\(language\\_model\)](https://en.wikipedia.org/wiki/BERT_(language_model))
- Wikipedia. (2022, Νοέμβριος 25). *Convolutional neural network*. Ανάκτηση Νοέμβριος 29, 2022, από [https://en.wikipedia.org/wiki/Convolutional\\_neural\\_network](https://en.wikipedia.org/wiki/Convolutional_neural_network)
- Wikipedia. (2022, Δεκέμβριος 8). *Long short-term memory*. Ανάκτηση Δεκέμβριος 26, 2022, από [https://en.wikipedia.org/wiki/Long\\_short-term\\_memory](https://en.wikipedia.org/wiki/Long_short-term_memory)
- Wikipedia. (2022, Σεπτέμβριος 8). *Multilayer perceptron*. Ανάκτηση Δεκέμβριος 4, 2022, από [https://en.wikipedia.org/wiki/Multilayer\\_perceptron](https://en.wikipedia.org/wiki/Multilayer_perceptron)
- Wikipedia. (2022, Δεκέμβριος 24). *Word2vec*. Ανάκτηση Δεκέμβριος 27, 2022, από <https://en.wikipedia.org/wiki/Word2vec>

- Xiuguo, W., & Shengyong, D. (2022). An Analysis on Financial Statement Fraud Detection for Chinese Listed Companies using Deep Learning. *IEEE Access*, *10*, σσ. 22516-22532.
- Αργυράκης, Π. (2001). *Νευρωνικά Δίκτυα και Εφαρμογές* (Τόμ. Β'). Πάτρα: ΕΑΠ.
- Κερανού, Ε. (2000). *Τεχνητή Νοημοσύνη και Έμπειρα Συστήματα* (Τόμ. Α'). Πάτρα: ΕΑΠ.
- Κύρκος, Ε. Γ. (2015). *Επιχειρηματική Ευφροσύνη & Εξόρυξη Δεδομένων*. Kallipos, Open Academic Editions.
- Παπαδάκης, Β. Μ. (2016). *Στρατηγική των Επιχειρήσεων: Ελληνική και Διεθνής εμπειρία* (7η εκδ., Τόμ. ΤΟΜΟΣ Α' ΘΕΩΡΙΑ). Αθήνα: Εκδόσεις Ε. ΜΠΕΝΟΥ.
- Τσακλάγκανος, Α. Α., & Σπαθής, Χ. Θ. (2017). *Ελεγκτική* (γ' εκδ.). Θεσσαλονίκη: Αφοι Κυριακίδη Εκδόσεις Α.Ε.

## **Factors affecting entrepreneurial intentions among youth in Nepal**

**Leif Longvanes<sup>1</sup>, Jon Gunnar Nesse<sup>2</sup> and Torbjørn Årethun<sup>3</sup>**

<sup>1</sup> Volda University College, Box 500, N-6101 Volda, Norway, +4790646424

<sup>1</sup> Western Norway University of Applied Sciences, Box 133, N-6851 Sogndal, Norway, +4757676324

<sup>2</sup> Western Norway University of Applied Sciences, Box 133, N-6851 Sogndal, Norway, +4740224296

<sup>3</sup> Western Norway University of Applied Sciences, Box 133, N-6851 Sogndal, Norway, +4757676322

[leif.longvanes@hvl.no](mailto:leif.longvanes@hvl.no); [leif.longvanes@hivolda.no](mailto:leif.longvanes@hivolda.no); [jon.nesse@hvl.no](mailto:jon.nesse@hvl.no); [torbjorn.arethun@hvl.no](mailto:torbjorn.arethun@hvl.no);



# **Factors affecting entrepreneurial intentions among youth in Nepal**

## **Abstract**

Economic growth, by replacing low-paid jobs in agricultural sector with well-paid work in advanced manufacturing industries and in the service sector by creating new enterprises has been an important goal in developing countries. Hence, policy makers are interested in studies on how to influence entrepreneurial intentions in developing countries. This study finds some of the determinants behind entrepreneurial intentions (EI) among high school students in Nepal. One sample survey was conducted among youth in 7 high schools in 7 different regions of Nepal. We got answers from 560 respondents.

The main results are that leadership and autonomy as career anchors, perceived support from family and friends and carrying a proactive personality are prominent factors in explaining EI among Nepalese youths. On the other hand, factors like gender, having self-employed parents or other role models who are running their own business, do not affect youth's EI. These results shed light on two areas for entrepreneurship education of youth: Nepalese schools should motivate young people into starting their own business by supporting their leadership ambitions and by building up a desire for autonomy.

**Keywords:** entrepreneurship, entrepreneurial intentions, youth, Nepal

## **1. Introduction**

Nepal is a republic in Asia with 28 million inhabitants (World Bank, 2019a). High birth rates and declining mortality rates have given the country a high natural population growth and a "young" population (Haugan, 2019). As much as 80 % of the population originates from northern India, while the rest have Tibetan-Mongolian roots. About 80 % of the population is Hindu, Buddhists make up around 11 %, Muslims 4 % and Christians about 0.2 % (Haugan, 2019). The country is landlocked between China in north and India in west, south and east. In the north we find famous mountains like Annapurna and Mount Everest.

Despite rich natural resources like hydropower, forest and herbs, mountains and water, Nepal is among the least developed countries in the world (Karki, 2007). There is a lack of finance capital and technology, but also of motivation to establish new enterprises (Karki, 2007). The World Bank (2019a) characterizes Nepal as a low-income country, with GNI per capita at only 970 US\$ in 2018. About 25 percent of the population is below the poverty line (Devkota, 2016; Haugan, 2019).

Only 17 % of the population lives in urban areas (Choudhary and Patil, 2015). Agriculture employs about 75 per cent of the population and is accordingly the main

industry. Mountains like Annapurna and Mount Everest are great tourist attractions, but the tourism industry had problems during the recent civil war. From 1996 to 2006, Nepal was ravaged by civil war between the communist and government forces (Haugan, 2019). The political conditions in Nepal are stable, but the country remains in a vulnerable situation after the internal conflict. Nepal has seen a positive development since the 2006 peace agreement (Regjeringen, 2020). In the years following the unrest, tourism has recovered, and the sector is growing (Haugan, 2019).

Moreover, Nepal was hit by powerful earthquakes in 2015, that led to massive devastation and large parts of the country were affected. As a result, parts of the country are unavailable. The biggest problems are connected to poor infrastructure and transport security and during the monsoon period there is a risk of landslides (Regjeringen, 2020). Clearly the country needs economic development, and it faces some challenges. In recent years, Nepal has enjoyed some economic growth, but the growth is largely due to remittances from Nepalese working abroad (Haugan, 2019).

Entrepreneurship, or the creation of new businesses (Low and MacMillan, 1988), would be an important contribution to economic development in Nepal (Karki, 2007). But Nepal is not an easy country to make a business in. Firstly, Nepalese have little knowledge about entrepreneurship (Karki, 2007). Secondly, Nepalese are, to a small extent, economic active through paid work and investments (Karki, 2007). And thirdly, in the World Bank's index "Ease of doing business", Nepal is ranked 94 out of 190 countries (World Bank, 2019b). Even though, Nepal's ranking is improved from 2010, when Nepal was no. 116 out of 183 countries, this indicates that the Nepalese Government should take measures to improve the environment for entrepreneurship (Karki, 2010). The biggest difficulties were found within these areas: Starting a business (no. 135 out of 190 countries), getting electricity (135/190), paying taxes (175/190), enforcing contracts (151/190). Especially, the procedures of registering a company in Nepal, and the costs of this registration, pose problems for entrepreneurs in Nepal. On average, it took 22.5 days to register a company in Nepal, compared to 0.5 days in New Zealand. The cost of registering a company in Nepal was 20% of income per capita per year, compared to 8% among countries in South East Asia altogether (World Bank, 2019b). Chalise (2014) writes that entrepreneurship has played a small role in economic development in Nepal the last decades. Investments are to a small extent put into productive sectors.

National or regional culture might have influence on individual attitudes towards entrepreneurship and entrepreneurial intentions (Fayolle and Liñán, 2014). Hofstede Insights (2020) has data on national cultures in many countries. Culture is measured in six dimensions: Power distance (high-low), individualism (vs. collectivism), masculinity (vs. femininity), uncertainty avoidance (strong-weak), long term orientation (vs. short term) and indulgence (vs. restraint). According to Hofstede Insights (2020) Nepal has the following scores for national culture (scale 1-100):

- Power Distance: 65/100
- Individualism: 30/100
- Masculinity: 40/100
- Uncertainty Avoidance: 40/100
- Long Term Orientation: NA

- Indulgence: NA

This means that Nepal is a hierarchical, collectivistic, feminine society, and people are not unwilling to take risks. Risk taking behavior is associated with a “high degree of acceptance for new ideas, innovative products and a willingness to try something new or different, whether it pertains to technology, business practices, or food” (Hofstede Insights, 2020). Along with a young population and rich resources, this is promising for future entrepreneurial behavior.

But, as we have seen, Nepal has a lot of problems like low economic growth, high degree of poverty, underdeveloped infrastructure, and relatively high production costs (Karki, 2007). In a way, Nepal is “trapped” between India and China, which both have rapid economic development (Karki, 2007). Karki (2007) suggests the establishing of Governmental programs for entrepreneurship to reduce poverty and create economic development.

Boosting entrepreneurial motivation among youths can help develop entrepreneurship and economic growth. Entrepreneurial development can also be an important strategy to address unemployment and hence increase attractiveness of rural and marginalized communities. Rigorous research may help identify important measures (at policy, local and individual level) to address those problems. This helps to improve living standard and welfare of rural and marginalized people by developing and enhancing sources of livelihood and increasing competitiveness. Though entrepreneurship is a highly researched topic (cf., e.g., Drost and McGuire, 2011; Kickul and Gundry, 2002; Kolvereid, 1996a,1996b; Linan, 2008; Nesse and Bhatta, 2017; Pruett, Shinnar, Toney, Llopis and Fox, 2009; Van Auken, Fry and Stephens, 2006), rural entrepreneurial ecosystem and its consequences, particularly in developing countries, have not received the same attention of researchers. One of the objectives of this study is therefore to bridge this research gap by investigating and assessing antecedents underlying entrepreneurial motivation among youths in developing countries.

Supporting entrepreneurship is an important part of national politics for economic development. It will be useful for decision makers at different levels and different areas to know more about the antecedents of entrepreneurial intentions (EI). Accordingly, our intention in this study is to map the determinants behind entrepreneurial intentions among youth in a developing country, Nepal. We have put forward the following research questions:

1. What are the antecedents of entrepreneurial intentions among youth in Nepal?
2. What are the educational policy implications of these results?

The main aim of this paper is to investigate the relationship between youth’s EI on one hand, and contextual and individual factors of entrepreneurship on the other hand in a developing country. This study contributes to the entrepreneurial intentions literature by improving our understanding of entrepreneurial intentions among youths in a country with a significant agricultural sector dominated by peasantry and small-scale farming, but on the path to industrialization and to reach a modern service sector. Our

findings could provide policymakers and entrepreneurship educators with more insight into the formative process of EI.

We have organized the remainder of the paper as follows: We present and discuss the relevant literature in Section 2 and describe the methodology in Section 3. In Section 4 we present the results and discuss these findings. Finally, we draw conclusions and discuss the implications for policy makers.

## **2. Literature review**

In this section, we will first present some studies on entrepreneurship in Nepal, and thereafter our theoretical framework.

### **Studies on entrepreneurship in Nepal**

Karki (2007) investigated SME's contribution in a national context, and the degree of economic activity (through paid employment and investments) among Nepalese. It is a descriptive study based on public statistics (secondary data). He found 180.000 SMEs with 1.5 million employees. These SMEs have some significance regarding employment and economic development. Most of the SMEs were registered in central areas. So, Karki (2007) suggests that the Government should take action to increase entrepreneurship in peripheral regions. Moreover, Karki (2007) found that there were relatively few economic active persons in Nepal. 60% of men, and 40% of women, were economic active. This number was decreasing for men and increasing for women. Therefore, Karki (2007) underlined the need for Governmental programs for entrepreneurship to reduce poverty and create economic development.

As mentioned in the introduction, most of the economic growth in Nepal is due to remittances from Nepalese in other countries (Haugan, 2019). It could therefore be interesting to find the economic contribution of migrants returning to Nepal. Devkota (2016) conducted such an investigation among 275 migrants that had returned to Nepal. The main results from Devkota (2016) can be summed up in three points:

1. The remittance money was to a small extent used for business investments. Just 4.4% av the money was used for this purpose. Instead, the money was used for housebuilding and consumption.
2. The following factors are determining the probability of return migrants becoming entrepreneurs: Education level (higher education, higher investment), overseas saving (higher saving, higher investment), returned time period (long period, more investments), and family size (bigger family, more investments).
3. Investment barriers in the Nepalese economy from the return migrants' point of view was: Power shortage, frequent strikes, unclear investment policy and an inefficient bureaucratic system.

Devkota (2016) advised the Government to take measures to direct the remittance money to more productive use – that is, to support green innovation and

entrepreneurship within the energy sector. This should increase local/national welfare and reduce dependency of other countries.

Choudhary and Patil (2015) discusses the opportunities for green entrepreneurship within the energy sector in Nepal. The discussion is based on secondary data. Green entrepreneurship means start-ups of companies within sustainable production of electricity, like hydropower, sun power, wind power, etc.

Nepal is to a great extent dependent on other countries for energy supplies, either through import of fossil fuels or of technology for building and running hydropower stations. Thus, it should be room for entrepreneurship and innovation within this sector in Nepal, to reduce the foreign dependence and to increase local welfare. But this requires more initiatives from the Government. Choudhary and Patil (2015) suggest that government reduces support to import of energy and increase the support to local/national entrepreneurship and innovation within the energy sector. In the long run, this will create less dependence of foreign supplies, and increase local welfare. The authors think that young people might be attracted to opportunities within green entrepreneurship. The greatest possibilities for green entrepreneurship are within energy, agriculture and recycling (Choudhary and Patil, 2015).

Traditionally, hydropower has been a national (state) responsibility in Nepal. In later years, private initiatives have been welcomed. There are also programs for Public-Private-Partnership. This opens for more of green entrepreneurship. Many of the projects are small, like micro and pico hydropower plants. In rural areas with lack of electricity and infrastructure, solar power seems to be the best solution. Biogas and wind power are also possible alternatives (Choudhary and Patil, 2015).

Pant (2015) studied the impact of family in the individual's choice of entrepreneurship as a career in Nepal through questionnaires to 225 entrepreneurs in Kathmandu (capital city) and Pokhara (major tourist destination). Traditionally in Asia, the family has been important in the start-up and running of businesses, so the impact of family is worth studying closer. Also note that in Nepal, living in a joint family is still quite common (compared to nuclear family). The main results from Pant's (2015) investigation:

- The impact of family type: Over ½ of the entrepreneurs lived in a nuclear family. The responsibility for serving one's family can be a motivation for entrepreneurship. About 1/3 lived in a joint family. The entrepreneurs had received support from their families to establish and run their businesses. Both types of family were relevant, but statistically spoken, no family type was more important than the other to motivate for entrepreneurship.
- The impact of parents: The parents of the entrepreneurs were found in these sectors: Business (28%), public and private service (26%) and agriculture (41%). Compared to the national average, this means that business and service are over-represented, and agriculture under-represented among the parents. Mind that agriculture in Nepal mostly is at subsistence level and should not be classified as self-employed business of entrepreneurial character. Only the father's profession has significant impact on the entrepreneur's career choice. Having a father within business or service increased the probability of becoming an entrepreneur. However, also the fathers that were farmers had encouraged

their children to become entrepreneurs. The mothers were mostly housewives (70%) or farmers (24%), and the mother's profession had no significant impact on the entrepreneur's career choice. But the mothers had also encouraged their children to be entrepreneurs, probably in a hope that their children could get a better life.

- Inspiration to become an entrepreneur: For male entrepreneurs, it was clearly the father who inspired the most. And for the female entrepreneurs, support from the husband was the most important, and the father was the second most important inspirator.

There is little information on problems encountered by women entrepreneurs in Nepal. Bushell (2008) gives a picture of the current situation (2008) for female entrepreneurs in Nepal, and put forward some measures for better policy in this matter.

The number of women entrepreneurs in Nepal is difficult to estimate because of insufficient statistics and lack of gender specific data. Bushell (2008) refers to these numbers from Nepal Labour Survey in 2000 and Central Bureau of Statistics in 2003:

- Of 9.5 million people working in Nepal, only 1.5 million got paid
- Of those with paid work, only 400.000 were women
- Of the 400.000 women with paid work, 82% were self-employed and 12% employed by others. Corresponding numbers for men were 69% and 27%
- Businesses run by women earns 2/3 of men's businesses, and women worked 3-4 hours more each day because of responsibilities at home in addition to running the business. Women's businesses are mostly small, with few employees, and with little professional assistance.

To get more data on female entrepreneurship in Nepal, Bushell (2008) conducted in-depth interviews with 15 women in the age range 23-62. The average years in business was 8.5. Geographic area was in and near Kathmandu – mostly urban areas. Main results from Bushell (2008):

1. Access to finance and respect: Women have the same rights to borrow money as men. But because of unequal ability to acquire security, men get loans easier than women. Security is often land or property. Laws for equal inheritance rights are not well known, so women have little property to show for themselves. In addition, several of the businesswomen report that both customers and husbands show little respect for their competence. Women entrepreneurs also like to see more public support and a better policy for entrepreneurship in Nepal.
2. Access to formal education: Even if education and training of women in Nepal has priority, women have on average lower education than men. Literacy rate for women/men: 60/80. Obviously, better education is needed to support women entrepreneurship.
3. Access to networks and markets: Businesswomen's networks are small and contain mostly family and friends. The women call for more support to build networks and to participate at trade fairs. This would give them new contacts

and better knowledge of market development. Trade organizations are dominated by men who do not welcome women as members.

All in all, the Bushell (2008) calls for a program to create a women entrepreneurship culture in Nepal. The following points are suggested to be integrated in the program:

- Information about women's rights to all relevant parties (right to inheritance, right to borrow money)
- Encourage entrepreneurship through early education
- Better training of skills and of leadership
- Develop entrepreneurial networks for women. In addition, reliable access to electricity and internet.
- Greater visibility for women entrepreneurs (prices, in media, etc.). This will create respect and role models. To have women in leading positions in society is also important in this respect.

In the literature, we have found some interesting cases that show possibilities for entrepreneurship in Nepal. In the following we will present three cases: The village Manang, the OVOP-program and examples from the readymade garment industry.

Morimoto and Chapagain (2014) describe the impact of entrepreneurship within the tourism industry in the Himalayan village Manang, located in the North of Central Nepal, by the Annapurna Massif. Mount Everest is in North East Nepal. In fact, more tourists visit the Annapurna Massif than the Mount Everest area. In short, the article shows how a peripheral village in Himalaya can earn money from tourists through entrepreneurship and innovation. The village could thus serve as a role model for other communities in Nepal.

Datasources for Morimoto and Chapagain (2014) is interviews with villagers of Manang and staff in relevant organizations both in Manang and Kathmandu.

From the 1960s on, people from Manang showed entrepreneurship through international trade. The most successful ones took their businesses to Kathmandu and invested in property. During the 1990s, these people saw potential in the tourism industry both in Manang and Kathmandu. Due to higher competition in trading, they switched their main business area from trading to tourism. This explains why finance capital could be available. Rogers (2004) describes how a villager borrowed money from a relative in Kathmandu to develop his hotel business. A peripheral village like Manang lacked most of the infrastructure needed to meet the demand from tourists. To develop their services, the villagers showed both innovativeness and entrepreneurship. Many new hotels were built near the village, to keep the old village untouched. Due to difficulties in getting supplies into the village, small power plants were built (solar and hydropower), greenhouses were built to grow vegetables and herbs, they had to learn to make breads, etc. Internet connection as well had to be established (Morimoto and Chapagain, 2014).

The dilemmas connected to this modernization are also discussed by Morimoto and Chapagain (2014). Tourists searching for something original, might want to visit other

and more remote places than Manang. And even if plans for a new road from Kathmandu to Manang are welcomed by some who think they can earn even more; others are afraid that big new groups of tourists organized from Kathmandu will use less of the local services.

What are the success factors for business in peripheral regions of Nepal? In his literature review, Rogers (2004) found the following factors to be crucial:

- Commercial opportunities (from geographical location, ecological environment, government sanctioned privileges, market and infrastructure development)
- A culture that encourages entrepreneurship
- Access to finance capital
- Lack of business hindering restrictions (lack of external control and expropriations)

In his own studies in Manang, Rogers (2004) found explanatory factors for economic success that corresponded well with those found in the literature review. But in addition, he made an important discovery: A special advantage developed by the villagers of Manang and the villagers that had moved to Kathmandu, was a social system of economic cooperation. Through this network they helped each other to establish new businesses, with financing, by controlling prices, by controlling access to the attractions, etc. But such a social system builds on mutual trust, which easily can be broken down. Rogers (2004) mentions a price war among the hotels in Manang as an example.

Karki (2010) presents the OVOP (One Village One Product) program, which seems to be a success. The idea of OVOP stems from Japan, and has spread to other countries in Asia, like China, Thailand and Nepal. OVOP is based on three principles:

1. Think Globally Act Locally
2. Self-reliance and creativity
3. Human Resource Development

In other words, OVOP is a bottom-up-strategy, based on local initiatives and resources. OVOP is used with some success in 11 districts in Nepal, and the article advises the Government to continue with supporting OVOP and similar initiatives. The products from the OVOP program in Nepal is within agriculture, fishing and agro-tourism.

Shakya (2008) studied three cases from the readymade garment industry in Nepal. She shows how cultural background has impact on capacity to respond to crises in an effective way. Different castes or ethnicities respond differently, with different consequences. The readymade garment industry was established in 1974, and faced two severe crises from 2000 on, due to international quota politics and a local Maoist uprising. These crises were met by different responses from different castes/ethnic groups.



The author used open, participating observation through unpaid work in three different factories. This means that her role as researcher was known to other workers, and to managers and owners. Through her field work, Shakya (2008) gained trust from workers, managers and owners, and was able to collect rich data through observation and informal conversations and interviews. Two of the cases were niche producers, and one was mass producer. Table 1 shows the cases, type of production, castes and the responses.

**Table 1 Three cases from the garment industry**

Cases	Type of production	Elite caste/ ethnicity	Response to crises
Rongoli	Niche (specialized) production	Hindu Marwaris (old entrepreneurs)	Resilient, stable and sustainable
Swakan-Chhemu	Niche (specialized) production	Buddhist Newars (old entrepreneurs)	Resilient, stable and sustainable
Arya Nepal	Mass (homogenous) production	Bahun-Chhetris (new entrepreneurs)	Unable to adapt, collapsed

The niche producers were better able to respond to the crises than the mass producer. Contrary to the mass producer, the niche producers managed to link their products to their traditional culture in a way that created interest and uniqueness in the international market. The niche producers were also better able to capitalize on their built-up cultural and social capital (as defined by Bourdieu, 1986). Shakya (2008) explains:

Bahun-Chhetris, the new business elites who had recently joined the industry aided by newly acquired finance, knowledge and skills, could only produce homogenous garments which could not survive the local and global crises (Shakya, 2008, p. 2). ...

Marwaris and Buddhist Newars, the old business elites with differing political and cultural legacies, went on to produce specialized garments and successfully capture secure and profitable market niches. They achieved this either by using the material knowledge and networks accumulated over generations, or by invoking their cultural identities to legitimise their authority over the semiotics used to distinguish their products (Shakya, 2008, p. 2).

A possible implication of Shakya's (2008) findings is that entrepreneurial training and policy in Nepal must take different cultural backgrounds into account. All in all, the case studies we have referred to above, show positive possibilities for entrepreneurship in Nepal.

### **Theoretical framework**

Our theoretical framework has been used several times before, e.g. Nesse (2010), Nesse, Årethun and Håvold (2015), Årethun, Nesse, Kolosta, Flaska and Håvold (2019). We will therefore give a shorter version here. Entrepreneurial intentions (EI) is defined as the commitment to start a new business (Krueger, 1993). Several scholars emphasize the importance of EI as a first step towards starting a business (Bird, 1988;

Krueger and Carsrud, 1993). Entrepreneurship is a process from vague ideas to establishing and running a new business (Bygrave, 2004). There are two main groups of factors that have an impact on this process: *contextual and individual factors* (Mazzarol, Volery, Doss and Thein, 1999; Nesse, 2010).

This paper investigates two main groups of contextual factors: *Cultural capital* and *social capital*, as defined by Bourdieu (1986). There are three types of cultural capital: incorporated, objectified and institutionalized (Bourdieu, 1986). In our study, the first type is the most relevant. According to Bourdieu (1986), incorporated cultural capital is a result of an individual's socialization process, that is knowledge and attitudes developed over a long time period. This knowledge can be acquired through formal education, informal training, personal experience, expert advice, and imitation of "best practice" in a field (Aldrich, 1999). All these ways of creating and sharing knowledge are of course very important for entrepreneurs.

Having parents as role models is a simple and convenient way of measuring cultural capital for entrepreneurship. Family businesses may help facilitate a successful venture and to provide access to essential business resources (Zellweger, Sieger and Halter, 2011) and provides insight into entrepreneurial activities and decision-making processes (Mueller, 2006), which makes it easier to move from intention to action because individuals bearing such knowledge will be less afraid of a possible failure (Shirokova, Osiyevskyy and Bogatyreva, 2016). There are several studies from different countries that show that having self-employed parents (one or both) increases the probability of becoming an entrepreneur (Goel, Vohra, Zhang and Arora, 2007; Greve and Salaff, 2003; Mazzarol et al., 1999; Nesse, 2010; Nesse, Årethun and Håvold, 2015; Spilling, 1998; Wang and Wong, 2004).

With nearly identical results from very different cultures, it appears that parents with experience in running their own businesses transfer competence regarding entrepreneurship to their children. This can be understood as incorporated cultural capital for entrepreneurship in these families. On the other hand, Kim, Aldrich and Keister (2006) did not find any correlation between cultural capital operationalized as entrepreneurial parents, and EI. Laspita, Breugst, Hebllich and Patzelt (2012) found that the impact of entrepreneurial parents and grandparents on offspring's EI is not the same across families and nations; the influences are particularly strong in cultures with high in-group collectivism.

Social capital and social networks are two of the most important concepts within social sciences (Leenders and Gabbay, 1999; Lin, Cook and Burt, 2001). We can define social capital as the ability to mobilize complementary resources through social networks (Bourdieu, 1986; Coleman, 1988; Greve, 2000). To entrepreneurs, the point is to use social networks to mobilize resources that facilitate the founding and running of a new enterprise (Greve, 2000). Social networks may be used to access information, knowledge, financial capital and other resources. To put it succinctly, social capital is the value of one's contacts. A person has social capital if he/she, by exploiting relationships with others, can implement something that would be impossible without these relationships or could be possible only with much greater effort (Field, 2003).

The significance of social networks in entrepreneurship has been a topic in many studies, as described by e.g. Aldrich and Ruef (2006), Greve (2000) and Johannison (2000). It is obvious that people with close connections to central actors have more influence than others (Freeman, Borgatti and White, 1991). However, indirect contacts through professionals or more serendipitous channels can play an important role as well (Burt 1992; 2000; Freeman, 1977; Granovetter, 1973; 1974). Aldrich and Whetten (1981) and Aldrich and Zimmer (1986) related this knowledge to entrepreneurship by showing how contact with entrepreneurs will give access to information and resources that increases the ability to start-up a new company. Knowing entrepreneurs and gaining support for a business idea in your network, seem to have positive impact on EI (Langowitz and Minniti, 2007; Liñán and Santos, 2007). Support from family and friends is also an important part of social capital for entrepreneurship. Individuals perceiving support from their relatives and social contacts are more likely to convert their EI into start-up activities (Zanakis, Renko and Bullough, 2012).

Regarding individual factors, we use *gender, career anchors and proactive personality* as the main antecedents of EI. The Global Entrepreneurship Monitor (GEM) studies maps entrepreneurship in about 50 countries every year. The main results regarding gender and entrepreneurship, is that male entrepreneurs are more common than female. But there are some countries with a good gender balance, e.g. Madagascar and Oman in Afrika, Brazil in South America and Saudi Arabia in the Middle East (Bosma, Hill, Ionescu-Somers, Kelley, Levie and Tarnawa, 2020). Male dominance in entrepreneurship is confirmed in many studies (Nesse, 2010; Zhao, Seibert and Hills, 2005). The reasons for this have been connected to personal attitudes and perceived behavioral control (Maes, Leroy and Sels, 2014) and lack of self-confidence and lack of role models (Minniti, Arenius and Langowitz, 2005).

Schein (1990, p. 1) defines a person's career anchor as "a combination of perceived areas of competence, motives, and values that you would not give up; it represents your real self". Career anchors mirror our perception of ourselves and will affect how we evaluate different career alternatives. Schein (1975) originally found five such career anchors: managerial competence, technical-functional competence, need for security, need for creativity, and need for autonomy or independence. Later, he presented three additional career anchors: dedication to a cause, pure challenge, and lifestyle (Schein, 1990). In this paper we test correlations between the five original career anchors and Nepalese youth's EI.

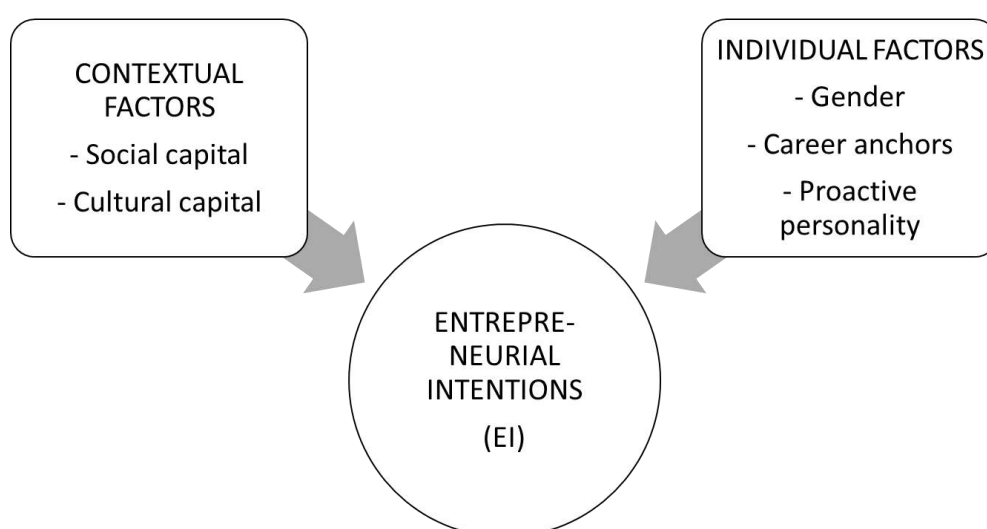
Bateman and Crant (1993) elaborated the concept of proactive personality (PAP) and defined the concept as "the relatively stable tendency to effect environmental change" (p. 103). Proactive people are those who do not blame circumstances, conditions, or conditioning for their behavior (Covey, 2004). Their behavior is a product of their own conscious choice, based on values, rather than a product of their conditions. Proactive behavior is intended to identify differences among people to the extent in which they take action to influence their environments. Proactive people are seeking out opportunities, showing initiative, and are persistent in order to bring about meaningful changes. At the other end of the line we find individuals who typically fails to show initiative and is less likely to change their environment (Covey, 2004).

There is a line of research linking proactive personality to entrepreneurial activities (Becherer and Maurer, 1999; Crant, 1996; Frank, Lueger and Korunka, 2007; Kickul

and Gundry, 2002; Luthje and Franke, 2003). Therefore, we should expect a positive correlation between PAP and EI also in our investigation.

### 3. Data and methodology

The aim of this survey is to investigate the antecedents of entrepreneurial intentions of Nepalese youth. A regression analysis was conducted to single out the most prominent factors affecting entrepreneurial intentions among young Nepalese. In addition, we used t-tests and bivariate analysis where such methods provided important supplementary information. In questions where “don’t know” was a response category, this category was removed from our analyses.



**Figure 1. Theoretical model of this study**

Data was sampled by a survey conducted in Nepal during the period January – February 2018. Graduate students in Business Administration at Kings College, Kathmandu, conducted the field survey. In close cooperation with the schools’ management and the teachers, a structured questionnaire was distributed in class to students at the upper secondary level. All students attending school on that particular day filled in the questionnaire. Seven different high schools in each of Nepal’s seven provinces was selected. 589 students responded.

Based on a literature study we constructed a model connecting EI with contextual and individual factors illustrated in figure 1. We apply a construct of EI as the dependent variable, as shown in Table 2. Three of the four items were measured by a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The last item was measured by a four-point scale from 1 (“strongly disagree”) to 4 (“strongly agree”). Finally, the items were aggregated into EI score, which served as our dependent variable. EI-values varies from 4 to 19. The EI construct is an indicator of an

individual's intentions to establish an enterprise, since most of the respondents, who is high school students, have not yet taken any action to start a new enterprise.

A factor analyses was completed to check for internal validity between the four items constituting EI, while Cronbach's alpha was applied as the reliability test. The criteria for choosing items in factor analysis are (Adelson and McCoach, 2011; Pallant, 2011):

- (a) the coefficient is at least 0.4
- (b) the pattern coefficient for non-relevant factors is less than 0.3
- (c) the pattern coefficient for non-relevant factors is 0.2 or less than the value of the relevant factor
- (d) the Cronbach's alpha is above 0.70.

The factor analysis showed that the four items only contained one common factor with eigenvalue greater than 1. The value of the Kaiser-Mayer-Olkin (KMO) of sampling adequacy was 0.616, just above the minimum value of 0.6 (Braeken and Assen, 2016). A screeplot confirmed the low KMO-value, forming a smooth rather than a disruptive transition moving from the first to the second common factor.

Cronbach's alpha, however, was 0.463, which is significantly below the minimum value recommended by Adelson and McCoach (2011).

The analyses have two main groups of independent variables: Contextual and individual factors. Contextual factors consist of cultural capital and social capital, and the individual factors include gender, career anchors and proactive personality. Table 3 illustrates these variables and their definitions.

*Cultural and social capital.* The profession of the respondents' parents is used as an indicator for cultural capital while respondent's expectations regarding receiving support from family and friends if they start their own business, are used as one of the proxies for social capital. Role models are considered as being part of the social capital concept as well. There is an important difference between cultural and social capital. Cultural capital is the values and attitudes gained from one's family, while social capital is the possibility of mobilizing resources from a society to attain ones' goals (Bourdieu, 1986; Coleman 1988).

**Table 2. The EI Construct**

<b>Items</b>	<b>Scale</b>	<b>Items values</b>
Item 1: It is better to have your own company than to work for others	5 point ordinal scale	1 = strongly disagree 5 = strongly agree
Item 2: I would start my own company even if the chances of economic losses were considerable	5 point ordinal scale	1 = strongly disagree 5 = strongly agree
Item 3: Having your own company involves a lifestyle that suits me well	5 point ordinal scale	1 = strongly disagree 5 = strongly agree
Item 4: Wish to operate your own company	4 point ordinal scale	1 = strongly disagree 4 = strongly agree
Entrepreneurial Intentions (EI)	Sum of the 4 items above, ranging from 4-19	For use in regression analysis

**Table 3. Contextual and individual factors as independent variables: definitions and types of variables**

Variable	Definition	Variable type
<b>Contextual factors</b>		
<i>Self-employed parents</i>	1 = having at least one of the parents self-employed or owning a business, 0 = otherwise	Binary
<i>Relatives as role model</i>	1 = respondent having relatives owning a business, 0 = otherwise	Binary
Friends as role models	1 = respondent having friends owning a business, 0 = otherwise	Binary
Other role models	1 = respondent knowing others owning a business, 0 = otherwise	Binary
Perceived support	Perceived support from friends/relatives to start an enterprise	5 point ordinal scale, ranging from 1 = "very little" to 5 = "very much"
<b>Individual factors</b>		
Gender	1 = female, 0 = otherwise	Binary
<i>Leadership</i>	Wishing to become a leader	4 point ordinal scale, ranging from 1 = "very unimportant" to 4 = "very important" for the career choice
<i>Autonomy</i>	Favoring independence	

<i>Creative</i>	Motivated to create something new	4 point ordinal scale, ranging from 1 = “very unimportant” to 4 = “very important” for the career choice	
<i>Security</i>	Favoring a secure life situation		
<i>Technical-functional competence</i>	Having a scientific or academic interest		
<i>Proactive personality (PAP)</i>	I enjoy facing and overcoming obstacles to my ideas	Each item has a 5 point scale, from 1 = “disagree completely” to 5 = “agree completely”	
	Nothing is more exciting than seeing my ideas turn into reality		
	I excel at identifying opportunities		PAP = Sum of the 5 items, ranging from 5 – 25
	I love to challenge the status quo		
	I can spot a good opportunity long before others can		

*Career anchors.* Schein’s (1975) five original career anchors were included in the model based on questions on how important these factors were in the respondents’ career decisions: desire to become a leader, autonomy, creativity, security, and having scientific or academic interests, as shown in table 3.

*Proactive personality.* The five items suggested by Kickul and Gundry (2002) are included in the PAP construct. These items are shown in table 3.

We performed similar validity and reliability tests for items connected to proactive personality as we did for entrepreneurial intentions. The value of the Kaiser-Meyer-Olkin (KMO) was 0.681, while the value of Cronbach’s alpha was 0.549, well below the minimum value of 0.7.

Both the EI- and the PAP-construct had values of internal consistency, measured by Cronbach’s alpha, that is well below the recommendations in the literature. This could result in biased estimates of the coefficients linking EI and its antecedents and a larger



standard error on these estimates. There were no particular items sticking out and the internal consistency was not improved by excluding some items.

A multiple of papers applying similar constructs in US, UK, Norway and Slovakia (Aldrich and Ruef, 2006; Low and MacMillan, 1988; Årethun et al., 2019) have proven to work well.

## 4. Results and discussion

### Results

The results are shown in Table 4.

**Table 4. Antecedents for Entrepreneurial Intentions (dependent variable is EI)**

Independent variables	Est. B <sup>a</sup>	t-stat	p-value
	(Constant)	0.975	7.064
	Est. β <sup>b</sup>		
Parents self-employed	0.069	1.804	0,072
Other relatives owning enterprise	0.037	0.901	0,368
Friends owning enterprise	0.020	0.482	0,630
Others owning enterprise	0.049	1.222	0,222
Support from family and friends	0.203	5.200	0,000
Gender	-0.075	-1.886	0,060
Leadership	0.121	3.011	0,003
Autonomy	0.132	3.274	0,001
Creativity	0.000	0.005	0,996
Security	-0.084	-2.109	0,035
Technical-functional competence	0.058	1.487	0,138
Proactive personality	0.203	4.844	0,000
Adjusted R <sup>2</sup>		0.183	
N		589	

<sup>a</sup> Unstandardized <sup>b</sup> Standardized

The regression model has an overall explanatory power of 18.3 % (Table 4). There are four important antecedents with a large and significant, positive impact on EI among Nepalese youths:

- Support from family and friends (contextual factor, indicator for social capital)
- Wish for autonomy as a career anchor (individual factor)
- Leadership ambitions as a career anchor (individual factor)
- Proactive personality (individual factor)

One career anchor, wish for security, has a negative impact on EI.

Anticipated moral support, financial funding, guidance or advisory support from family or friends has a major impact on EI. A desire for leadership and living an autonomous life could be realized thru starting and managing your own firm. In addition, Nepalese youth carrying a proactive personality tend to have an EI above average.

The desire for security is negatively correlated to EI, while gender had no effect on EI at a 5 %-level. At a 10 %-level, however, we observe that boys have higher EI than girls. Moreover, at 10 %-level, having self-employed parents has a positive impact on EI. But relations at 10 %-level might be considered as dubious.

## **Discussion**

Neither cultural capital, i.e. having parents who are self-employed, nor having role models, like family and friends who have become self-employed, are significant antecedents to EI among youths in Nepal. A possible reason for this is that the bulk of Nepalese entrepreneurial activities are necessity-driven, mainly caused by high unemployment and low salaries among blue-color workers. These financial incentives probably dominate cultural, entrepreneurial heritage and role models as important determinants for youth's EI. In addition, most Nepalese youths in our study have at least one self-employed parent or other relatives who run their own business, making it hard to statistically separate the small group with no self-employed parents.

This result is in line with Kim et al. (2006) who did not find any correlation between cultural capital and business start-ups. On the other hand, studies conducted by a multiple of other researchers (Altinay, Madanoglu, Daniele, and Lashley, 2012; Espiritu-Olmos and Sastre-Castillo, 2015; Greve and Salaff, 2003; Mazzarol et al., 1999) found that transfer of cultural capital from parents to children is an important antecedent for youth's EI. However, neither of these studies were conducted in a less-developed country.

Not having role models as a significant antecedent for Nepalese youth's EI, is not in line with findings of Langowitz and Minniti (2007), and Liñán and Santos (2007). However, Degeorge and Fayolle (2008) did not find any correlation between EI and having an entrepreneur as a close relative.

Social capital in the form of perceived support from family and friends, on the other hand, has significant impact on EI (as also found by Nesse, 2010; Nesse et al., 2015;

Årethun et al., 2019). Nepalese students, like students in many countries, receive a significant amount of financial support from their families when studying. During their lifespan, a dominant aspect of a children-nuclear/large family relationship in Nepal, is reciprocal financial and social support. Financial support from parents and/or the extended family while studying is reflected by a financial and social support from the young generation to their parents and other family members when they get old and are unable to provide for themselves. These tight links make perceived support from family when starting your own business very important (Pant, 2015).

There is no significant gender difference, at least at 5%-level, in youth's EI. 82% of Nepalese women with paid work, are self-employed compared to 69% of their male counterparts (Bushell, 2008), which makes it self-evident for many young females to enter into the labor force as self-employed.

Two out of five career anchors, leadership and autonomy, have a positive impact on EI. Those who place special emphasis on becoming a leader have a higher EI than others. Nepalese youths connect leadership to the activity of leading your own business, and they link leadership to high income. Starting your own business could be an option for leaving a predetermined carrier as a farmer or a peasant. Gaining autonomy through entrepreneurship is a credible alternative to a future carrier as a low-paid clerk or as a farm laborer. Youths who prefer security, have an EI significantly below average. The negative correlation between preferences for security and EI is in line with and Nesse et al. (2015). Nesse (2010) and Årethun et al. (2019) found that especially young women in Norway had a negative correlation between wish for security and EI. Since Nepal is a feminine society (Hofstede Insights, 2020), could it be that this triggers a mechanism that makes preference for security a barrier against entrepreneurship? Hofstede points out that the Nepalese society has some hallmarks indicating that Nepal has a risk-taking population. This is not in line with our findings.

An individual with high scores on proactive personality (PAP) is a person who takes initiatives to get things done, who does not wait for others. He/she is in favor of changes and is eager to try out new gadgets, new technology and new social environments. These attitudes, trying out new ideas and possibilities, are positively linked to EI and nascent plans to start your own business. This is in line with findings by Becherer and Maurer (1999), Brandstätter (2011), Crant (1996), Kautonen, Hatak, Kibler and Wainwright (2015), Kickul and Gundry (2002), Luthje and Franke (2003), and Shirokova et al. (2016).

## **5. Conclusions and implications for educational policy**

Living an autonomous life, having leadership ambitions and putting a low priority on living a secure life are all career anchors that will increase a Nepalese youth's propensity to become an entrepreneur. This is also the case for youths who perceive support from family and friends and carrying a proactive personality. The insignificant correlation between role models, i.e. having friends, acquaintances or other relatives than your own parents as entrepreneurs, on one hand and proactive personality on the other hand, is probably caused by a necessity-driven EI where financial motives for self-employment dominate entrepreneurial influence through their social relations.

The overall implications of these results for education policy makers in Nepal is to build leadership ambitions, encourage autonomous choice of future career path and reduce financial and mental barriers among Nepalese youths by providing financial support and entrepreneurial guidance and training. The results presented here highlight two areas regarding entrepreneurship education conducted by schools in Nepal:

- They should motivate young people, and particularly young women, in entrepreneurship through supporting and building leadership ambitions (also suggested by Bushell, 2008; Liñán, 2008; Rogers, 2014) and proactive abilities (also suggested by Årethun et al., 2019).
- They should motivate young people in entrepreneurship through supporting and building up a desire for autonomy.

Our findings may equip educators with tools to better understand their students' entrepreneurial motivations, and thus provide better training and entrepreneurial self-efficacy to Nepalese youth. Coaching techniques may effectively encourage such student motivation (Espíritu-Olmos and Sastre-Castillo, 2015). Elert, Andersson and Wennberg (2015) found that participation in a Junior Achievement Company Program increased the long-term probability of starting a firm among Swedish high school students.

The analyses conducted in this paper are based on a quantitative dataset for the purpose of generalization. Even though, the questionnaire has been applied on students and young people in other countries, the dataset seemed to fit the model less well in Nepal than in European countries. This was the case for both the overall model fit in the regression analyses, as well as the low reliability in the factor analyses. A recommendation for further research is to conduct follow-up qualitative studies in Nepal trying to develop hypothesis regarding additional antecedents on EI in developing countries and supplementary dimensions in factors describing EI and PAP. Further quantitative studies, using larger samples may convert some of the independent variables from seemingly insignificant to become significant. In addition, new studies will provide greater insight into the because EI could change over time (Sutton, 1998). Our sample consists of Nepalese youth and the results will partly depend on the cultural and economic conditions in Nepal and can not necessarily be generalized to other developing countries. Therefore, future studies might be conducted in other, developing countries to determine whether our findings can be generalized.

### **Acknowledgement**

The Authors thank Dr. Bharat P. Bhatta, King's College, Katmandu, Nepal for collecting the dataset from Nepal. The Nepalese part of the dataset was gathered in January and February of 2018.

### **References**

Adelson J. L. and McCoach, B. D. (2011). Development and psychometric properties of the math and me survey: Measuring third through sixth graders' attitudes toward

- mathematics. *Measurement and Evaluation in Counseling and Development*, 44(4), 225–247.
- Aldrich H. (1999). *Organizations Evolving*. London: Sage Publications.
- Aldrich H.E. and Ruef M. (2006). *Organizations Evolving* (2nd ed.). London: Sage Publications.
- Aldrich H.E. and Whetten D.A. (1981). Organization-Sets, Action-Sets, and Networks: Making the Most of Simplicity, in Nystrom P.C. and Starbuck W.H. (Eds.), *Handbook of Organizational Design*. Oxford: Oxford University Press, pp. 385-408.
- Aldrich H.E. and Zimmer C. (1986). Entrepreneurship through Social Networks, in Sexton D. and Smilor R. (Eds.), *The Art and Science of Entrepreneurship*. Cambridge: Ballinger, pp. 3-23.
- Altinay L., Madanoglu, M. Daniele, R., and Lashley, C. (2012). The Influence of Family Tradition and Psychological Traits on Entrepreneurial Intention. *International Journal of Hospitality Management*, 31(2), pp. 489– 499.
- Bao H. and Peng Y. (2016). Effect of Land Expropriation on Land-lost Farmers' Entrepreneurial Action: A Case Study of Zhejiang Province. *Habitat International*, 53, pp. 342-349
- Bateman T.S. and Crant J.M. (1993). The Proactive Component of Organizational Behavior: A Measure and Correlates. *Journal of Organizational Behavior*, 14(2), pp. 103-118.
- Becherer R.C. and Maurer J.G. (1999). The Proactive Personality Disposition and Entrepreneurial Behaviour among Small Company Presidents. *Journal of Small Business Management*, 37(1), 28.
- Bird B. (1988). Implementing Entrepreneurial Ideas: The Case for Intention. *Academy of Management Review*, 13(3), pp. 442–453.
- Bosma N., Hill S., Ionescu-Somers A., Kelley D., Levie J. and Tarnawa A. (2020). *Global Entrepreneurship Monitor. 2019/2020 Global Report*. London: Global Entrepreneurship Research Association (GERA), London Business School.
- Bourdieu P. (1986). The Forms of Capital, in Richardson J.G. (Ed.), *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood Press, pp. 241-58.
- Braeken J. and Assen M. A. L. M. (2017). An empirical Kaiser criterion. *Psychological Methods*. 22(3), 450-466. <https://doi.org/10.1037/met0000074>
- Brandstätter H. (2011). Personality Aspects of Entrepreneurship: A Look at Five Meta-analyses. *Personality and Individual Differences*, 51(3), pp. 222-230.
- Burt R.S. (1992). *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press.
- Burt R.S. (2000). The Network Structure of Social Capital, in Staw B.M. and Sutton R.I. (Eds.), *Research in Organizational Behavior*. Amsterdam: JAI, 22, pp. 345-423.
- Bushell B. (2008). Women entrepreneurs in Nepal: What prevents them from leading the sector? *Gender & Development*, 16(3), pp. 549-564.
- Bygrave W.D. (2004). The Entrepreneurial Process, in Bygrave W.D. and Zacharakis A. (Eds.), *The Portable MBA in Entrepreneurship*. Hoboken, NJ: John Wiley & Sons, pp. 1-27.
- Chalise B. (2014). Development of entrepreneurship culture: Great challenge for developing Countries; experience from Nepal. *Procedia - Social and Behavioral Sciences*, 2014. Retrieved January 6<sup>th</sup> 2020 from <https://www.researchgate.net>

- Choudhary S. and Patil N. (2015). Green entrepreneurship: Role of entrepreneurs in energy economics in Nepal. *Annual Research Journal of Symbiosis Centre for Management Studies*, 3(1), pp. 166-175.
- Coleman J.C. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, pp. 95-120.
- Covey S.R. (2004). *The 7 Habits of Highly Effective People*. Englewood Cliffs, NJ: Prentice-Hall.
- Crant J.M. (1996). The Proactive Personality Scale as a Predictor of Entrepreneurial Intentions. *Journal of Small Business Management*, 34(3), pp. 42-49.
- Degeorge J.M. and Fayolle A. (2008). Is Entrepreneurial Intentions Stable Through Time? First Insights from a Sample of French Students. *International Journal of Entrepreneurship and Small Businesses*, 5 (1), pp. 7-27.
- Devkota J. (2016). Do return migrants use remittances for entrepreneurship in Nepal? *Journal of Economics and Development Studies*, 4(2), pp. 90-100.
- Drost E.A and McGuire S.J.J. (2011). Fostering entrepreneurship among Finnish business students: Antecedents of entrepreneurial intent and implications for entrepreneurship education. *International Review of Entrepreneurship*, 9(2), pp. 83-112.
- Elerst N., Andersson F.B. and Wennberg K. (2015). The Impact of Entrepreneurship Education in High School on Long-Term Entrepreneurial Performance. *Journal of Economic Behavior & Organization*, 111, pp. 209–223.
- Espíritu-Olmos R. and Sastre-Castillo M.A. (2015). Personality Traits versus Work Values: Comparing Psychological Theories on Entrepreneurial Intention. *Journal of Business Research*, 68(7), pp. 1595–1598.
- Fayolle A. and Liñán F. (2014). The Future of Research on Entrepreneurial Intentions. *Journal of Business Research*, 67(5), pp. 663–666.
- Field J. (2003). *Social capital*. New York: Routledge.
- Frank H., Lueger M. and Korunka C. (2007). The Significance of Personality in Business Start-Up Intentions, Start-Up Realization and Business Success. *Entrepreneurship & Regional Development*, 19 (3), pp. 227–251
- Freeman L.C. (1977). A Set of Measures of Centrality Based on Betweenness. *Sociometry*, 40, 35-41.
- Freeman L.C., Borgatti S.P. and White D.R. (1991). Centrality in Valued Graphs: A Measure of Betweenness Based on Network Flow. *Social Networks*, 13, pp. 141-154.
- Goel A., Vohra N., Zhang L. and Arora B. (2007). Attitudes of the Youth towards Entrepreneurs and Entrepreneurship: A Cross-Cultural Comparison of India and China. *W.P. No. 2007-01-06*, January 2007. Ahmedabad, India: Indian Institute of Management.
- Granovetter M.S. (1973). Strength of Weak Ties. *American Sociological Review*, 78, pp. 1360-1380.
- Granovetter M.S. (1974). *Getting a Job*. Cambridge, Massachusetts: Harvard University Press.
- Greve A. and Salaff J.W. (2003). Social Networks and Entrepreneurship. *Entrepreneurship Theory & Practice*, 28(1), pp. 1-22.
- Greve A. (2000). Sosial kapital: Hvor står vi i dag? En kommentar til Colemans artikkel. *Magma*, 3(1), pp. 80-90.

- Haugan S. (2019, 28. desember). Nepal. In *Store norske leksikon*. Retrieved April 7<sup>th</sup> 2020 from <https://snl.no/Nepal>
- Hofstede Insights. (2020). *What about Nepal?* Retrieved April 10<sup>th</sup> 2020 from <https://www.hofstede-insights.com/country-comparison/nepal/>
- Johannison B. (2000). Networking and Entrepreneurial Growth, in Sexton D. and Landström H. (Eds.), *Handbook of Entrepreneurship*. Oxford: Blackwell Publishers Ltd, pp. 368-386.
- Karki B.B. (2007). Role of entrepreneurship and small business in national development. *Journal of Nepalese Business Studies*, 4(1), pp. 76-82.
- Karki B.B. (2010). Doing business and role of government for entrepreneurship development. *Journal of Nepalese Business Studies*, 7(1), pp. 53-62.
- Kautonen T., Hatak I., Kibler E. and Wainwright T. (2015). Emergence of Entrepreneurial Behaviour: The Role of Age-based Self-image. *Journal of Economic Psychology*, 50, pp. 41–51.
- Kickul J. and Gundry L. (2002). Prospecting for Strategic Advantage: The Proactive Entrepreneurial Personality and Small Firm Innovation. *Journal of Small Business Management*, 40(2), pp. 85-97.
- Kim P.H., Aldrich H.E. and Keister L. (2006). Access (not) Denied: The Impact of Financial, Human, and Cultural Capital on Entrepreneurial Entry in the United States. *Small Business Economics*, 27(1), pp. 5-22.
- Kolvreid L. (1996a). Organizational employment versus self-employment. *Entrepreneurship Theory & Practice*, 20(3), pp. 23-31.
- Kolvreid L. (1996b). Prediction of employment status choice intentions. *Entrepreneurship Theory & Practice*, 21(1), pp. 47-57.
- Krueger N.F. (1993). The Impact of Prior Entrepreneurial Exposure on Perceptions of New Venture Feasibility and Desirability. *Entrepreneurship Theory & Practice*, 18(1), pp. 5-21.
- Krueger N.F. and Carsrud A.L. (1993). Entrepreneurial Intentions: Applying the Theory of Planned Behaviour. *Entrepreneurship & Regional Development*, 5(4), pp. 315–330.
- Langowitz N. and Minniti M. (2007). The Entrepreneurial Propensity of Women. *Entrepreneurship Theory & Practice*, 31 (3), pp. 341-364.
- Laspita S., Breugst N., Heblich S. and Patzelt H. (2012). Intergenerational Transmission of Entrepreneurial Intentions. *Journal of Business Venturing*, 27(4), pp. 414–435.
- Leenders R.Th. A.J. and Gabbay S.M. (Eds.). (1999). *Corporate Social Capital and Liability*. Amsterdam: Kluwer Academic Publishers.
- Lin N., Cook K. and Burt R.S. (Eds.) (2001). *Social Capital. Theory and Research*. New Brunswick, New Jersey: Aldine Transaction.
- Liñán F. (2008). Skill and Value Perceptions: How Do They Affect Entrepreneurial Intentions? *International Entrepreneurship and Management Journal*, 4(3), pp. 257-272.
- Liñán F. and Santos F.J. (2007). Does Social Capital Affect Entrepreneurial Intentions? *International Advances in Economic Research*, 13(4), pp. 443-453.
- Luthje C. and Franke N. (2003). The Making of an Entrepreneur: Testing a Model of Entrepreneurial Intent Among Engineering Students at MIT. *R&D Management*, 33(2), pp. 135-147.



- Low M.B. and MacMillan I.C. (1988). Entrepreneurship: Past research and future challenges. *Journal of management*, 14(2), 139-161.
- Maes J., Leroy H. and Sels L. (2014). Gender Differences in Entrepreneurial Intentions: A TPB Multi-group Analysis at Factor and Indicator Level. *European Management Journal*, 32(5), pp. 784–794.
- Mazzarol T., Volery T., Doss N. and Thein V. (1999). Factors Influencing Small Business Start-ups. A Comparison with Previous Research. *International Journal of Entrepreneurial Behaviour & Research*, (5)2, pp. 48-63.
- Minniti M., Arenius P. and Langowitz N. (2005). *Global Entrepreneurship Monitor. 2004 Report on Women and Entrepreneurship*. London: Babson College and London Business School.
- Morimoto I. and Chapagain P.S. (2014). Entrepreneurship in the peripheral regions: A case of tourism in the Himalayan village Manang, Nepal. *International & Regional Studies*, Meiji Gakuin University, 46, pp. 1–18.
- Nesse J.G. (2010). Kjønnsskilnader i ungdommars motivasjon for entreprenørskap. *Beta*, 24(1), pp. 2-25.
- Nesse J.G. and Bhatta B.P. (2017). The influence of local entrepreneurial environment and role models in motivating youths to create a new enterprise. *International Journal of Entrepreneurship and Economic Issues*, 1, pp. 57-74.
- Nesse J.G., Årethun T. and Håvold J.I. (2015). Entrepreneurial Intentions among Youth in Rural Areas: Regional Differences and Changes over Time. In *Proceedings of the 12th International Conference on Enterprise Systems, Accounting and Logistics (12th ICESAL 2015)*, pp. 86-107.
- Mueller P. (2006). Entrepreneurship in the Region: Breeding Ground for Nascent Entrepreneurs? *Small Business Economics*, 27(1), pp. 41-58.
- Pallant J. (2011). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS* (4th edn.). Australia: Allen & Unwin.
- Pant S.K. (2015). Role of the family in entrepreneurship development in Nepali society. *Journal of Nepalese Business Studies*, 9(1), pp. 37-47.
- Pruett M., Shinnar R., Toney B., Llopis F. and Fox J. (2009). Explaining entrepreneurial intentions of university students: A cross-cultural study. *International Journal of Entrepreneurial Behavior & Research*, 15(6), pp. 571-594.
- Regjeringen. (2020). *Nepal – reiseinformasjon*. Retrieved April 7<sup>th</sup> 2020 from [https://www.regjeringen.no/no/tema/utenrikssaker/reiseinformasjon/velg-land/reiseinfo\\_nepal/id2416354/](https://www.regjeringen.no/no/tema/utenrikssaker/reiseinformasjon/velg-land/reiseinfo_nepal/id2416354/)
- Rogers C. (2004). Explaining disparate economic success in highland Nepal: Opportunity, cooperation, and entrepreneurship in Manang. *Contributions to Nepalese Studies*, 31(1), pp. 115-185.
- Schein E.H. (1975). How 'Career Anchors' Hold Executives to Their Career Paths. *Personnel*, 52(3), pp. 11-24.
- Schein E.H. (1990). *Career Anchors: Discovering Your Real Values*. Revised edn., San Francisco: Pfeiffer & Company.
- Shakya M. (2008). *Cultural capital and entrepreneurship in Nepal: The readymade garment industry as a case study*. Doctoral dissertation. London School of Economics and Political Science. London.
- Shirokova G., Osiyevskyy O. and Bogatyreva K. (2016). Exploring the Intention-Behavior Link in Student Entrepreneurship: Moderating Effects of Individual and

- Environmental Characteristics. *European Management Journal*, 34(4), pp. 386-399.
- Spilling O.R. (1998). Entreprenørskap, etablerere og nye foretak, in Spilling O.R. (Ed.), *Entreprenørskap på norsk*. Bergen: Fagbokforlaget, pp. 95-119.
- Sutton S. (1998). Predicting and Explaining Intentions and Behavior: How Well Are We Doing? *Journal of Applied Social Psychology*, 28(15), pp. 1317-1338.
- Van Auken H., Fry F.L. and Stephens P. (2006). The influence of role models on entrepreneurial intentions. *Journal of Developmental Entrepreneurship*, 11(2), pp. 157-167.
- Wang C.K. and Wong P. (2004). Entrepreneurial Interest of University Students in Singapore. *Technovation*, 24(2), pp. 163-172. [https://doi.org/10.1016/S0166-4972\(02\)00016-0](https://doi.org/10.1016/S0166-4972(02)00016-0)
- World Bank. (2019a). *Nepal*. Retrieved April 7<sup>th</sup> 2020 from <https://data.worldbank.org/country/nepal>
- World Bank. (2019b). *Economy profile of Nepal. Doing Business 2020*. Retrieved January 8<sup>th</sup> 2020 from <https://www.doingbusiness.org/content/dam/doingBusiness/country/n/nepal/NPL.pdf>
- Zanakis S.H., Renko M. and Bullough A. (2012). Nascent Entrepreneurs and the Transition to Entrepreneurship: Why Do People Start New Businesses? *Journal of Developmental Entrepreneurship*, 17(1), pp. 1-25
- Zellweger T., Sieger P. and Halter F. (2011). Should I Stay or Should I Go? Career Choices of Students with Family Business Background. *Journal of Business Venturing*, 26(5), pp. 521–536.
- Zhao H., Seibert S.E. and Hills G.E. (2005). The Mediating Role of Self-Efficacy in the Development of Entrepreneurial Intentions. *Journal of Applied Psychology*, 90(6), pp. 1265-1272.
- Årethun T., Nesse J.G., Kolosta S., Flaska F. and Håvold J.I. (2019). What can schools do to increase the entrepreneurial intentions among young women? Analysis of data from Norway and Slovakia. In *Proceedings of the 16th International Conference on Enterprises, Systems, Accounting, Logistics and Management (16th ICESALM 2019)*, pp. 65-91.

## Appendix 1

**Table. Means and Standard Deviations for the variables in the Analyses (n = 560)**

	Mean	SD	Low	High	Range
<i>Dependent variable:</i>					
Entrepreneurial Intentions (EI)	1.89	0.57	1	4	3
<i>Independent variables:</i>					
Gender	0.53	-	0	1	1
Parents self-employed	0.64	-	0	1	1
Relatives owning enterprise	0.50	-	0	1	1
Friends owning enterprise (No:0; Yes:1)	0.26	-	0	1	1
Others owning enterprise (No:0; Yes:1)	0.42	-	0	1	1
Support from family and friends	1.48	0.72	1	5	4
Leadership	1.89	1.02	1	5	4
Autonomy	1.18	0.48	1	5	4
Creativity	1.35	0.51	1	5	4
Security	1.19	0.45	1	5	4
Technical-functional competence	1.41	0.69	1	5	4
Proactive personality	1.84	0.46	1,0	3.2	2.2

Notes:

1. SD = Standard deviation.

## Exploring the determinants of Key Audit Matters in audit reports

Georgia Boskou<sup>1</sup>, Maria Tsipouridou<sup>2</sup>, Charalambos Spathis<sup>3</sup>

<sup>1</sup>International Hellenic University, [boskoug@ihu.gr](mailto:boskoug@ihu.gr) ,

<sup>2</sup>Aristotle University of Thessaloniki, [mtsipouridou@econ.auth.gr](mailto:mtsipouridou@econ.auth.gr),

<sup>3</sup>Aristotle University of Thessaloniki, [hspathis@econ.auth.gr](mailto:hspathis@econ.auth.gr)

### **Abstract:**

The aim of this study is to explore the new regulation regarding the disclosure of significant audit issues in the audit report, the Key Audit Matters (hereinafter referred to as KAMs), which was implemented in Greece in 2017. An empirical analysis is carried out to examine the determinants of KAMs. First, if the quality of the audit firm, and second, if client characteristics affect the number of KAMs. To answer this question, we hand-collected data from audit reports of companies listed on the Athens Stock Exchange (ASE). Our empirical analysis shows that the number of KAMs is positively related to the quality of the audit firm. In addition, various client characteristics, such as profitability, affect the number of KAMs.

**Keywords:** Key Audit Matters, International Auditing Standard 700, International Auditing Standard 701

# The impact of the introduction of the euro on the accounting of banks and other non-bank financial institutions in Croatia

Sanja Broz Tominac

Faculty of Economics and Business Zagreb, Croatia  
sbroz@efzg.hr

## **Abstract:**

The objective of this thesis is to examine the impact of the introduction of the euro as the official currency in the Republic of Croatia on the financial reporting of financial institutions, with a focus on banks. In this paper, IAS 21 The Effects of Changes in Foreign Exchange Rates is used. The paper explains the administrative adjustment, logistical and infrastructural adjustment, as well as the conversion of cash, deposits, loans and securities. All this leads to an analysis of the impact of the introduction of the euro on accounting and financial statements. Among the benefits expected from the introduction of the euro is the elimination of currency risk. There have also been certain costs, particularly in terms of the loss of an independent monetary policy.

**Keywords:** *euro introduction, financial institutions, banks, accounting, financial statements*

## **Analyzing the impact of ESG on mutual fund performance during COVID-19 using DEA, PSM, and logistic regression.**

**Ioannis Tampakoudis**

Department of Business Administration, University of Macedonia,  
156 Egnatia Street, GR-546 36 Thessaloniki, Greece  
Email: [tampakoudis@uom.edu.gr](mailto:tampakoudis@uom.edu.gr)

**Nikolaos Kiosses**

Department of Accounting and Finance, University of Macedonia,  
156 Egnatia Street, GR-546 36 Thessaloniki, Greece  
Email: [nkiosses@uom.edu.gr](mailto:nkiosses@uom.edu.gr)

**Konstantinos Petridis**

Department of Business Administration, University of Macedonia,  
156 Egnatia Street, GR-546 36 Thessaloniki, Greece  
Email: [k.petridis@uom.edu.gr](mailto:k.petridis@uom.edu.gr)

**Abstract:** This study aims to assess the performance of mutual funds during the COVID-19 pandemic based on ESG criteria. It investigates whether there is a association between a mutual fund's ESG score and its performance. The dataset includes 9,864 mutual funds with available ESG scores from the Refinitiv database. The analysis employs two DEA models (DEA Portfolio Index and Range Direction Measure DEA), as well as Propensity Score Matching (PSM) and logistic regression. The findings indicate that mutual funds with higher ESG scores demonstrate significantly better performance than those with low to medium scores, regardless of their type. Moreover, the PSM and logistic regression models suggest that mutual funds with high ESG scores are more likely to be efficient during the COVID-19 pandemic.

The study's results demonstrate a positive association between ESG performance and mutual fund efficiency during the pandemic crisis. This relationship can be explained by various factors, including the ability of companies with strong ESG practices to manage non-financial risks and maintain resilient business models. Additionally, companies may perceive ESG issues as a potential source of competitive advantage that can enable them to attract and retain employees, enhance their brand reputation, and reduce regulatory and reputational risks. The findings suggest that sustainability considerations are increasingly important for investors and companies to achieve sustainable long-term value, particularly in the face of complex challenges such as the COVID-19 crisis and climate change.

Several theoretical frameworks can be used to explain the positive relationship between ESG and mutual fund performance. According to stakeholder theory, companies can

improve their reputation and attract more customers by focusing on ESG performance, which can lead to increased revenue and better financial performance. The resource-based view theory suggests that ESG can be used to build intangible resources such as a positive reputation and human capital, resulting in increased customer loyalty, innovation, and productivity. Legitimacy theory proposes that companies must act in a socially responsible manner to maintain legitimacy and that participating in ESG initiatives can improve financial performance. Institutional theory suggests that ESG reporting standards can help companies meet the expectations of stakeholders and reduce the risk of negative institutional pressures, leading to better financial performance. Therefore, organizations that implement ESG practices are likely to achieve better market returns.

This study suggests that investing in mutual funds with high ESG scores can provide investors with better financial performance during a crisis such as the COVID-19 pandemic. The application of various theoretical frameworks helps to understand the mechanisms through which ESG factors can impact financial performance. Fund managers should evaluate their internal strategies and consider the effect of ESG scores on the performance of mutual funds by incorporating ESG criteria into the process of fund asset allocation. Policymakers can use the results to prepare disclosure guidelines and non-financial reporting requirements for asset managers on sustainability issues. Finally, empirical evidence can allow governments to develop environmental, social and governance legislative initiatives, helping market participants to handle future economic crises and laying the foundations for growth and economic development.

**Keywords:** mutual funds; financial performance; DEA; ESG; PSM; logistic regression.

**JEL Classification:** C61, C67, G11, G15, Q56



The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the 4th Call for Action “Science and Society”- Emblematic Action – “Interventions to address the economic and social effects of the COVID-19 pandemic” (Project Number: 5098).

## **Corporate governance and women representation in the boardrooms: a study of listed companies in Greece**

Stergios Tasios<sup>1</sup>, Evangelos Chytis<sup>2</sup> and Thomas Kitsantas<sup>3</sup>

<sup>1,2</sup> University of Ioannina, Ioannina, Greece, Department of Accounting & Finance  
[stertasi@uoi.gr](mailto:stertasi@uoi.gr), [ehytis@uoi.gr](mailto:ehytis@uoi.gr), [th.kitsantas@uoi.gr](mailto:th.kitsantas@uoi.gr)

### **Abstract:**

The inclusion of women on corporate boards is considered to promote social equity, corporate performance, governance efficiency (Zhu, Husnain, Ullah, Khan and Ali 2022) and to positively affect corporate social performance (Nerantzidis, Tzeremes, Koutoupis, and Poyrgias (2022). As of 2016, gender quotas in the European Union (EU) were mandatory for listed private companies only in France, Germany, Italy, Netherlands, and Spain (European Commission 2016). Although gender board diversity increased in the last years, women in Europe remain rare both in firms and corporate boards (Tyrowicz, Terjesen and Mazurek 2020). Research indicates that board gender diversity can be interpreted by agency and resource dependence theory and that the main factors that influence women's representation on the board include firm and board size, board diversity, industry, type of ownership, customer base, as well as social and cultural characteristics (Reddy and Jadhav 2019).

Considering the above theories, studies, and findings, this study aims to explore the factors that affect women's presence on the board of directors in a small European capital market, which is characterized by family ownership, underrepresentation of women in management, and weak corporate governance structures. For this purpose, a logit panel regression model was constructed to examine the impact on the probability to include women on the board of directors of a set of corporate governance factors that include board size, board independence, chief executive officer (CEO) duality, family ownership, institutional ownership, and government ownership, controlling for firm-specific characteristics (firm size, efficiency, profitability, liquidity and leverage). A sample of 36 large and middle capitalization non-financial companies listed on the Athens Stock Exchange (ASE) that comprised large and middle capitalization market indexes for the five-year period from 2014 to 2018 was selected for the study.

Greece is an EU member since 1981 and is an interesting case to study for many reasons. Greece suffered a severe financial crisis the previous decade, in which several significant events occurred (rescue packages, haircut of public debt, capital controls, political instability). In this volatile context, various aspects of corporate governance were revised. During 2020 a major corporate governance reform occurred in Greece,



following a series of corporate failures. Law 4706/2020 introduced the obligation for a minimum quota per gender on the board of directors, the obligation for a nomination and remuneration committee, and enacted strict penalties for violations of corporate governance law. Since gender quotas on the board of directors became mandatory for private companies in Greece in 2020, the study provides useful insights on the state of board diversity and of the factors that affected it in a period where this obligation did not exist (see Directive (EU) 2017/828).

The estimated panel logit regression model is depicted in the following equation:

$$Wboard_{it} = \beta_0 + \beta_1 bsize_{it} + \beta_2 bindep_{it} + \beta_3 ceodual_{it} + \beta_4 famown_{it} + \beta_5 inown_{it} + \beta_6 govown_{it} + \beta_7 fsize_{it} + \beta_8 effic_{it} + \beta_9 prof_{it} + \beta_{10} liq_{it} + \beta_{11} lev_{it} + u_{it}$$

Where:

**wboard**: the presence of women on the board of directors, a dummy variable that takes the value 1 if there is at least one female director on the board and zero otherwise;

**bsize**: board size, measured by the total number of members of the board;

**bindep**: board independence, measured by the percentage of independent members to the total members of the board of directors;

**ceodual**: a dummy variable that takes the value 1 if the position of the president and the CEO are held by the same individual and 0 otherwise;

**famown**: family ownership, the percentage of the shares owned by the founding family of the firm;

**inown**: institutional ownership, the percentage of shares owned by institutional investors;

**govown**: government ownership, the percentage of shares held by the state;

**fsize**: firm size, measured by the natural logarithm of total assets;

**effic**: firm efficiency, measured by asset turnover ratio;

**prof**: profitability, measured by return on assets ratio (ROA);

**liq**: liquidity, measured by current assets to current liabilities ratio;

**lev**: leverage, measured by debt-to-equity ratio;

**u**: error term.

Descriptive statistics indicate that although women were observed on the boards of most firm-year observations (58.88%), they appear to be underrepresented. On average, only 11.96% of board members were female. Boards on average comprised 10 members and about one-third of these members were independent (29.32%). Family ownership was relatively high, with a mean value amounting to 27.88% and a maximum value of 82.05%. Institutional ownership averaged 24.58% and low levels of government ownership were observed (mean value 6.78%). CEO duality was observed for 33.33% of firm-year observations. As far as control variables are concerned, mean asset turnover amounted to 0.75, and mean return on assets (ROA) to 0.02, showing moderate levels of operational efficiency and profitability. The firms of the sample present adequate liquidity (mean value of liquidity ratio equaled to 1.95) and do not

appear to face significant financial and investment risks (average leverage amounted to 1.01).

The results of random effects logit panel regression are presented in the table that follows:

	Coef.	Std. Err.	Z	P> z
Bsize	1.345520	0.458720	2.93	0.003***
Bindep	16.292770	9.401043	1.73	0.083*
Ceodual	5.842302	2.311057	2.53	0.011**
Famown	12.272300	4.397715	2.79	0.005***
Inown	-11.789430	5.145447	-2.29	0.022**
Govown	-8.559736	6.696771	-1.28	0.201
Fsize	-0.723469	0.890427	-0.81	0.417
Effic	-3.077697	1.328215	-2.32	0.020**
Prof	-7.860698	17.979090	-0.44	0.662
Liq	0.462605	0.671608	0.69	0.491
Lev	-0.351098	0.307059	-1.14	0.253
Constant	-0.661543	16.921670	-0.04	0.969

Number of obs = 180, Number of groups = 36

Wald chi2= 47.61 Prob > Chi2 = 0.0000

\*\*\* = significant at 0.01, \*\*=significant at 0.05, \*=significant at 0.10

Results of the study indicate that firms with larger boards, with CEO duality and higher family ownership are more likely to include women directors on their boards. On the other hand, firms with higher institutional ownership and more efficient firms as measured by asset turnover, are less likely to have gender diverse boards. A positive association is found with board independence, but this relationship is significant at the 10% level of significance. There are several limitations in this study that need to be considered when interpreting the results. These limitations concern the size of the sample and several attributes that may influence women's representation on the boards that were not accounted for, such as demographic characteristics, nationality, educational level, and expertise. Finally, the results of the study may be of interest to regulators, management and all other parties involved in corporate governance.

**Keywords:** *corporate governance, board, gender diversity, ownership.*

## References

European Commission (2016), 'Gender balance on corporate boards. Europe is cracking the glass ceiling', available at :

[https://ec.europa.eu/newsroom/document.cfm?doc\\_id=46280](https://ec.europa.eu/newsroom/document.cfm?doc_id=46280)

Directive (EU) 2017/828 of the European Parliament and of the Council of 17 May 2017 amending Directive 2007/36/EC as regards the encouragement of long-term shareholder engagement, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017L0828>

Law 4706/2020, Government Gazette Issue A' 136/17.07. Corporate governance of public limited companies, modern capital market, integration into Greek legislation of Directive (EU) 2017/828 of the European Parliament and of the Council, measures for the implementation of Regulation (EU) 2017/1131 and other provisions, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=NIM:286602>

Nekhili M. and Gatfaoui H. (2013), 'Are demographic attributes and firm characteristics drivers of gender diversity? Investigating positions on French board of directors', *Journal of Business Ethics*, 118: 227-249.

Nerantzidis M., Tzeremes P., Koutoupis A. and Pourgias A. (2022), 'Exploring the black box: Board gender diversity and corporate social performance', *Finance Research Letters*, 48: 1-9.

Reddy S. and Jadhav A.M. (2019), 'Gender diversity in boardrooms – A literature review', *Cogent Economics and Finance*, 7: 1-11.

Tyrowicz J., Terjensen S. and Nazurek J (2020), 'All on board? New evidence on gender diversity from a large panel of European firms', *European Management Journal*, 38: 634-645.

Zhu C., Husnain M., Ullah S. Khan M.T. and Ali W. (2022), 'Gender Diversity and Firms' Sustainable Performance: Moderating Role of CEO Duality in Emerging Equity Market', *Sustainability* 14: 1-26.

# Information Systems Urbanization: A Framework for Information Systems Governance

Salem Ben Dhaou DAKHLI  
Paris-Dauphine University, France

## Abstract

*Modern organizations face many external constraints arising from an external environment characterized by various economic, political, and technology-related forces that reshape business dynamics. Many authors have emphasized that information technology plays a critical role in maintaining competitive advantage of organizations. As demonstrated by academics and practitioners, to support the continuously changing organizational processes and overcome problems induced by external pressures, information systems must be agile enough and effectively governed. Nevertheless, the effective governance of organizational information systems is a difficult task due to their heterogeneity. Indeed, in most organizations, the information system is a stack of interrelated applications developed using methods, languages, and tools which corresponds to different periods and technology eras. It follows that the information systems heterogeneity makes difficult both the maintenance and evolution of existing applications and the development of new applications that must be integrated in the information system. In this paper, we propose a framework which demonstrates that information systems urbanization is an effective instrument for governing organizational information systems.*

*Keywords: information city, information system urbanization, Target urbanization Plan, information systems governance, architecture principles and rules*

## **Using blockchain-based payments in the tourism**

Alfreda Šapkauskienė<sup>1</sup>, Aida Mačerinskienė<sup>2</sup>, Rasuolė Andriulienė<sup>3</sup>, Saulius Masteika<sup>4</sup>,  
Kęstutis Driaunys<sup>5</sup>

Faculty of Economics and Business Administration, Vilnius University, Vilnius, Lithuania<sup>1,2,3</sup>, Kaunas  
Faculty, Vilnius University, Kaunas, Lithuania<sup>4,5</sup>

Corresponding author: Alfreda, Šapkauskienė, [alfreda.sapkauskiene@evaf.vu.lt](mailto:alfreda.sapkauskiene@evaf.vu.lt)

### **Abstract:**

The speed of financial technology has led to changes in the monetary system and the emergence of new payment methods. Research studies show that the main driving force behind innovative financial technologies is online and mobile payments (Arner et al., 2016). The creation of a blockchain as one of FinTech's innovations for payments with virtual currency has enhanced the efficiency of transactions, reduced payment time and, by eliminating intermediaries, simplified cross-border payments, and reduced transaction costs and exchange fees (Alt et al. 2018; Nam et al.; 2019; Tharkor, 2019; Tredinnick, 2019; Treiblmaier et al., 2020). Currently, there are more than 19,000 institutions that accept virtual currencies around the world, such as PayPal, OverStock, Dash or AirBaltic. Although the blockchain has attracted the attention of tourism researchers in recent years, there is still very scarce research conducted on the use of virtual currencies in tourism (Korže, 2019; Capar and Aslan, 2020) and current knowledge about travelers' intention to use virtual currencies for payment purposes is limited (Treiblmaier et al., 2020). The aim of this research is to carry out scientific research into the consumption habits of tourists paying for tourism services in order to determine the intention of consumers and the need to pay in cryptocurrencies. In this research we collected new survey data through qualitative empirical research using questionnaire survey methods. The study found a relation between satisfaction with the use of cryptocurrencies in relation to attitudes towards cryptocurrencies and the intention to use cryptocurrencies when purchasing tourism services. The results showed that motivational factors, technology awareness and satisfaction strongly influence

attitude. It is also important to note that technology awareness, satisfaction, attitude, subjective norms strongly influence intention.

**Keywords:** *blockchain; payment; virtual currency; tourism; COVID-19*

## Funding

This project has received funding from European Regional Development Fund (project No 13.1.1-LMT-K-718-05-0006) under grant agreement with the Research Council of Lithuania (LMTLT). Funded as European Union's measure in response to Cov-19 pandemic.

## References

- Alt, R., Beck, R. & Smits, M. T. (2018). FinTech and the transformation of the financial industry. *Electronic Markets*, 28, 235-24. <https://doi.org/10.1007/s12525-018-0310-9>
- Arner, D.W., Barberis, J.N. & Buckley, R.P. (2016). *The Evolution of FinTech: A New Post-Crisis Paradigm?* The University of Hong Kong. SSRN Electronic Journal, 47, 1271-1319. <http://dx.doi.org/10.2139/ssrn.2676553>
- Çapar, H. & Aslan, Ö. (2020). Factors Affecting Destination Choice in Medical Tourism. *International Journal of Travel Medicine and Global Health*. 8(2), 80-88. 10.34172/IJTMGH.2020.13
- Korže, S. Z. (2019). How smart tourism embrace blockchains and smart contracts. Mednarodno inovativno poslovanje. *Journal of Innovative Business and Management*, 11(2), 32–40. <https://doi.org/10.32015/JIBM/2019-11-2-4>
- Nam, K., Dutt, C., Chathoth, P. & Khan, S. (2019). Blockchain technology for smart city and smart tourism: latest trends and challenges, *Asia Pacific Journal of Tourism Research*, 454–468. <https://doi.org/10.1080/10941665.2019.1585376>
- Tharkor, A. V. (2019). Fintech and banking: What do we know? *Journal of Financial Intermediation*, 41, 100833. <https://doi.org/10.1016/j.jfi.2019.100833>
- Tredinnick, L. (2019). Cryptocurrencies and the blockchain. *Business Information Review*. 36(1) 39–44. <https://doi.org/10.1177/0266382119836314>
- Treiblmaier, H., Leung, D., Kwok, A. O. J. & Tham, A. (2020). Cryptocurrency adoption in travel and tourism – an exploratory study of Asia Pacific travellers, *Current Issues in Tourism*, 1–17. <https://doi.org/10.1080/13683500.2020.1863928>

# Factors determining default in P2P lending

Evangelia Avgeri, Maria Psillaki

Department of Economics, University of Piraeus, Piraeus, Greece.

## Abstract

The research documented in this paper examines multiple factors related to borrowers' default in peer-to-peer (P2P) lending in the United States. The empirical study is based on a total number of 1,863,585 loan records issued through LendingClub from 2007 to 2020Q3 and a logistic regression model is developed to predict loan defaults.

This study is motivated by the hypothesis that both P2P loan characteristics and macroeconomic variables have influence on loan performance. We define a set of loan characteristics, borrower characteristics and macroeconomic variables that are significant in determining the probability of default and should be taken into consideration when assessing credit risk.

Our results, in line with prior research, show that a number of borrower and contractual loan characteristics predict loan defaults such as loan credit grade, loan purpose, loan maturity, annual income and employment length.

The innovation of this study is the introduction of specific macroeconomic indicators in order to explain the defaults in P2P lending industry. The study indicates that macroeconomic variables assessed alongside loan data can significantly improve the forecasting performance of default model. Our general finding demonstrate that higher percentage change in House Price Index, Consumer Sentiment Index and S&P500 Index is associated with a lower probability of delinquency. The empirical results also exhibit significant positive effect of unemployment rate and adverse effect of GDP growth rate on P2P loan default rates.

Our results have important implications for investors for whom it is of great importance to know the determinants of borrowers' creditworthiness and loan performance when estimating the investment in a certain P2P loan. In addition, the forecasting performance of our model could be applied by authorities in order to deal with the credit risk in P2P lending and to prevent the effects of increasing defaults on the economy.

## Acknowledgement

This work has been partly supported by the University of Piraeus Research Center

**Keywords:** P2P, marketplace lending, loan default, United States

**JEL classification:** G23, G28, G14, G20, O16, D14

## **ANALYSIS OF THE DETERMINANT FACTORS FOR VALUE CREATION IN THE BUSINESS REPORT: A PORTUGUESE COMPANIES ANALYSIS**

Cristina Gois<sup>1</sup>, Mariana Ramos<sup>2</sup> and Clara Viseu<sup>3</sup>

Polytechnic Institute of Coimbra, Coimbra Business School, Coimbra, Portugal.<sup>1,2,3</sup>

cgois@iscac.pt<sup>1</sup>; iscac14093@alumni.iscac.pt<sup>2</sup>; cviseu@iscac.pt<sup>3</sup>

### **Abstract:**

The traditional financial report, through the financial statements, evaluates and justifies the routine of a company in its different components and dimensions. It intends to check whether the objectives set by the entity have been achieved as well as the way in which they have been achieved. The problem with this type of report is its tendency to focus on the recognition and measurement of assets and liabilities and on short-term financial performance, through the periodic treatment of information mainly for shareholders. In addition, there is an increasing concern with Social and Environmental Responsibility, which makes it necessary to prepare more detailed and relevant reports on these aspects, the so-called sustainability reports.

The limitations identified in the financial information presented and the reduced literature dealing with the topic that identifies which factors contribute most to the perception of value creation by companies and their importance for investor decision making was the main motivation for carrying out this work. Also, the analysis of the research work developed by Reitmaier and Schultze (2017), in which they made an analysis of the relevance of the disclosures and the determinants for the market evaluation, for German companies, raised the need to investigate what would be the results obtained to the reality of Portuguese companies. Although the Portuguese business environment is composed mostly of Small and Medium Enterprises, there is a significant number of listed companies and it is in this group that this investigation will focus, more specifically on the listed companies from the Lisbon Euronext. This choice is justified by the fact that the research model used requires a large amount of information that, in Portugal, is only available to these companies with securities listed on the Lisbon Stock Exchange.

This study has as main objectives to identify which are the determining factors for the creation of value in corporate reports, to understand the connection of voluntary disclosures with the creation of value and to verify if these disclosures are relevant for the evaluation of companies in the market. This investigation is mainly focused on the evaluation of the determinants, but some fundamental aspects are also addressed for the Enhanced Business Report model and its importance for the evaluation of investors. The Enhanced Business Report aims to respond to investors' information needs, so that they can make more thoughtful assessments when making investment decisions.

Based on the defined objectives, the main purpose of the present study is to evaluate which information contained in the Reports and Accounts are the most determinant for the evaluation of the companies' value creation. In addition to this analysis, it is intended to assess the contribution of voluntary disclosures to the creation of value and the assessment of companies by the market. Another objective of this study will be to identify which factors lead to investors' decision to invest and what leads them to



choose one company over another when they make that decision. It is intended to ascertain whether this decision is related to the complexity of the published Reports and Accounts and/or to their extension.

To achieve the defined objectives, companies with values listed on the Portuguese stock exchange will be used as a sample. The data will be obtained through a comprehensive score, developed from an evaluation model, to identify a set of information items that will allow to obtain results to understand what are the determining factors for the creation of value, both for the company, or for the investor.

The obtained results show that the quality of profits and the size of companies are the most significant determinants and that voluntary disclosures, other than making a difference to value creation, are relevant to market valuation and provide additional value through their explanatory power.

**Keywords:** *Determinants, Disclosure, Information, Reports, Value*

## REFERENCES

- Beyer, A., Cohen, D. A., Lys, T. Z., & Walther, B. R. (2010). The financial reporting environment: Review of the recent literature. *Journal of Accounting and Economics*, 50(2-3), 296-343. DOI: 10.1016/j.jacceco.2010.10.003
- Blanco, B., Lara, J. M. G., & Tribo, J. A. (2015). Segment Disclosure and Cost of Capital. *Journal of Business Finance & Accounting*, 42(3-4), 367-411. DOI: 10.1111/jbfa.12106
- Boedker, C., Mouritsen, J., & Guthrie, J. (2008). Enhanced business reporting: international trends and possible policy directions. *Journal of Human Resource Costing & Accounting*, 12(1), 14-25. DOI: 10.1108/14013380810872734
- Branco, M. C., & Rodrigues, L. L. (2008). Factors Influencing Social Responsibility Disclosure by Portuguese Companies. *Journal of Business Ethics*, 83(4), 685-701. Available in <https://link.springer.com/article/10.1007/s10551-007-9658-z>.
- Cerbioni, F., & Parbonetti, A. (2007). Exploring the Effects of Corporate Governance on Intellectual Capital Disclosure: An Analysis of European Biotechnology Companies. *European Accounting Review*, 16(4), 791-826. DOI: <https://doi.org/10.1080/09638180701707011>
- Cormier, D., Ledoux, M.J., Magnan, M., & Aerts, W. (2010). Corporate governance and information asymmetry between managers and investors. *Corporate Governance*, 10(5), 574-589. DOI: <https://doi.org/10.1108/14720701011085553>
- Dechow, P. M., & Dichev, I. D. (2002). The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors. *The Accounting Review: Supplement 2002*, 77(s-1), 35-59. DOI: <https://doi.org/10.2308/accr.2002.77.s-1.35>
- Easton, P. D., & Monahan, S. J. (2005). An Evaluation of Accounting-Based Measures of Expected Returns. *The Accounting Review*, 80(2), April, 501-538. DOI: <https://doi.org/10.2308/accr.2005.80.2.501>
- FASB (2001). *Improving Business Reporting: Insights into Enhancing Voluntary Disclosures, Steering Committee Report*. Business Reporting Research Project, January, Norwalk. Available in <https://www.fasb.org/brrp/brrp1.pdf>.
- Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics*, 31(1-3), September, 405-440. DOI: [https://doi.org/10.1016/S0165-4101\(01\)00018-0](https://doi.org/10.1016/S0165-4101(01)00018-0)

- Kristandl, G., & Bontis, N. (2007). The impact of voluntary disclosure on cost of equity capital estimates in a temporal setting. *Journal of Intellectual Capital*, 8(4), 577-594. DOI: <https://doi.org/10.1108/14691930710830765>
- Larcker, D. F., & Rusticus, T. O. (2010). On the use of instrumental variables in accounting research. *Journal of Accounting and Economics*, 49(3), April, 186-205. DOI: 10.1016/j.jacceco.2009.11.004
- Melloni, G. (2015). Intellectual capital disclosure in integrated reporting: an impression management analysis. *Journal of Intellectual Capital*, 16(3), 661-680. DOI: <https://doi.org/10.1108/JIC-11-2014-0121>
- Orens, R., Aerts, W., & Lybaert, N. (2009). Intellectual capital disclosure, cost of finance and firm value. *Management Decision*, 47(10), 1536-1554. DOI: <https://doi.org/10.1108/00251740911004673>
- Reitmaier, C. & Schultze, W. (2017). Enhanced Business Reporting: Value Relevance and Determinants of Valuation-Related Disclosures. University of Augsburg. *Journal of Intellectual Capital*, Forthcoming. 65 Páginas. Available in [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2966075](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2966075).
- Ruhwedel, F., & Schultze, W. (2002). Value Reporting: Theoretische Konzeption und Umsetzung bei den DAX100-Unternehmen. *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung*, 54(7), 602-632. Available in <https://link.springer.com/article/10.1007/BF03372689>.
- Serafeim, G. (2011). Consequences and Institutional Determinants of Unregulated Corporate Financial Statements: Evidence from Embedded Value Reporting. *Journal of Accounting Research*, 49(2), May, 529-571. DOI: 10.1111/j.1475-679X.2011.00401.x
- Wang, K., O, S., & Claiborne, M. C. (2008). Determinants and consequences of voluntary disclosure in an emerging market: Evidence from China. *Journal of International Accounting, Auditing and Taxation*, 17(1), 14-30. DOI: <https://doi.org/10.1016/j.intaccudtax.2008.01.001>
- Watson, A., Shrives, P., & Marston, C. (2002). VOLUNTARY DISCLOSURE OF ACCOUNTING RATIOS IN THE UK. *The British Accounting Review*, 34(4), December, 289-313. DOI: <https://doi.org/10.1006/bare.2002.0213>
- Zhou, S., Simnett, R., & Green, W. (2017). Does Integrated Reporting Matter to the Capital Market? *Abacus*, 53(1), March, 94-132. DOI: 10.1111/abac.12104

## **Assessment of the perception of professionals and authorities on the risk of rural fire in the use of fireworks**

José Góis

University of Coimbra, Association for the Development of Industrial Aerodynamics, Mechanical Engineering Department, Faculty of Sciences and Technology, 3030-788 Coimbra, PORTUGAL  
[jose.gois@dem.uc.pt](mailto:jose.gois@dem.uc.pt)

### **Abstract:**

In recent decades, Portugal has suffered immense damage resulting from forest fires, which have caused trauma to populations living close to forest areas and led to the issuance of legal diplomas with preventive measures for cleaning rural spaces and the more restricted use of fire. The attribution of the origin of some forest fires to the launching of pyrotechnic articles resulted in the publication of legislation that came to prohibit the launching of lit fuse balloons and any type of rockets during the critical period (July 1st to September 30th), and imposed that in all rural spaces the use of fireworks and other pyrotechnic articles is subject to prior authorization from the respective municipal council (Decree-law n.º 124/2006). Due to the increased risk of fire during the critical period, the entities in charge of authorizing fireworks take refuge in civil protection alerts to prohibit the use of any pyrotechnic displays during the critical period (Diário de Notícias, 2018). This situation has led to an ever-decreasing number of pyrotechnic displays at festive events, with the loss of the show transmitted by fireworks, breaking with tradition, thus reducing the number of public and consequent loss of income associated with tourism. It has also been causing the strangulation of the economic activity of the pyrotechnics sector in Portugal, whose period of greatest demand coincides with the summer, leading in recent years to a reduction in the number of companies and pyrotechnic professionals in activity.

In order to face the restrictions imposed by the legislation and the difficulties in obtaining authorization from the municipalities during the critical period, pyrotechnic companies began to use devices for launching pyrotechnic articles in the form of a tube, which guarantee a low dispersion of potentially incandescent particles. In addition, the Public Security Police (PSP) produced technical standards aimed at users of pyrotechnic articles with rules on places of use, assembly of devices, size of security areas and security and emergency plan (Ministry of Internal Affairs, 2018).

Despite these measures, in recent years some Inter-Municipal Communities (CIM) have unanimously decided not to authorize the use of fireworks or other pyrotechnic articles in rural spaces during the critical period (Notícias de Viseu, 2020; Bairrada Informação, 2021), disregarding the technical conditions, typology of pyrotechnic articles, degree of cleanliness of the launch site envelope, means of preventing and fighting fire present. These prohibitions are specific to mainland Portugal and usually occur in many places, which leads to questioning the grounds for decisions, when, for example, it is a question of beaches, rivers, lakes or areas with very little or no vegetation around the required security area.

When there are only very low flammable materials around the launch site or the residues of pyrotechnic articles are of very low dispersion, it is acceptable to assume that the fire risk (IR) attributed to the launching of pyrotechnic articles is very low (Reis *et al.*, 2019). In order to demonstrate that the launching of pyrotechnic articles can be carried out without IR, as long as the recommended safety distances are safeguarded, the Association for the Development of Aerodynamics (ADAI) carried out a study in 2019 with the purpose of determining the ignition on the ground generated by residues from launching pyrotechnic articles (Reis *et al.*, 2019). In that study, statistical data of forest fires recorded in the database of the Institute for the Conservation of Nature and Forests (ICNF) within the period between 2003 and 2018 were analyzed, identifying the number of occurrences and burned area attributed to the use of pyrotechnic articles, having been concluded that since 2006 the number of occurrences has been less than 1% of the total number of cases, standing at an average of 0.5% and the number of burned areas, in the same period, has been less than 0.5%, with the exception of year 2015.

This article aims to assess the perception that professionals and the different entities involved in the authorization and licensing of fireworks displays have about the risk of fire in rural areas attributed to the use of pyrotechnic articles. In order to allow an understanding of the involvement of the different entities in decision-making, an analysis is made of the legislation applicable to the use of pyrotechnic articles, as well as that relating to the defense of the forest against fires and management in prevention, self-protection of people and infrastructures and decision support mechanisms in the device for combating rural fires. To assess the perception of the different official entities and pyrotechnic companies about the risk of fire in rural areas attributed to the use of pyrotechnic articles, questionnaires were carried out.

During the critical period, most municipalities consider the presence of firefighters essential during the fireworks display. The security forces (GNR and PSP) attribute the majority of fires caused by pyrotechnic articles to the negligence of users and consider that the population is not properly informed and aware of the risks of rural fires resulting from the inadvertent use of pyrotechnic articles. However, they admit that the use of over-the-counter pyrotechnics by consumers without specialist knowledge will not increase the risk of rural fires. A review of the model for classifying fires attributed to the use of pyrotechnic articles is considered necessary, as well as the training of staff who

monitor the processes, whether for licensing or investigation of rural fires attributed to pyrotechnics. The authorities shown a reasonable perception of the risks of rural fires in the use of pyrotechnic articles, but there is a need to raise the population's awareness of these risks.

**Keywords:** rural fire, fireworks, perception of risk

## References

- APA (2021). State of the Environment Report: Environmental Risks - Rural Fires. Portuguese online report, available on <https://rea.apambiente.pt/content/inc%C3%AAndios-rurais>, Accessed on 2022/04/22
- Bairrada informação (2021). Region of Coimbra recommends banning the use of fire during a critical period. *Online journal article of June 5 2021*, Portuguese edition, available on <https://www.bairradainformacao.pt/2021/06/05/regiao-de-coimbra-recomenda-proibicao-do-uso-do-fogo-durante-periodo-critico/>, Accessed on 2021/09/29
- Decree-law n.º 124/2006, of June 28<sup>th</sup> (2006). Measures of action to be developed within the scope of the National System for the Defense of Forests against Fires, *Diário da República – I Série –A, Nº 123*, Available on: <https://dre.pt/application/dir/pdf1sdip/2006/06/123A00/45864599.pdf>, Accessed on 2020/10/30
- Diário de Notícias (2018). Association of pyrotechnics against the ban on fireworks. *Online journal article of August 2nd, 2018*, Portuguese edition, Available on: <https://www.dn.pt/pais/calor-associacao-de-pirotecnicia-repudia-proibicao-de-fogo-de-artificio-pelo-governo-9670249.html>, Accessed on 2020/10/30
- Jornal de Notícias (2017). *What was lost by each county hit by the flames*, *Online journal article of October 20th 2017*, Portuguese edition, Available on <https://www.jn.pt/nacional/o-que-perdeu-cada-concelho-atingido-pelas-chamas-8861067.html>, Accessed on 2020/10/30
- Ministério da Administração Interna (2018). Technical Standard Nº 3/2018 on the Use of Pyrotechnic Articles, (Portuguese document), *National Directorate of the PSP, Organic Unit of Operations and Security Department of Arms and Explosives*, Available on <http://www.apipe.org/docs/Norma%20t%C3%A9cnica%203-2018.pdf>, Accessed on 2020/10/30.
- Notícias de Viseu (2020). Municipalities in the Coimbra region prohibit burnings, fires and fireworks, *Online journal article of July 8th 2020*, Portuguese edition, Available on <https://www.noticiasdevisau.com/municipios-da-regiao-de-coimbra-proibem-queimas-queimadas-e-fogo-de-artificio/>, Accessed on 2020/10/30
- Público (2019). Fireworks were banned throughout the country, but Lisbon was able to do so, *Online journal article of September 9th 2019*, Portuguese edition, Available on <https://www.publico.pt/2019/09/09/local/noticia/empresas-denunciam-onda-indignacao-proibicao-fogodeartificio-1886025>, Accessed on 2020/10/30

Reis, L., Raposo, J., Viegas, D.X., Ribeiro, L. and Góis, J. (2019). Study on the use of pyrotechnic articles and their relationship with the ignition of forest fires. (Portuguese report), Center for Forest Fire Study, Association for the Development of Industrial Aerodynamics, Associated Energy, Transport and Aeronautics Laboratory, May 2019

# **Portfolio Investment Companies listed in the Athens Stock Exchange. Performance Analysis during financial crisis.**

Nikolaos Kalantzopoulos<sup>1</sup>, Athanasios Mandilas<sup>2</sup>, Dimitrios Kourtidis<sup>3</sup>, and Eleftheria Panagiotidou<sup>4</sup>

<sup>1</sup> *International Hellenic University, Department of Accounting and Finance, Campus of Kavala, Kavala Greece, kalantzopoulos@otenet.gr*

<sup>2</sup> *International Hellenic University, Department of Accounting and Finance, Campus of Kavala, Kavala Greece, smand@af.i.hu.gr*

<sup>3</sup> *International Hellenic University, Department of Accounting and Finance, Campus of Kavala, Kavala Greece, kourtidis@af.i.hu.gr*

<sup>4</sup> *International Hellenic University, Department of Accounting and Finance, Campus of Kavala, Kavala Greece, elefthpan@hotmail.com*

The purpose of this paper is to examine the shrinkage of Portfolio Investment Companies in the Athens Stock Exchange during the period 2009-2019. This study investigates the performance of those companies using financial ratios. Financial ratios are also used to test the performance of the industry as a whole. Moreover, financial information regarding the returns of the shares, the relationship between market and book value of their stocks are provided during the period 2000-2019. Covid-19 period were excluded from investigation. The results provide evidences that market value and actual price of each share do not justify its book value, the one, which suggests the financial statements of the company. As well as their behavior according to the index seems to show a slight decrease in liquidity, an increasing level of efficiency, and the profitability of most of those companies decreased. Moreover, it will be identified if the market value of stocks in ASE listed companies is correlated with book value of stocks. The testing period enables us to provide insightful conclusions about Portfolio Investment Companies in Greece.

## **KEYWORDS**

Financial Markets, stock behaviour, Portfolio Investment companies

**JEL CLASSIFICATION CODES:** F65, G01, G15, G41

## **Robotic Process Automation a Digital Transformation and Its Applications in the Businesses: A Literature Review**

**Thomas kitsantas<sup>1</sup>, Peter Georgoulas<sup>2</sup> and  
Evangelos Chytis<sup>3</sup>**

<sup>1,3</sup>University of Ioannina, Ioannina, Greece, School of Economics & Administrative Sciences,  
Department of Accounting & Finance  
[th.kitsantas@uoi.gr](mailto:th.kitsantas@uoi.gr), [ehytis@uoi.gr](mailto:ehytis@uoi.gr)

<sup>2</sup>Accountant and Business Consultant  
[pgeorgoulas@gmail.com](mailto:pgeorgoulas@gmail.com)

### **Abstract**

Robotic Process Automation (RPA) has gained significant attention as a way to automate repetitive and mundane tasks across various organizations and industries. RPA is a game-changer for many businesses looking to achieve cost savings, increase speed, and improve efficiency, scalability, and accuracy. However, academic research seems to be stagnating in this domain. To bridge this gap, we conducted a structured and systematic literature review of published scientific articles on RPA. We aimed to identify the RPA in academic literature, examine its feasibility in terms of implementation, describe its advantages and disadvantages, and assess the risks and best practices. In this manuscript, we present that the literature has notably lacked to discuss adequately the benefits of RPA and its best practices and identify those that are especially useful for practitioners and organizations. Based on our outcomes, we also propose an agenda of future topics for the exploration of RPA technology.

**Keywords:** RPA, Task, Automation, Business, Robot

**Paper type:** Research paper

**JEL:** M15, M21, M40

### **I. Introduction**

In today's competitive world, RPA is gaining popularity in many industries since it can reduce errors, increase efficiency, improve accuracy by automating routine and time-consuming tasks, speed up processes, and free up employees for more complex tasks (Cohen, Rozario, & Zhang, 2019). Unlike other automation technologies, RPA can be automated without significant disruption or expense (Asatiani & Penttinen, 2016), due to its non-intrusive nature into current Information Technology (IT) systems. They can be programmed to learn from previous interactions (Willcocks, Lacity, & Craig, 2017), improving performance over time. Thus, RPA is a powerful technology that can assist organizations to achieve greater efficiency, productivity (Andreas, Radke, & Albert, 2020), and cost savings by automating repetitive tasks.



A definition for RPA could be the following:

*“A preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management” (Deloitte, 2017).*

RPA involves the use of software robots, “bots”, or “virtual agents” to automate repetitive and mundane tasks (Rajesh & Ramesh, 2018; Lacity & Willcocks, 2016), such as data entry, form filling, and document processing that are typically performed by humans. These bots are designed to mimic human actions and can be programmed to perform a variety of tasks (Willcocks, Lacity, & Craig, 2017), interacting with computer systems, applications, and data sources, including data extraction, data processing, record keeping, report generation, and many other back-office functions (Suri, Elia, & Hillegersberg, 2017). Consequently, repetitive and daily tasks that are usually performed by junior staff will be replaced by robots and human expertise will be needed at a higher level for decisions requiring judgment.

While RPA is not a new technology, it is still rapidly evolving and growing in popularity as more and more organizations look to leverage its benefits, being a very useful and important tool in all categories of business administration tasks. As a result, RPA can be used to automate tasks across various industries, including finance, healthcare, and manufacturing. Hence, RPA has become a very useful and important tool in all categories of business administration tasks.

This study attempts to investigate why RPA is implemented extensively in organizations than examined by researchers. To bridge this chasm, a systematic literature review was carried out to identify and comprehend the major prospective areas for deploying RPA systems, exploring the applications, advantages, disadvantages, limitations, and other technologies and approaches that can be integrated with and supplemented by RPA systems.

Therefore, this paper complements the current literature in several ways. First, this manuscript contributes to the existing literature by providing a greater understanding of the current research by justifying and analyzing RPA systems and describing the technical aspects of the implementation and RPA life cycle. Second, this research study enriches the existing literature by exploring and further developing the business features related to the applications of RPA systems in the business environment. In addition, this study examines the perceived advantages as well as the limitations and drawbacks of this technology, complementing the existing literature on RPA systems. Therefore, the outcome of this study could provide new avenues and insights for practice, motivating and assisting organizations and experts in understanding and further exploring this new technology.

The remainder of the manuscript is organized as follows: materials and methods are presented in the next section, followed by a descriptive literature review of RPA systems. The following section is analyzing the applications of RPA systems. The next section analyzes the benefits and advantages of RPA Systems, followed by the drawbacks and limitations of RPA technology. Finally, a discussion, future research, and conclusions are presented.

## II. Materials and Methods

The methods used for this study were based on the literature review and grounded in theory. An extensive analysis was essential for this research because the main objective of this manuscript was to develop new insights based on comprehensive data collection. Thus, this research paper attempted to investigate the context of RPA and its applications in businesses. Specifically, this study utilizes an exploratory qualitative research methodology (Bryman, 2012). The data were obtained from several databases: Scopus Web of Science, Business Source Premier (EBSCO), ABI Inform (Proquest), and Google Scholar. The keywords that were used for limiting irrelevant research were: (“Robotic Process Automation” OR “RPA”) AND (“Robotic Process Automation” OR “Bots” OR “Robots”), (“Robotic Process Automation and Bots”) AND (“Robotic Process Automation and Robots”).

From the initial pool, only peer-reviewed journals were considered, that directly addressed RPA systems. Following an in-depth review that validated the data collection and datasets through keyword searches, using the title, abstracts, and keywords of the entries in the databases, yielded a total of 71 potential publications for the review process, excluding journals with content not related to RPA systems. All abstracts and conclusions of the identified 71 manuscripts were read and confirmed as relevant to the research. In the literature review, all of the articles were organized by the authors, using color-coding and tagging techniques (Knafl, 1998). Hence, the articles were classified and sorted according to the title and/or theme and compared to what was applicable to each category. Finally, after several screenings in the review process, 56 journals were chosen and deemed relevant to this research. Figure 1 highlights the flowchart of steps involved in the methodology.

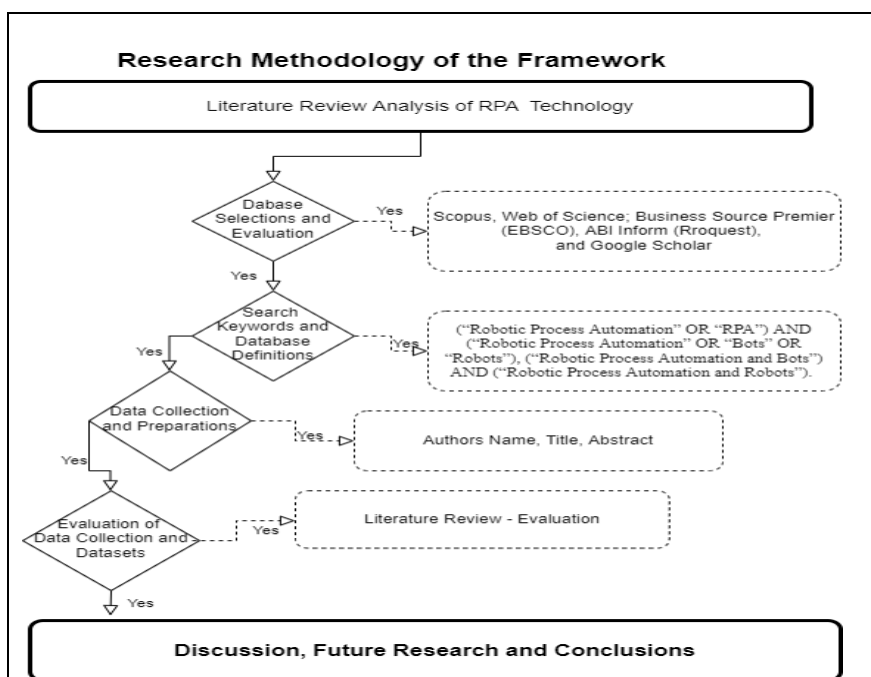


Figure 1. The flowchart of steps involved in the methodology

### III. Literature Review

The use of RPA systems has become more popular in the last 20 years. According to Gartner, Inc. (2019), RPA software revenue grew 63.1% in 2018 to \$846 million, which makes it the fastest-growing segment of the global enterprise software market. The projected potential economic impact of technologies that will automate knowledge work is estimated to be between \$5 and \$7 trillion by 2025 (McKinsey, 2019). Forrester (2017) estimates that by 2021, there will be over 4 million robots automating repeatable tasks, focusing on integration with Artificial Intelligence (AI) and improvements in RPA analytics.

However, Deloitte (2017) has surveyed over 400 companies that have started adopting RPA and almost a quarter of these companies plan to do so within the next two years. They also predict that payback periods are averaging around a year and their expectations of cost reduction, accuracy, flexibility, timeliness, and improved compliance are met or exceeded. Additionally, RPA technology has been revealed to reduce the cost of human resource-related spending by 20–50 percent with transaction processing costs by 30–60 percent (Syed, 2020).

RPA is a business software solution that performs and automates repetitive tasks using software robots (Kim, 2019; Ribeiro, Lima, Eckhardt, & Paiva, 2021), that are typically replicated by humans. RPA bots are designed to emulate the actions of an employee, interacting with applications, databases, and other systems to perform tasks, (e.g., data entry, data processing, and customer service). RPA bots are typically implemented using a Graphical User Interface (GUI) (Greyer-Klingeberg, Nakladal, & Baldauf, 2018), which allows users to design and configure automated processes using a drag-and-drop interface. The processes are then executed by software robots, also known as bots (Rajesh & Ramesh, 2018), which interact with the target systems in the same way as a human.

Particularly, RPA is defined as the application of specific technology and methodologies based on software and algorithms to automate repetitive human tasks (Gejke, 2018; Mendling, Decker, Hull, Reijers, & Weber, 2018) that are, rule-based, and time-consuming, within business processes. RPA can improve efficiency, accuracy (Ratia, Myllärniemi, & Helander, 2018), and productivity of business processes while assisting companies to reorganize their operations, reduce costs, and improve compliance (Rajesh & Ramesh, 2018). Some common functions that software robots can perform are: searching, opening, reading, editing, updating, validating, importing, and formatting data into other applications. For example, an RPA robot can access systems in the same way as humans, through a login, gathering data and processing them using instructions and rules, and finally uploading these data into a different system. Figure 2 illustrates this process.

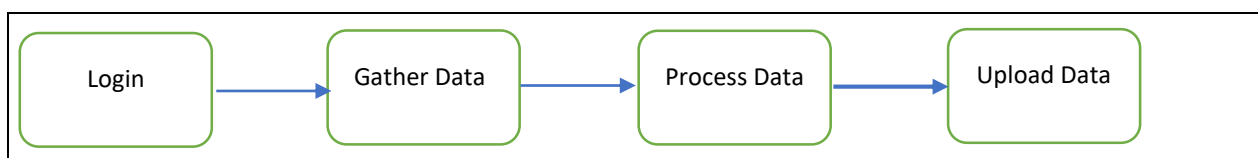


Figure 2. Illustrates a typical RPA Process.

Moreover, RPAs could be deployed faster than other IT solutions that rely on Application Program Interfaces (APIs) to integrate with systems, often taking two to four weeks as opposed to months or years to implement (Asatiani & Penttinen, 2016). With RPA, business entities can automate processes quickly and easily without requiring extensive IT support, custom coding, or advanced configuration (Asatiani & Penttinen, 2016). This means that businesses can implement digital transformation initiatives quickly and with limited risk, giving them a competitive advantage in the marketplace by changing the way businesses approach digital transformation.

However, human intervention is needed to manually feed the robots with processed data, since robots are not yet skilled in processing or manipulating unstructured data. As a result, robots cannot handle cognitive tasks and rules for which they cannot comprehend, or be modeled, and require the expertise of humans (Perrier, 2018). Organizational capabilities and understanding of the business objectives of RPA implementation are critical to the success of RPA projects. Inadequate understanding of what RPA can achieve and where it can be implemented, lack of managerial support, and the fear of job loss by employees are identified as key challenges to process automation (Suri, Elia, & Hillegersberg, 2017).

### **1. Technical Characteristics and Steps in Implementing RPA Systems**

The choice of an RPA tool will depend upon the specific needs and requirements of the organization. Thus, it is important to evaluate the features, functionality, and integrations of different RPA tools and integrate the one that best meets the organization's needs. Therefore, some of the main RPA tools available in the market that are suitable for different types of tasks and industries are the following:

**Table 1:** The Main RPA Tools

	<b>RPA Software Tools</b>	<b>Description</b>
1.	UiPath RPA Software Tool	UiPath RPA Software Tool offers a wide range of features and integrations. It is suitable for automating a wide range of tasks across different industries, including finance, healthcare, and manufacturing.
2.	Automation Anywhere RPA Software Tool	Automation Anywhere RPA Software Tool offers a variety of features and integrations. It is ideal for automating tasks in industries such as banking, insurance, and telecommunications.
3.	Blue Prism is an RPA Software Tool	Blue Prism is an RPA Software Tool that focuses on delivering enterprise-grade automation solutions. It provides automation for complex business processes and is commonly used in industries such as finance and healthcare.
4.	WorkFusion is an RPA Software Tool	WorkFusion is an RPA Software Tool that combines RPA with Artificial Intelligence (AI) and Machine Learning (ML) capabilities. It is appropriate for automating complex tasks that require intelligent decision-making and is

		commonly used in industries, including banking and healthcare.
5.	Kofax is an RPA Software Tool	Kofax is an RPA Software Tool that focuses on automating document-intensive processes. It is useful for automating tasks such as data entry and document processing and is commonly used in industries such as insurance and healthcare.
6.	Power Automate is an RPA Software Tool	Power Automate is an RPA Software Tool that focuses on building activities and processes with no coding experience, and it connects easily with all of Microsoft’s services.

## 2. Steps Involved in Implementing RPA Life Cycle

Several authors have contributed and developed the idea of an RPA life cycle (Chacón-Montero, Jiménez-Ramírez, & Enríquez, 2019), dividing it into the following stages: analysis, design, development, deployment, testing, and monitoring. The RPA life cycle is shown in Figure 3.

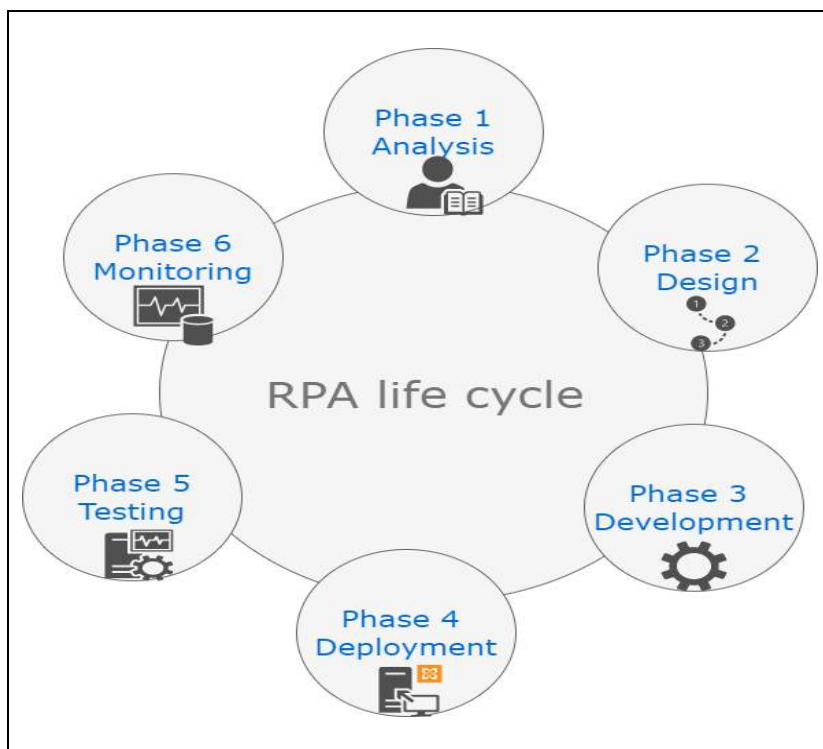


Figure 3. The RPA life cycle

Moreover, Yi-Wei et al., (2019) developed a similar model, regarding the phases of the RPA life cycle, such as the RPA Plan, RPA Demand and Definition, RPA Design, RPA Implement, RPA Test, RPA Operation, and RPA Maintenance. However, this research study uses the RPA life cycle from Chacón-Montero, et al., (2019), defining the concepts of RPA life cycle phases, as follows:

Analysis Phase

- The first phase is to select and classify the appropriate processes for automation. This involves analyzing the current workflow, identifying repetitive and rule-based tasks that can be performed by software bots. Second, defining the scope of the automation, identifying the systems that need to be integrated, and establishing the rules and logic of the actions that can be performed by software robots (Chacón-Montero, Jiménez-Ramírez, & Enríquez, 2019). Third, choose an RPA tool that meets the defined requirements and characteristics. The chosen RPA tool should be easy to use, scalable, and able to integrate with the existing or legacy systems that an organization operates.

#### Design Phase

- This phase intends to describe and analyze in detail all the actions involved in creating workflows, activities, design patterns, and defining the tasks to be performed in the RPA process (Enriquez, Ramirez, Mayo, & Garcia-Garcia, 2020).

#### Development, Deploying, and Testing Phase

- The RPA solution is then developed and tested in a controlled environment. However, at this point, we have to decide which method should be applied, the classic waterfall model or the agile approach. Yi Wei et al., (2019), suggested a specific solution by comparing the two methods according to their practical use. Then, the developed flow should be tested according to the requirements, defined in the previous step, followed by testing the solution to ensure that it meets the defined requirements to determine whether it behaves correctly (Chacón-Montero, Jiménez-Ramírez, & Enríquez, 2019). Once the RPA solution has been developed and tested, it is deployed in the production environment. This involves installing the software robots on the machines that will be used for automation and configuring the solution to run in the background. When the RPA solution has been deployed in production, it is very important to train employees on how to use and operate the new system, ensuring that employees are comfortable working with it.

#### Monitoring Phase

- Afterward, the RPA solution has to be monitored and maintained to make sure that it continues to meet the predefined requirements and steps. This involves monitoring the performance of the software robots, identifying and fixing issues that might arise, and making updates and changes to the solution as needed (Chacón-Montero, Jiménez-Ramírez, & Enríquez, 2019). Finally, as the organization gains experience and confidence in the RPA technology, we can scale up and expand the RPA solution to automate more processes and achieve greater efficiency in the organization.

Therefore, deploying RPA software in a production environment requires systematic and careful planning, testing, and monitoring to ensure an efficient and successful implementation.

## **IV. Applications of RPA Systems**

RPA systems could be applied in a wide range of tasks across various industries. The following section presents some of the common and practical applications of RPA systems in different industry domains. Applications have been categorized into the following groups: Finance and Accounting, Manufacturing, Banking and Financial Services, Customer Service, Healthcare, and Human Resources.

## **1. Finance and Accounting**

RPA has the potential to transform the finance and accounting fields. The big four major accounting firms (PwC, EY, Deloitte, and KPMG) have already started to automate their work processes, using several digital tools to save manpower and time, improving the efficiency, and quality of audit work. According to Cooper et al., (2019), RPA bots will shift the professional accountant's role to devote and focus more on analytical and strategic work such as financial analysis and forecasting activities (Lavinia-Mihaela, 2019) at the expense of routine activities.

Therefore, RPA can be used to automate various tasks including accounts payable and accounts receivable, financial reporting, invoice processing, risk management, and financial planning and analysis (Fernandez & Aman, 2018). Finance and accounting using RPA bots could improve payment processing, account reconciliation, clearing customer dues, and report generation (Gotthardt, et al., 2019), improving their overall business; thereby reducing costs and the risk of errors. Likewise, General Ledger (GL) can be automated with RPA bots by collecting financial data, (e.g., assets, liabilities, expenses, and revenue), and updating the GL with the appropriate data information, improving the speed and accuracy of transactions. As a result, RPA bots would significantly reduce the time and effort required to complete the mentioned tasks, improving accuracy and reducing the risk of errors.

Moreover, RPA could automate the process of invoicing, including data entry, validation, and approval. In the same way, RPA would automate the process of data extraction from multiple sources, consolidation, and analysis for financial reporting (Tansel, Turkyilmaz, & Birol, 2019). As far as accounting, traditionally, invoice data has to be manually entered into an Enterprise Resource Planning system (ERP), which is time-consuming and error-prone, however, RPA bots could automatically validate records into ERP, minimizing human error (Rajesh & Ramesh, 2018), by being programmed to extract data from the invoice, (e.g., vendor name, invoice number, date, and amount). The bot then could validate the data against the company's ERP system, attesting that the information is accurate and complete, saving the accounting employees hours of manual data entry. In addition, RPA bots could also send notifications to the relevant parties - accountants or the procurement staff alerting them to the status of the invoice, replacing, in a way, humans and improving performance (Lacurezeanu, Tiron-Tudor, & Bresfelean, 2020), by assisting them to manage other complex processes.

## **2. Manufacturing**

In the manufacturing industry, companies are always looking for ways to optimize their operations and increase efficiency. RPA has emerged as a powerful solution for the manufacturing industry, offering a range of benefits that can help improve speed, scalability, increase productivity (Andreas, Radke, & Albert, 2020), and simplify manufacturing operations. RPA could play an

important role, in leading manufacturers to automate various tasks (e.g., inventory and supply chain management), by automating processes regarding shipment tracking, payment processing, and quality control (Flechsigg, Anslinger, & Lasch, 2021) by performing tasks consistently and without variations; thus, reduce errors (Vasarhelyi & Rozario, 2018). Logistics could also be automated; this includes transport management, monitoring goods in transit, and providing valuable insights regarding carriers and insurance companies. This can be extremely important in industries such as aerospace, automotive, and medical device manufacturing, where quality is paramount for optimizing their supply chain management and logistics.

Moreover, RPA is a technology that could be used to automate various other repetitive and rule-based tasks in manufacturing processes, including production order processing, data entry, and invoicing (Lievano, et al., 2022). Particularly, intelligent bots could receive purchase orders from any source, including fax, email, or website, and "read" them by extracting data and sending the data to the relevant databases, fulfilling the purchase order. Also, bots could take bills of lading and reconcile them with raw goods inventory, ensuring that all materials have been received and paid accurately, eliminating errors in scheduling and reducing the risk of delivering the wrong inventory. Additionally, RPA might assist manufacturers to identify trends and patterns in data, which can be used to make informed decisions about production, pricing and inventory management, increasing efficiency, reducing costs and improving accuracy (Viale & Zouari, 2020). Hence, RPA bots could provide manufacturers with real-time visibility into their production processes, enabling them to identify issues and bottlenecks quickly.

As a consequence, RPA would enable manufacturers to focus on more strategic and value-added activities (Remko, Larsen, & Lacity, 2022), including innovation and product development, optimizing their processes, improving overall productivity, and overcoming the competition in an increasingly demanding market.

### **3. Banking and Financial Services**

In today's world, the banking and financial services industry is highly competitive, with organizations always looking for ways to improve their operational efficiency and reduce costs. The banking industry is constantly challenged with the processing of vast amounts of sensitive data, which requires high levels of accuracy and speed. RPA is an effective solution that can help banks automate various processes, changing the business and customer service model and internal operating procedures (Met, Kabukçu, Uzunogullar, Soyalp, & Dakdevir, 2020). RPA can allow banks and financial services companies to automate repetitive and rule-based tasks. For example, data entry, document processing, and customer service inquiries. Thus, several leading banks have taken steps toward adopting RPA in their organizations (Vishnu, Agochiya, & Palkar, 2017).

In the near future, automating existing, or new accounts and loan processing with RPA will be crucial for financial institutions in order to reduce costs. RPA bots could pinpoint the accounts that have been temporarily blocked, and obtain their previous activities, removing any temporary



blocks and restrictions. Bots could open new accounts, by extracting customer data from various sources, such as ID cards or application forms, and validating these data against regulatory obligations. Figure 4 illustrates the process of opening new accounts and loan origination. Accordingly, bots could extract relevant data from paper applications and documents, calculate key metrics (e.g., credit risk scores and debt-to-income ratios), automating the process of new loan applications. This can significantly reduce the time and resources required to open new accounts and loans while improving accuracy and reducing errors.

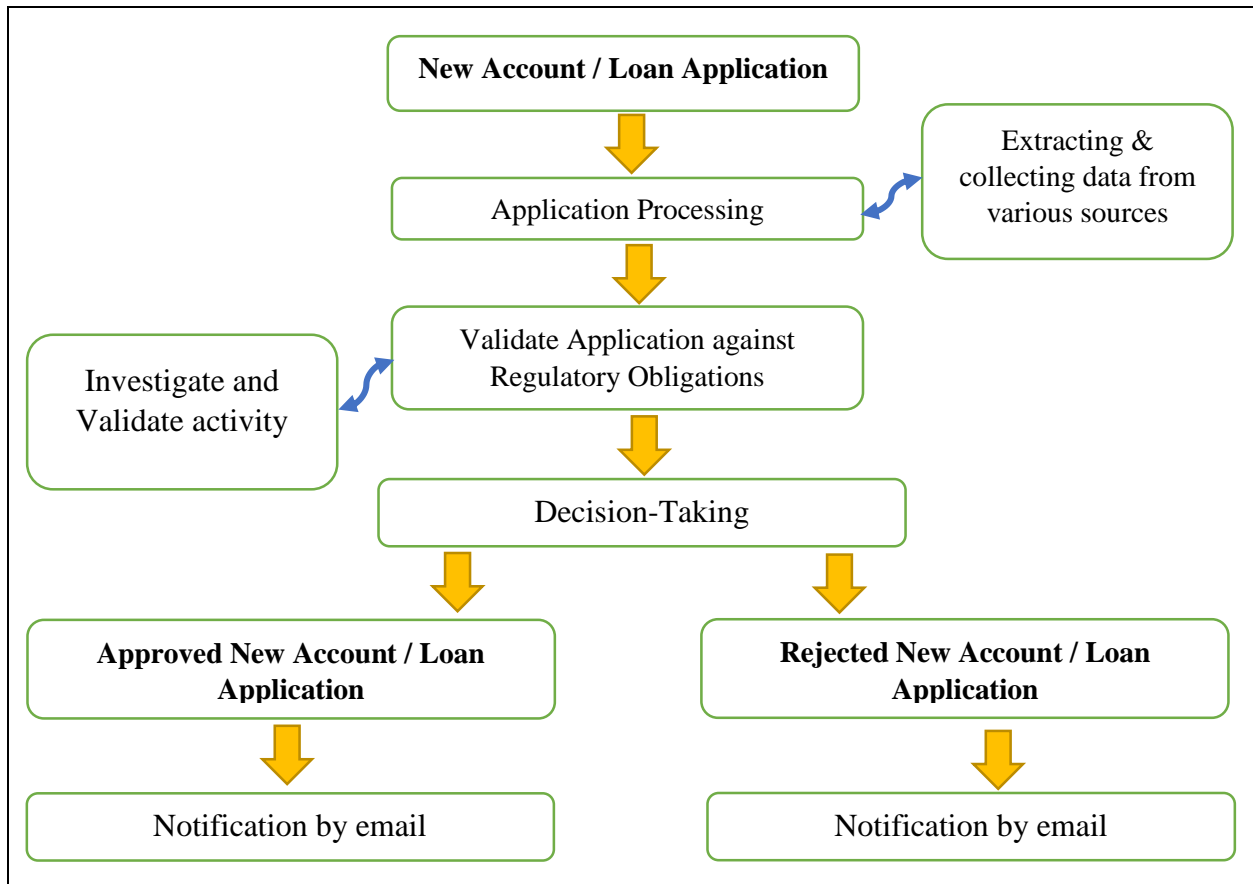


Figure 4 illustrates the stages of opening new accounts and loan origination.

Moreover, RPA bots could automate the process of invoicing and billing, extracting relevant data from invoices, validating them against contracts or orders, and generating payment instructions. Thus, bots could identify patterns, anomalies, and inconsistencies, triggering alerts to human analysts to further investigate suspicious activity. In the same way, account reconciliation could be improved with RPA bots by automating the reconciliation process, matching transactions across multiple bank accounts or systems, identifying errors and discrepancies, and resolving them automatically. Also, credit card issuance can be automated with RPA by reducing time-consuming processes, including document collection, credit checks, and determining whether a client is eligible or not for a credit card.

Likewise, fraud detection and prevention could be used with RPA bots to analyze large datasets and identify potential fraudulent activities (Maček, Murg, & Veingerl, 2020), detect anomalies,

focus on high-value transactions in vulnerable segments, and send alerts to financial institutions. RPA can also be used for generating reports functions (Suri, Elia, & Hillegersberg, 2017) by collecting information from various sources, validating, and organizing data in the required format with high accuracy, managing critical problems with extreme reliability, and sharing reports with the necessary stakeholders.

Therefore, by automating these tasks, banks and financial services companies can significantly reduce the time and resources required to process new applications, and loans, automate invoicing and billing, and prevent fraud while improving accuracy, reducing errors, and freeing up employees to focus on more complex tasks that require human expertise (Remko, Larsen, & Lacity, 2022).

#### **4. Customer Service**

RPA could be a valuable tool for improving customer service, by automating tasks such as ticket routing, data entry, email response, and routine tasks. RPA bots could also automate repetitive tasks including data entry, order processing, and customer inquiries, enabling faster response times, reduce errors, and improving overall customer experience.

Additionally, RPA could be trained to effectively handle customer inquiries by answering frequently asked questions, guiding the customer through self-service options, or directing the query to the appropriate representative. Email management with RPA could be also automated by processing incoming customer emails, reading and analyzing the content of each email, categorizing it based on the customer's needs, prioritizing urgent cases, generating responses, and forwarding the email to the appropriate human representative.

Data management through an RPA robot could be used to automatically collect, aggregate, and analyze customer data, (e.g., as customer reviews and feedback), providing assistance when identifying areas for improvement and bring to light potential problems that may require attention. Order processing could be improved with RPA robots, automating the processing of orders from customers, including invoicing and payment processing, as well as updating stock and managing shipping and returns.

Hence, by automating these tasks, customer service representatives can focus on more complex issues that require human intervention, resulting in faster resolution times and leading to higher customer satisfaction.

#### **5. Healthcare**

In the healthcare industry, RPA technology has the potential to automate repetitive and mundane tasks (Aguirre, 2017), and ultimately improve the efficiency of the healthcare system. RPA could be used to automate tasks (e.g., patient registration, claims processing, and appointment scheduling); thus, reducing errors, and improving efficiency, allowing healthcare professionals to focus on patient care (Ratia, Myllärniemi, & Helander, 2018). For instance, due to the rapid spread of COVID-19, examination rooms were experiencing high demand, resulting in long lines of

patients waiting for examinations. RPA bots could provide a solution by speeding up the testing process of COVID-19 up to 90% using robots to collect patient data, integrate them into the Electronic Medical Records (EMR) of the hospital, record the test results, and send these data to different departments while eliminating the manual errors and reducing waiting time (D.G.S. Inc., 2021).

Particularly, RPA bots could automate patient data, by enabling faster appointment booking, searching application records and collecting data, validating records such as order processing and integrating EMR, improving payment processing or prescription management, reducing errors, and improving patient safety. Figure 5 illustrates the main applications of RPA in healthcare. In terms of medical billing RPA could automate the process, including claim submission and payment posting, enabling a faster payment process.

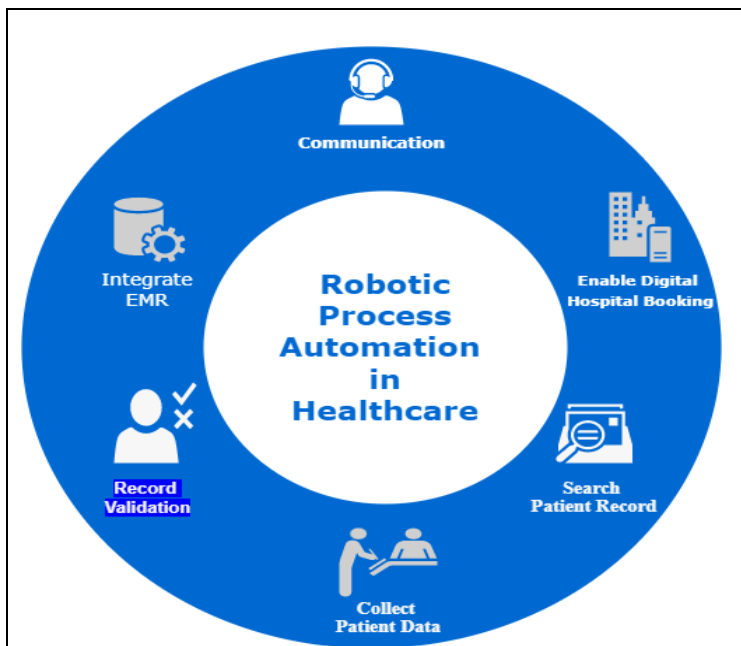


Figure 5 illustrates the main RPA application stages in healthcare.

Moreover, healthcare organizations deal with a large number of insurance claims on a daily basis as to which they have to manually process. These claims are time-consuming and liable to errors. By implementing RPA technology in the healthcare context, organizations could automate claim data entry and validation, verify data accuracy and completeness, and process claims with minimal human intervention. This could save valuable time and resources, reduce errors and streamline claims processing workflow. Thus, RPA would significantly improve the efficiency, accuracy, and speed of various healthcare processes, allowing healthcare providers to focus on providing better patient care.

## 6. Human Resources

Human Resources (HR) departments are responsible for managing several tasks from recruitment and onboarding to employee data and performance management. These tasks are time-consuming

and repetitive (Mohamed, Mahmoud, Mahdi, & Mostafa, 2022), so RPA could be of great assistance (Anagnoste, 2018). RPA could automate HR functions, including payroll processing, performance management, employee data management, and employee engagement surveys.

Subsequently, RPA could automate the process of screening and assessment of curriculum vitae (CVs) and matching candidate profiles with job requirements, scheduling interviews, and sending notifications by email to candidates. RPA might automate the process of collecting, executing tasks, verifying, and validating employee records in the database. Also, RPA could automate the payroll process by automatically extracting employee attendance and leave data, calculating wages, and generating pay slips, as well as automating the process of collecting and organizing employee performance data, creating performance reports, and setting up performance improvement plans. This could significantly reduce the time and effort required to process payroll, while also improving accuracy and reducing errors.

Therefore, RPA could be an essential tool for HR departments looking to improve their efficiency, reduce manual effort, and increase accuracy. By automating repetitive tasks, RPA could allow HR staff to focus on more strategic tasks such as employee engagement, talent development, and organizational culture.

## **V. Benefits and Advantages of RPA Systems**

RPA systems offer numerous benefits and advantages for businesses looking to streamline their operations, improve efficiency, and reduce costs. Particularly, some of the main advantages of RPA systems are the following:

### **1. Improved Efficiency**

RPA is a powerful software that can help businesses improve efficiency by automating repetitive and time-consuming tasks (Ratia, Myllärniemi, & Helander, 2018). The use of RPA tools could enable the ability to complete tasks at a faster rate than humans, increasing productivity and efficiency for companies. RPA tools could also significantly reduce the amount of time and resources required to complete various business processes, allowing employees to focus on more strategic tasks (Santos, Pereira, & Vasconcelos, 2019), that require critical thinking and decision-making skills, improving overall productivity and efficiency. RPA bots could work around the clock, 24 hours a day (Driscoll, 2018), which means that processes can be completed at any time of day without requiring human intervention. This could help streamline workflows and eliminate bottlenecks, speeding up overall productivity (Kedziora, Leivonen, Piotrowicz, & Öörni, 2021), assisting businesses to reduce human errors (Vasarhelyi & Rozario, 2018) which, could lead to costly mistakes and rework, resulting in significant improvements in efficiency.

Moreover, RPA bots could be used to automate tasks (e.g., data validation), to ensure that data is accurate and up-to-date, assisting companies to improve customer service and, automating tasks (e.g., processing orders, improving response times), reducing the workload on customer service representatives. This could improve a business' overall efficiency, providing a better customer experience, and reducing the time and cost required to ensure compliance (Kedziora, Leivonen, Piotrowicz, & Öörni, 2021).

## **2. Scalability**

Scalability is a key factor for businesses that want to grow and expand their operations. As a consequence, RPA bots can be scaled up or down (Chugh, Macht, & Hossain, 2022) depending on the needs of the business entity to quickly adapt to changing workloads (Santos, Pereira, & Vasconcelos, 2019). This makes it easy to adjust the level of automation based on demand, leading to greater flexibility and agility, ensuring that they have the resources needed to meet the demand.

Hence, RPA is a cost-effective way to scale up business operations, by automating repetitive tasks and, reducing the need for human labor, without incurring significant additional labor costs. Bots can be easily configured and customized to meet the specific needs of a business in a way that is tailored to their unique requirements, without the need of extensive training or development of complex applications, and automating capabilities - in a matter of days or weeks, rather than months or years, using other applications.

## **3. Improved Accuracy**

RPA bots can perform tasks with a high degree of accuracy and consistency (Devarajan, 2018); thus, reducing errors and improving data quality. RPA bots can be programmed to execute tasks with precision and accuracy; therefore, eliminating errors (Vasarhelyi & Rozario, 2018), that are typically associated with human operators (Devarajan, 2018), improving accuracy and quality of work, leading to better business outcomes. They can perform tasks consistently, without the variability that can occur with human operators, allowing tasks to be performed according to the same set of rules, leading to greater accuracy and standardization (Greyer-Klingeberg, Nakladal, & Baldauf, 2018).

Particularly, RPA bots can perform tasks without the need of manual intervention, reducing the risk of errors caused by human operators, and minimizing the time and effort required to perform tasks, leading to increased efficiency and accuracy (Cutura, 2019). RPA bots could be programmed to monitor processes in real-time (Willcocks, Lacity, & Craig, 2017), identifying and flagging any errors or anomalies, and resolving them quickly, leading to improve accuracy and reducing downtime. Lastly, RPA bots could perform tasks faster than employees, reducing time (Kedziora, Leivonen, Piotrowicz, & Öörni, 2021), improving accuracy, and increasing the speed of tasks, especially when tasks are time-sensitive or require a high degree of precision.

## **4. Cost Savings**

RPA could significantly reduce the cost of labor by automating repetitive and routine tasks, reducing the need for human labor (Ratia, Myllärniemi, & Helander, 2018), and improving overall decision-making, and critical thinking. RPA can increase efficiency by completing tasks at a faster rate than humans, improving accuracy, reducing error rates, and automating mundane tasks (Greyer-Klingeberg, Nakladal, & Baldauf, 2018).

Moreover, RPA bots can be dedicated to tasks, including data entry, invoice processing, and customer service, reducing the time and cost required to complete them (Alt, 2018). RPA can assist

businesses in reducing labor costs by automating repetitive tasks, freeing up employees, and emphasizing higher-value tasks (Gotthardt, et al., 2019), improving businesses' compliance with regulatory requirements. Since they can be programmed to comply with regulations tasks (Rajesh & Ramesh, 2018), RPA bots reduce the risk of non-compliance and associated fines or penalties. Additionally, bots can help companies achieve availability, reducing the need for overtime pay or the cost of hiring additional employees for overtime work hours since RPA bots can work around the clock (Driscoll, 2018), saving money and increasing productivity.

## **VI. Challenges and Limitations of RPA Systems**

RPA could lead to several benefits for businesses, however, it is very important to carefully evaluate and assess some of the potential challenges and limitations of RPA, ensuring that it is the right solution for the business needs. According to Ravn et al., (2016) and Kenneth, et al., (2019), about 30-50% of all RPA deployments fail because of misapplication. Hence, RPA might not be suitable for all tasks that a company uses, meaning we have to consider and address other issues and problems as well. As a result, some potential limitations and drawbacks that need to be addressed and considered are the following:

1. RPA bots are designed to perform repetitive tasks based on pre-defined rules and instructions. However, they lack cognitive abilities (Perrier, 2018), and cannot perform tasks that require complex reasoning, decision-making, or intellectual thinking. Hence, tasks requiring creativity, judgment, or problem-solving skills are unsuitable for automation using RPA tools.
2. RPA bots might have limited integration capabilities with legacy systems or other software applications that are not designed for automation, limiting the range of tasks that can be automated through RPA systems.
3. RPA bots are designed and dependent to work with a structured digital form and will struggle with unstructured data or data that requires further interpretation (Yatskiv & Vasylyk, 2020), limiting the diversity of tasks that can be automated using RPA software.
4. RPA bots can pose security risk issues, if not implemented appropriately. They may have access to sensitive data and can be vulnerable to cyber threats or hacking attempts. Thus, it is very important to ensure that RPA is implemented securely.
5. RPA bots require regular maintenance if any system / application interface changes or implement new business processes and it is necessary to update them, in order for them to work properly. This can be time-consuming and might be costly for companies to maintain the RPA bots effectively, ensuring that all necessary resources are available (Axmman & Harmoko, 2020).
6. RPA bots are designed to perform tasks based on specific rules and instructions. If these processes change or evolve to new procedures and functions, the RPA bots might not be able to adapt to the new requirements, decreasing efficiency and accuracy.
7. RPA can offer a great cost of savings in the long term, nevertheless, the initial cost of implementing RPA might be high. High acquisition costs might be associated with licensing, implementation, customization and training, integration and scalability of RPA platform installation and upgrade scripts, (Syed, 2020), error handling, and programming architecture. Thus, it is important to carefully examine and evaluate the potential costs and benefits of RPA adoption (Yatskiv & Vasylyk, 2020).

8. RPA can lead to the displacement of human employees who previously were responsible for performing all these automated tasks (Suri, Elia, & Hillegersberg, 2017). This might lead to negative consequences for employee morale and potentially create a skills gap in the workforce or may have a negative impact on the workplace (Asatiani & Penttinen, 2016).

## **VII. Conclusion and Further Research**

From a theoretical perspective, based on the literature review, this study indicates that the field of RPA systems is still relatively new and that no theoretical frameworks have been formulated. Therefore, this paper contributes to the existing literature by analyzing the technical and business aspects regarding the applications of RPA systems, exposing the advantages as well as the drawbacks and limitations of this technology, providing new knowledge for practice, and assisting researchers in further exploring RPA systems.

The outcomes of this paper reveal that RPA is a powerful tool that can be used to automate repetitive and rule-based tasks by using software robots, which can significantly reduce the time and human effort required. However, RPA software has some potential challenges and limitations that need to be considered. RPA systems require a high degree of accuracy regarding the input data, and any errors in the data can lead to significant problems. RPA may not be suitable for complex or unpredictable tasks that require human judgment, intervention, or decision-making. RPA software requires regular maintenance to ensure that they are accomplishing tasks properly. Lastly, RPA bots usually have access to sensitive data and might be exposed to hacking attempts, losing valuable data, if not set properly.

On the other hand, RPA has the potential to revolutionize the way businesses operate, improving efficiency, reducing costs, and enhancing customer service. RPA could automate a wide range of tasks across different industries, functions, applications, and systems, (e.g., data entry, invoice processing, customer support, and many other repetitive tasks). Moreover, as the technology continues to evolve, we can expect to see even greater applications of RPA in the future, especially prominent in industries such as finance and accounting, bank services, healthcare, human resources, and manufacturing.

RPA systems in the future could also be integrated with other technologies, in Industry 4.0 projects including AI, ML, Intelligent Process Automation (IPA) (Lin, 2018), and in blockchain technologies, improving its capabilities and enabling RPA to handle more complex tasks and make more intelligent decisions based on data analysis. Therefore, future research is required to examine and understand more intensively the integration of IPA and RPA systems. IPA technologies could greatly help RPA applications to learn from data-driven processes and make intelligent decisions, instead of mapping rule-based processes. Also, Natural Language Processing (NLP) could promote RPA bots to interact with humans in a more natural and intuitive way.

Moreover, in the near future, we might use a more secure RPA-as-a-Service that enables businesses to access RPA capabilities without having to invest in expensive infrastructure and training. Thus, this could make RPA more accessible to smaller businesses. Also, cloud-based RPA, robotic devices, and Internet of Things are growing as they offer greater scalability,

flexibility, and cost-effectiveness, creating more automated and efficient processes compared to traditional on-premises solutions.

Concluding, RPA software has the potential to convey significant benefits for companies when they are planned and implemented carefully, maximizing the benefits to organizations. Therefore, organizations should carefully assess their business processes and identify areas where RPA could add value by enhancing their processes, while investing in training, and preparing their employees to work along with RPA software, ensuring a stable and successful transition to automation.



## References

- Aguirre, S. R. (2017). Automation of a business process using robotic process automation (RPA): A case study. *Applied Computer Science Engineering Communication Computer Information Science*.
- Alt, R. (2018). Electronic markets on digitalization. *Electronic Markets*, 28, 397–402.
- Anagnoste, S. (2018). Robotic Automation Process – The operating system for the digital enterprise. *Proceedings of the International Conference on Business Excellence. De Gruyter Poland*, 12, pp. 54-69.
- Andreas, M., Radke, M. T., & Albert, T. (2020). Using Robotic Process Automation (RPA) to Enhance . *Scientific Journal of Logistics*, 16(1), 129-140.
- Asatiani, A., & Penttinen, E. (2016). Turning robotic process automation into commercial success. *Journal of Information Technology Cases*, 6, 67–74.
- Asatiani, A., & Penttinen, E. (2016). Turning robotic process automation into commercial success – Case OpusCapita. *J. Inf. Technol. Teach. Cases*, 6(2), 67–74.
- Axmann, B., & Harmoko, H. (2020). Robotic Process Automation: An Overview and Comparison to Other Technology in Industry 4.0. *10th International Conference on Advanced Computer Information Technologies, ACIT 2020 - Proceedings*, (pp. 559–562). doi:10.1109/ACIT49673.2020.9208907
- Bryman, A. (2012). *Social research methods*, in. *Book Social research methods*, OUP Oxford.
- Chacón-Montero, J., Jiménez-Ramírez, A., & Enríquez, J. (2019). Towards a method for automated testing in robotic process automation projects. *Proceedings - IEEE/ACM 14th International Workshop on Automation of Software Test, AST 2019*, pp., (pp. 42–47). doi:10.1109/AST.2019.00012
- Chugh, R., Macht, S., & Hossain, R. (2022). Robotic Process Automation: A review of organizational grey literature. *International Journal of Information Systems and Project Management*, 10(1), 5-26. doi:10.12821/ijispm100101
- Cohen, M., Rozario, A., & Zhang, C. (2019). Exploring the use of robotic process automation (RPA) in substantive audit procedures. *CPA Journal*, 89(7), 49–53.
- Cooper, L., Holderness, D., Sorensen, T., & Wood, D. (2019). Robotic Process Automation in Public Accounting, Accounting. Horizons, 33. <https://doi.org/10.2308/acch-52466>.
- Cutura, S. (2019). *The Benefits of Robotics in Financial Services*. Retrieved from <https://info.convedo.com/the-benefits-of-robotics-in-financial-services>
- D.G.S. Inc. (2021). *Robotic process automation (RPA) use cases in COVID-19 pandemic situations*. Retrieved from <https://www.datamatics.com/intelligent-automation/solutions>
- Deloitte. (2017). *Guide for Terms and Concepts in Intelligent Process Automation*. EEE Corporate Advisory.
- Deloitte. (2017). *The robots are ready. Are you? Untapped advantage in your digital workforce*. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/technology/deloitte-robotsare-ready.pdf>

- Devarajan, Y. (2018). A Study of Robotic Process Automation Use Cases Today for Tomorrow's Business. *International Journal of Computer Techniques*, 5(6).
- Driscoll, T. (2018). Value Through Robotic Process Automation: Replacing Labor-and Transaction-Intensive Processes with RPA can Reduce Costs while Improving Efficiency and Quality. *Strategic Finance*, 99(9), 70-72.
- Enriquez, J., Ramirez, A., Mayo, F., & Garcia-Garcia, J. (2020). Robotic Process Automation: A Scientific and Industrial Systematic Map Ping Study,. *IEEE Access*, 8(1), 39113–39129. doi:10.1109/ACCESS.2020.2974934
- Fernandez, D., & Aman, A. (2018). Impacts of Robotic Process Automation on Global Accounting Services. *Asian Journal of Accounting and Governance*, 9, 123-132.
- Flechsig, C., Anslinger, F., & Lasch, R. (2021). Robotic process automation in purchasing and supply management: A multiple case study on potentials, barriers, and implementation. *Journal of Purchasing and Supply Management*. doi:10.1016/j.pursup.2021.100718
- Forrester, F. T. (2017). *Wave Robotic Process Automation, Q1*. What Matter Most and How They Stack Up, Forrester Research, Inc., The 12 Providers. Retrieved from <https://www.forrester.com/report/The+Forrester+Wave+Robotic+Process+Automation+Q1+2017/-/ERES131182> (2017)
- Gartner, I. (2019). *Gartner says worldwide robotic process automation software market grew 63% in 2018*. Retrieved from <https://www.gartner.com/en/newsroom/press-releases/2019-06-24-gartner-says-worldwide-robotic-process-automation-sof>
- Gejke, C. (2018). A new season in the risk landscape: Connecting the advancement in technology with changes in customer behaviour to enhance the way risk is measured and managed. *Journal of Risk Management in Financial Institutions*, 11(2), 148–155.
- Gotthardt, M., Koivulaakso, D., Paksoy, O., Saramo, C., Martikainen, M., & Lehner, O. (2019). Current State and Challenges in the Implementation of Robotic Process Automation and Artificial Intelligence in Accounting and Auditing. *ACRN Oxford Journal of Finance & Risk Perspectives*, 8, 31-46.
- Greyer-Klingeberg, J., Nakladal, J., & Baldauf, F. (2018). Process Mining and Robotic Process Automation: A Perfect Match. *16th International Conference on Business Process Management ,Sydney, Australia*.
- Kedziora, D., Leivonen, A., Piotrowicz, W., & Öörni, A. (2021). Robotic Process Automation (RPA) Implementation Drivers: Evidence of Selected Nordic Enterprises. *Issues in Information Systems*, 22, 21-40.
- Kenneth, B., Jim, H., & Svetlana, S. (2019). *Hype cycle for artificial intelligence*. Retrieved from <https://www.gartner.com/en/documents/3953603/hype-cycle-for-artificialintelligence-2019>
- Kim, K. (2019). A study of convergence technology in robotic process automation for task automation. *J. Conver. Inf. Technol. (JCIT)*, 8-13. Retrieved from <https://dx.doi.org/10.22156/CS4SMB.2019.9.7.008>

- Knafli, K. (1998). Managing and analyzing qualitative data. A description of tasks, techniques, and materials. *Western Journal of Nursing Research*, 10(2), 195-218.
- Lacity, M., & Willcocks, L. (2016). Robotic process automation at telefónica O2. *MIS Q. Executive*, 15, 21–35.
- Lacurezeanu, R., Tiron-Tudor, A., & Bresfelean, V. (2020). Robotic process automation in audit and accounting. *Audit Financiar*, 18(4), 752-770.
- Lavinia-Mihaela, C. (2019). How AI Can Be Part of Solving Accounting and Business Issues. *19th International Multidisciplinary Scientific GeoConference SGEM. Albena Bulgaria*, (pp. 305-312).
- Lievano, M., Federico, A., Ledesma, F., Javier, D., Burgos, D., Branch-Bedoya, J., & Jimenez-Builes, J. (2022). Intelligent Process Automation: An Application in Manufacturing Industry. *Sustainability*, 8804, 14(14). doi:10.3390/su14148804
- Lin, P. (2018). Adapting to the new business environment: The rise of software robots in the workplace. *The CPA Journal*, 88(12), 60-63.
- Maček, A., Murg, M., & Veingerl, Z. (2020). How Robotic Process Automation is Revolutionizing the Banking Sector. In *In Managing Customer Experiences in an Omni channel World* (pp. 271-286). Emerald Publishing Limited.
- McKinsey, G. I. (2019). *Disruptive technologies: Advances that will transform life, business, and the global economy*. Retrieved from [www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Disruptive%20technologies/MGI\\_Disruptive\\_technologies\\_Executive\\_summary\\_May2013.ashx](http://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Disruptive%20technologies/MGI_Disruptive_technologies_Executive_summary_May2013.ashx)
- Mending, J., Decker, G., Hull, R., Reijers, H., & Weber, I. (2018). How do Machine Learning, Robotic Process Automation, and Blockchains Affect the Human Factor in Business Process Management? *Communications of the Association for Information Systems*, 43.
- Met, I., Kabukçu, D., Uzunogullar, G., Soyalp, U., & Dakdevir, T. (2020). Transformation of Business Model in Finance Sector with Artificial Intelligence and Robotic Process Automation. In *Digital Business Strategies in Blockchain Ecosystems* (pp. pp. 3-29).
- Mohamed, S., Mahmoud, M., Mahdi, M., & Mostafa, S. (2022). Improving efficiency and effectiveness of robotic process automation in human resource management. *Sustainability*, 3920, 14(7).
- Perrier, F. (2018). *Pushing the limits of RPA with AI*. Retrieved from: <https://www.capgemini.com/2018/11/pushingthe-limits-of-rpa-with-ai/>.
- Rajesh, K., & Ramesh, K. (2018). Robotic Process Automation: A Death knell to dead-end jobs? *CSI Communications-Knowledge Digest for IT Community*, 42(3), 10-14.
- Ratia, M., Myllärniemi, J., & Helander, N. (2018). Robotic Process Automation - Creating Value by Digitalizing Work in the Private Healthcare. *ACM International Conference Proceeding*.
- Ravn, R., H. P., Gustafsson, J., & Groes, J. (2016). *Get ready for robots: Why planning makes the difference between success and disappointment*.

- Remko, V., Larsen, J., & Lacity, M. (2022). Robotic process automation in Maersk procurement—applicability of action principles and research opportunities. *Robotic process automation in procurement*, 52(3), 285-298.
- Ribeiro, J., Lima, R., Eckhardt, T., & Paiva, S. (2021). Robotic process automation and artificial intelligence in industry 4.0-A literature review. *Procedia Comput. Sci* 181, 51-58. Retrieved from <https://dx.doi.org/10.1016/j.procs.2021.01.104>
- Santos, F., Pereira, R., & Vasconcelos, J. (2019). Toward robotic process automation implementation: an end-to-end perspective. *Business process management journal*. 26(2), 405-420.
- Suri, V., Elia, M., & Hillegersberg, J. (2017). Software bots-The next frontier for shared services and functional excellence. *International Workshop on Global Sourcing of Information Technology and Business Processes*, Springer, Cham, 81-94.
- Syed, R. (2020). Robotic Process Automation: Contemporary themes and challenges. *Computers in Industry*, 15, 103-162.
- Tansel, K., Turkyilmaz, M., & Birol, B. (2019). Impact of RPA Technologies on Accounting Systems. *Journal of Accounting & Finance*, 82, 235-250.
- Vasarhelyi, M. A., & Rozario, A. M. (2018). How Rootic Process Automation Is Transformin Accountin and Auditing. *The CPA Journal*. Retrieved from <https://www.cpajournal.com/2018/07/02/how-robotic-process-automation-istransforming-accounting-and-auditing/>
- Viale, L., & Zouari, D. (2020). Impact of digitalization on procurement: The case of robotic process automation. *Supply Chain Forum: An International Journal*, 21(3), 185-195.
- Vishnu, S., Agochiya, V., & Palkar, R. (2017). Data-centered dependencies and opportunities for robotics process automation in banking . *Journal of Financial Transformation*, 45(1), 68-76.
- Willcocks, L., Lacity, M., & Craig, A. (2017). Robotic Process Automation: Strategic Transformation Lever for Global Business Services? *Journal of Information Technology Teaching Cases*. 7(1), 17-28.
- Yatskiv, N. Y., & Vasylyk, A. (2020). Method of Robotic Process Automation in Software Testing Using Artificial Intelligence. *10th International Conference on Advanced Computer Information Technologies, ACIT 2020 - Proceedings*, (pp. 501–504). doi:10.1109/ACIT49673.2020.9208806
- Yi-Wei, M., Danping, L., Shiang-Jiun, C., Hsiu-Yuan, C., & Jiann-Liang, C. (2019). System Design and Development for Robotic Process Automation. *Proceedings - 4th IEEE International Conference on Smart Cloud, SmartCloud 2019 and 3rd International Symposium on Reinforcement Learning, ISRL*, (pp. 187–189). doi:10.1109/Smart-Cloud.2019.00038