

Predicting Success for Web Product through Key Performance Indicators based on Balanced Scorecard with the Use of Machine Learning

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Abstract: - Machine Learning (ML) can be proved as an important tool in planning better business strategies. For the purposes of the present study, the prospect for the development of an electronic platform by a technology firm providing financial services is explored. The purpose of this article is to demonstrate the ways in which a start-up can predict the success of an online platform prior to its market launch. The prediction is achieved by applying Artificial Intelligence (AI) on Key Performance Indicators (KPIs) derived from the customers' perspective, as shown in the Balanced Scorecard (BSC). The research methodology was quantitative and online questionnaires were used to collect empirical quantitative data related to bank loans. Subsequently, KPIs were created based on the collected data, to measure and assess the success of the platform. The effectiveness of the model was calculated up to 91.89%, and thus, it is estimated that the online platform will be of great success with 91.89% validity. In conclusion, prediction was found to be crucial for businesses to prevent a dire economic situation. Finally, the necessity for businesses to keep up with technological advances is highlighted.

Key-Words: - Artificial Intelligence, Machine Learning, Business plan, Business strategy, Change management, Balanced Scorecard, Product Success, E-Business, Start-ups, Artificial Neural Networks

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1 Introduction

A business strategy is a specific plan with basic principles about the routes in which a company can achieve its goals [1]. The importance of a strategy is to provide businesses with the time to get a sense of their performance, their capabilities, and their potential growth. In the digital era, the number of businesses that provide their services in the form of web applications is constantly increasing and lately, many of those appear to have a web presence since their inception [2]. As a result, the advances that have taken place in the web technologies have significantly altered the way that businesses collaborate and compete [3].

E-business can be defined as information systems for acquiring, processing, and transmitting information for more effective decision making, in relation to competitive standards [4]. On the other hand, digital networks and communication infrastructures are also a part of the broader economic framework that is accountable for the drastic changes in business that e-business

represents [5]. Due to the growing number of online businesses, it is becoming more and more challenging for them to stand out in the web market. Therefore, it is important to have the right business strategy because without it, even the best idea cannot be successfully implemented [6].

In terms of business strategy, start-ups frequently deal with disruptive technological developments as they seek to develop innovative services for emerging markets or enter an existing market using a new strategic mentality or business model. It is well understood that start-ups must continuously learn from customer behavior, because quick and continuous organizational learning provides a competitive advantage for them. Therefore, they should be tactfully dynamic since they function in a continuously changing and volatile operating environment. As a result, their strategic development is a process of learning [7].

As the market environment tends to change more rapidly than in past decades, numerous organizations have embraced emerging technologies created to improve performance and acquired a

competitive advantage. AI holds a key role in these advancements and has caught the interest of both academics and the industrial sector [8].

Data is being collected in massive amounts, various forms and faster than ever before. This has resulted in the emergence of new technologies, culminating in the acceleration of technological developments that include computational processing capabilities, as well as the development of new AI methods [9].

As a result of the exponential growth in online platforms occurred in recent years, some of them utilize ML technologies to improve the services they provide and to support the decision-making process of the individuals using them [10].

Change management is crucial for a company's survival, operation, and success in a competitive market in light of the substantial change that the use of AI has brought to the practice of decision-making in businesses. To accomplish the objectives it has set, a company should be able to alter its management and organizational structure as needed [11]. The BSC, which outlines the means for a coherent strategic plan that will lead in the success of the business, is a methodology used in modern businesses for change management and, by extension, decision making. More specifically, it takes into account four factors: 1) Financial, 2) Customers, 3) Internal processes and 4) Learning and innovation [12].

Thus, in order to describe the key components of these four aspects of a business, a BSC employs an array of measurements, ratios, indexes of significant accomplishments, and target goals [13]. As a result, the importance of the BSC is about determining the company strategy, breaking it down, and implementing it, all of which are critical phases for a startup looking to introduce new products [14].

KPIs are indicators used by organizations to measure, manage, and compare their performance. These indicators can focus on a variety of aspects and can be implemented to monitor monetary efficiency, customer satisfaction and overall operational quality, among others [15]. Thus, this study is using KPIs from the customers' perspective of the BSC in order to estimate the success of a new product. Specifically, the estimation was achieved by applying an Artificial Neural Networks (ANNs) algorithm using the Python programming language.

2 Problem Formulation

In more detail, this paper examines the success of an online product (financial services platform) using KPIs and an ANN model to determine whether it is likely for a potential customer to use the platform. The data collection was carried out using a questionnaire. The sample was obtained using snow-ball sampling (by sharing it on social media), in an effort to be as large and representative as possible. Usually, in snowball sampling, researchers contact a small number of individuals who then pass the questionnaire along to their own group of people, and so on. Furthermore, the questionnaire that was created consisted of two (2) groups of questions: 1) demographic questions and 2) questions related to the platform's scope of services. The purpose of this article is to demonstrate how a start-up can estimate the KPI that is responsible for the success of an online platform prior to its market launch. The estimation is performed by utilizing AI, using the KPIs derived from the customers' perspective of the BSC.

The contribution of this research to the literature focuses on how ML can be used to design a strategy for optimal decision making about a new web product. For the purposes of this study, the potential development of an online platform by a technology company providing financial services is explored. In this paper, the results for the estimation of the KPI were extracted after the literature review and quantitative analysis using ML with the use of an ANN model. Then, some comments were made, and the research's scope and future steps were also mentioned. Finally, conclusions were drawn.

3 Literature Review

3.1 Change Management and Balanced Scorecard

According to [16], the advancement of technology has resulted in a highly competitive global market. This has brought changes in the management of businesses where companies are no longer concerned only with their production and financial investments but also with the quality of their products in order to differentiate themselves from similar companies. Therefore, there is an obvious need for product evaluation in a business to ensure that the product is profitable.

On the other hand, [17], in their article on measuring the performance of public administration bodies, mention the importance of applying not only financial indicators but also non-financial indicators

in the analysis models. This led them to the conclusion that the BSC is the most effective tool for measuring a company's performance, especially when it is tailored to the specifics of the organization. Thus, it is clear that the appropriate use of BSC should be carried out following sufficient research pertaining to its four aspects mentioned in the previous section.

Through their investigation into the Multicriteria Decision Aid WAP method's integration into the BSC, [13], arrived at the conclusion that this method's application is highly beneficial for a business due to its many advantages. This research employs both the theoretical framework of change management and mathematical models via linear programming. It is, thus, important, because applying a theory via models validates the theory.

According to [18], the application of AI in business has revolutionized decision making. Particularly in their article they make use of the BSC tool in combination with an ANN model to analyze the available data of a co-financed European Union program resulting in optimal decision making.

The necessity of managing internal company changes is discussed by [19]. In particular, they claim that a company finds it difficult to adapt to changes that take place within the organization because the environment in which it operates is altering quickly and unpredictably. These changes have both positive and negative effects, so managers should make the necessary adjustments in the business to maximize positive results while minimizing negative ones. Therefore, for the business's overall well-being, change management should offer the most appropriate balance between positive and negative changes.

Similarly, in their article, [20], describe a study they conducted that identifies the factors that influence the management of a change in a particular firm. They conclude by generalizing that the factors that influence change management need further research by managers and are the ones that contribute to the implementation of effective change in a company. Consequently, prior to implementation, change management in a business requires extensive research and pilot testing.

The research conducted by [21] that studies the ways to use a BSC in planning the launch of a new product, is also important. With a new product in mind, they examine all four aspects of the BSC. According to them, in the financial perspective, a company can assess not only the effectiveness of all the perspectives but also the effectiveness of

previous strategies to achieve economic success. It also pursues to define the financial performance of revenue growth and cost-cutting processes. The Internal perspective is used to identify and better satisfy customer demand through innovation and process improvement, as well as to follow up with excellent customer management service. Additionally, they demonstrate how effectively business resources are used to provide value to customers. The Customers' perspective evaluates the degree of target market penetration. The level of customer performance underlines how much the customer market and service have improved. Organizations must enhance their new product development process and product quality, modify their products to customers' requirements, hasten the commercialization process, and stay one step ahead of their rivals if they are willing to continue growing further. Finally, the Learning and Innovation perspective is related to management of routine processes, employee training, and skills development. In other words, to align them with the strategic goals of the organization, this perspective focuses on internal skills and capabilities. This element is essential for the development of new products and serves as the foundation for management. To use their minds and creative abilities to accomplish organizational and customer goals, employees must be motivated.

The importance of coordinating people, processes, and technology to support strategic goals is acknowledged in the study performed by [22]. Therefore, organizations should consider making investments in coordinating these three aspects that encourage learning and development.

3.2 Business Management with AI

[23] describe in great depth the ML benefits in business. They discuss how both ML and deep learning affect positively a company's increased output, customer retention and growth in the context of today's rapid technological advancements. They also mention the difficulties analysts face and their inability to interpret the outcomes of the algorithms. Therefore, ML algorithms are viewed as a tool that aids in better managing the various issues that may arise in business by speeding up analysis and increasing output.

As demonstrated by [24], the abundance of services deriving from the application of ML opens new opportunities for many technology companies and contributes to the quick expansion of these types of web platforms on the internet. In particular, it is stated that AI is part of many companies today, facilitating business activities, increasing

productivity and offering a variety of ways to speed up communication processes. Additionally, automation using AI systems carries many of the tasks that were once performed by employees and results in company's reduced costs, significant time savings and a gradual increase in profits [25].

In addition to ML, a subfield of AI is Deep Learning. Deep Learning is based on ANNs, which consist of a large number of simple units, called neurons, that exchange signals with each other and form a model used to solve computational problems, [26]. Due to its ability to process information in a similar way that humans acquire certain types of knowledge and the higher accuracy it offers compared to conventional ML methods, it was chosen to be used in this research work. The Deep Learning method with an ANN that was used in this paper is based on the Supervised Learning approach. In this approach, a computer algorithm is trained using labeled data as input in order to accurately classify data or predict outcomes [27].

Moving on to the role of KPIs in this study, [28] mention the identification of KPIs in project-based organizations based on their organizational and functional needs. Their research is primarily concerned with the categorization of KPIs using a qualitative approach to project success.

4 Research Methodology

4.1 Balanced Scorecard

For the change management of the technology company in the example of this research, a BSC, as shown in Figure 1, was constructed including the four aforementioned aspects.

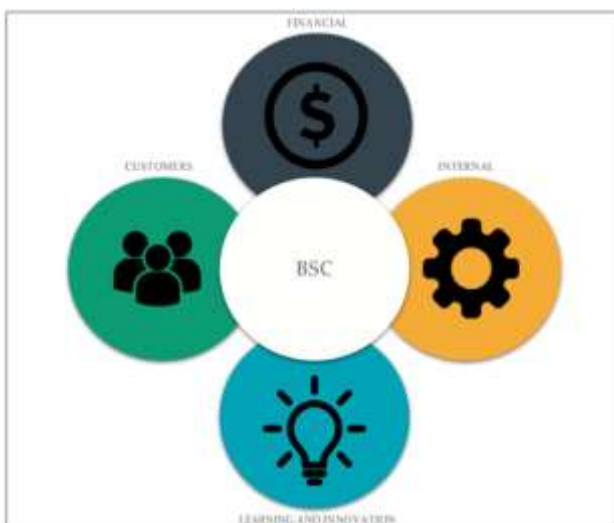


Fig. 1: The balanced scorecard.

Source: Authors

Additionally, the information for these four aspects is summarized in Tables 1, 2, 3, and 4. The four KPIs, which are the measures of the customer's perspective of the BSC (KPI2, KPI3, KPI4 and KPI5), were used with the combination of another key performance indicator (KPI1) that was constructed from the quantitative survey and estimated. The KPI1 ultimately determines whether the online product will be a success, allowing the business strategy and its development to proceed. Specifically, KPI1 is the dependent variable y , and it is the one that is estimated. Furthermore, KPI1 demonstrates the success of the web product and indicates the Percentage (%) of potential users of the platform, with a range [1, 5], (1: Not at all, 2: Not Really, 3: Undecided, 4: Somewhat, 5: Very much). Also, KPI2 up to KPI5 are the four independent variables X_2, \dots, X_5 . All of the five KPIs are presented in Table 5.

Moreover, the BSC initially starts from the objectives which represent the strategic targets. On the basis of that, the corresponding measures that quantify the objectives emerge. Next to that, the targets pertinent to the goals that need to be achieved are listed, and in the rightmost part, the steps that the business will take to accomplish the strategic goals are presented [18]. Specifically, Table 1 contains information relevant to financial goals, Table 2 showcases the customer's goals, Table 3 is about goals relevant to internal process and Table 4 lists the learning and innovation goals. All of these perspectives have been developed with an understanding of the requirements of a company that strives to be successful and remains competitive over time.

Table 1. The financial perspective.

Objectives	Measures	Targets	Actions
Profit increase	Earnings ratio	Finding net profits	Advertising campaign in social media
Reduction of operating costs	Average cost	Reduction of operating Costs / Expenses	Reducing costs while maintaining high quality
Cash liquidity	Sales growth rate	Acquisition of cash / Equity capital	Attract new customers
Increase in market share	Market share index	Increase in market share	Create advertisements

Table 2. The customers perspective.

Objectives	Measures	Targets	Actions
Customer retention	Total number of users of bank websites	Maintaining customer trust	Frequent update of product/website
Customer satisfaction	Total satisfied and not satisfied citizens who have used bank websites	Increase customer confidence	Direct line of communication via chat, email, phone etc.
Customer knowledge related to the product	Proportion of their education level and computer literacy	Introducing the product to potential customers	Product related campaigns
Financial comfort of customers	Total employees per household	Customer segmentation	Targeted marketing

Table 3. The internal processes perspective.

Objectives	Measures	Targets	Actions
Research and innovation	Number of product creation methods	Support for scientific research	Participation in research products
Product quality control	Quality control index	Ensuring the quality of the products	Research and development
Cooperation of departments	Internal problem resolution index	Correct operation of the departments	Network modifications for enhanced communication between departments
Productivity Increase	Number of working hours spent / task	Personnel training	A merit-based evaluation system

Table 4. The learning and innovation perspective.

Objectives	Measures	Targets	Actions
Employee satisfaction	Employee satisfaction score	Reduction of employee attrition	Assessment of personnel needs
Continuous training of employees	Staff productivity index	Highly skilled colleagues	Business tools training program
Business process development	Internal operations index	Smooth operation of all departments	Investigation of needs in each department separately
Personnel performance	Personnel efficiency index	Staff performance improvement	Staff training program and assessment of their competences

4.1 Methodology and Dataset

The data used for this survey is anonymous personal data on bank loans and was collected with the use of a questionnaire that is presented in Appendix A. For its proper structure and design, bibliographic research was considered necessary. Specifically, [29], states that a questionnaire is regarded as a tool for gathering data for an analysis. Therefore, when designing it, researchers should consider the larger context in which the questionnaire will be used. For instance, the survey's goals, the questions that will

be asked, the number of participants, the study sample, the delivery and completion methods, as well as the format design, which should adhere to international standards. Based on this, it is clear that the design of a questionnaire should be of top priority in order to avoid discouraging respondents and also ensuring that the data collected is as suitable as possible for analysis.

To interpret the analysis performed on the gathered data and how they can improve a business promoting a platform of this kind, the research conducted by [30] was utilized. Their findings cover general strategies and recommendations as well as the foundational ideas for business problem analysis, with an emphasis on data and the development and evaluation of solutions.

The findings of [31] cover both theory and applications of the survey and were used for the proper organization of the questionnaire, which was essential for the collection of appropriate data. They address issues regarding data collection, analysis, sampling, questionnaire design and statistical estimation. Consequently, the research part of the questionnaire was based on this book, which focuses on conducting sampling and collecting data to create the KPIs.

Furthermore, the methodology that is used is empirical research, which means that the theory is linked to reality [32] and is therefore inductive. It is also a case study. Then, a quantitative analysis was performed using ML, specifically by applying an ANN model with the use of Python programming language. Afterwards, the results were extracted to estimate the KPI1.

In particular, the data were obtained using online questionnaires, where the number of completed questionnaires is 122 and each of them consists of 32 questions. Thus, for their analysis, the original raw data were arranged in a table with dimensional structure of (122, 32). The sampling method used is Snowball sampling and the majority of the sample's basic demographic characteristics are people who are adequately educated, have a moderate income, and have fairly good computer literacy.

Following the data collection, the raw data were transformed in order to create KPIs. First, they were interpreted from text data to numerical data with the scope to analyse them quantitatively. Then the data were combined and thus created the five KPIS (KPI1, KPI2, KPI3, KPI4 and KPI5) which are presented in Table 5 below.

Table 5. The five KPIs of the research

KPI	Objectives	Measures	Variable
KPI 1	Product success	Percentage (%) of potential users of the platform	Dependent variable y
KPI 2	Customer retention	Total number of users of bank websites	Independent variable X_2
KPI 3	Customer satisfaction	Total satisfied and not satisfied citizens who have used bank websites	Independent variable X_3
KPI 4	Customer knowledge related to the product	Proportion of their education level and computer literacy	Independent variable X_4
KPI 5	Financial comfort of customers	Total employees per household	Independent variable X_5

Afterwards, the data were separated into Training data (70%) and Test data (30%), using the empirical rule [33]. The separation process was carried out in order for the algorithm to learn the characteristics of the data from the model (Model Training) and then for verifying the effectiveness of the model using the test data (Model Testing).

The next step was the encoding of the dependent variable y (KPI 1), which involves converting the codes of the classes: (1: Not at all, 2: Not Really, 3: Undecided, 4: Somewhat, 5: Very much) from the number of each category to a specific code that can be used in the algorithm, consisting entirely of zeros and ones. On the other hand, the independent variables X_i, \dots, X_N , with $i = 2$ and $N = 5$ (KPI 2 – KPI 5) were normalized, i.e. they were transformed in a way that centers them around zero in order to follow the normal distribution (Gaussian) with zero mean and unit variance within the range [0, 1].

The next step was to develop an ANN model using the training data and the appropriate parameters, which are given in Table 6 and detailed in paragraph 3.3.1. The model was then trained in order to learn the characteristics of the training data.

Finally, the ANN model was evaluated with the use of testing data and the confusion matrix tool. As a result, the overall effectiveness of the ANN model was calculated, and the misclassifications—areas in which the model is confused between the classes—were identified.

4.3 Model

This research addresses the contribution of ML in designing a strategy for optimal decision making. This occurs as a result of ANNs' ability for pattern recognition and their strength to imitate the neural networks in the human brain. This procedure is currently a lot more efficient thanks to faster computer processing [34].

In terms of structure and function, the abstract model of an ANN, which is called a perceptron model in its general form, is made up of neurons which are also known as nodes. Nodes can receive information from the outside world or from other nodes, transmit it to other nodes, and then extract it as final result. Thus, three types of nodes can be distinguished: Input nodes, Hidden nodes, and Output nodes.

Another part of the structure of ANNs is their edges, which link nodes to one another. The edge has a specific weighting depending on the significance and strength of the connection. The higher the weighting, the greater the influence a node can exert on another connected node. Furthermore, bias is added in the model and a threshold decides the binary output of the model [35]. If the weighted sum of the inputs is greater than the threshold, then the value of the output will be '1', otherwise it will be '0'. Finally, in order for the output to be within the specified range [0,1], the activation function is employed in conjunction with the inputs, after they have been transformed into a weighted sum to a certain output according to a set of rules.

A supervised learning algorithm called a multi-layer perceptron was used in this study. The key distinction between it and the simple perceptron is that this model's hidden layers are non-linear, and as a result, the multi-layer perceptron is non-linear. Also, the multilayer perceptron uses the backpropagation technique to iteratively change the network's weights [36].

4.3.1 Experimental Parameters

The total number of records in this study was 122. Therefore, the ANN was decided to have four layers as according to the literature, the less data a problem has, the fewer levels it should have. The first layer is the input layer, the second and third are the two hidden layers and the fourth is the output layer.

Furthermore, in this research there are five categories in the output, i.e. it is a multiclass classification. In Figure 2 below, the structure of the ANN of this research is illustrated in a diagram.

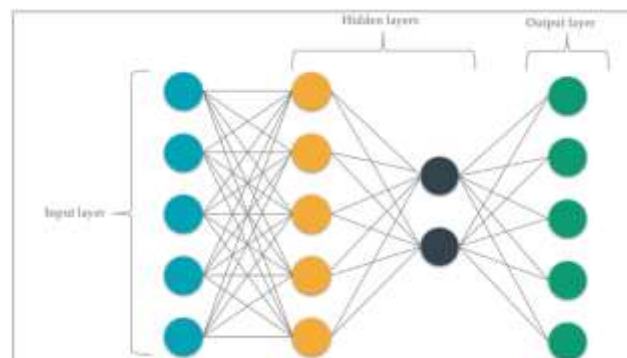


Fig. 2: Structure diagram of research's levels.

Source: Authors

In terms of functions, two activation functions were used initially, the ReLu function and the Softmax function. The choice of the former was made since this function allows the models to learn faster and perform better. According to the literature it is commonly used as an activation function not only for the input layer but also for the hidden layers [37]. The second function was chosen because it is appropriate for categorical variables with more than two categories and is commonly used for the output layer in the literature [38]. In the first three layers (the input layer and the two hidden layers), the ReLu function was used, while in the Output layer, the Softmax function was used for the reasons mentioned above.

Another important element of the Neural Model is its type. The type of model chosen is the Sequential model. The Sequential model was applied in this paper in order to insert data into the ANN model sequentially. This means that the output data from one layer is introduced as input data to the next layer. According to the literature this type of model is used for classification problems [39].

The Loss function is another function used in this ANN model for the purpose of measuring its performance. The Loss function used in this study is the Categorical Cross Entropy function, which was chosen because it is applicable to multi-class classification problems.

In order to be able to measure the performance of the ANN model through the Performance Function, an Optimizer algorithm is applied. In this case the 'Adam' Optimizer was used.

Another parameter applied is the epochs, i.e. the number of iterations of the training of the ANN model. According to the literature, there is no fixed

number of epochs that will give the optimal model, and thus tests on the ANN must be performed to determine the ideal number [40]. In this paper, after several tests, the Optimizer was given 1000 epochs or iterations, to find the minimum point. This parameter along with Training data and Test data were used during the Model fitting of the ANN. Table 6 summarizes all the parameters used in this research.

Table 6. Experimental neural network parameters.

	Predicted Class					Row Total	Row %
	1	2	3	4	5		
Actual Class	1	6	0	0	0	0	100%
	2	0	2	0	0	0	100%
	3	0	0	4	0	0	100%
	4	0	1	1	8	0	80%
	5	0	0	0	1	14	93.33%
Column Total	100%	66.66%	80%	88.88%	100%	91.89%	

4.4 Evaluation

To evaluate the model and in particular to find the correct and incorrect classifications of the categories of the dependent variable y, the Confusion Matrix was used. The Confusion Matrix is a tool that verifies the classification results, i.e., verifies the overall accuracy of the classification and finds the correct and incorrect classifications of the variable y [41].

5 Problem Solution

From the analysis of the data using the ANN, the following results were obtained. As shown in Figure 3, out of 122 participants, 48 chose option number five (5), making it the most popular, indicating that they would use a financial service platform to the extent of 5: Very much (with a range of 1: Not at all - 5: Very Much). However, a small percentage of the population would not use it at all, having selected the option 1: Not at all (18/122). Moreover, the mean of 3.8 demonstrates that a majority of respondents, specifically 7/10, would use the platform.

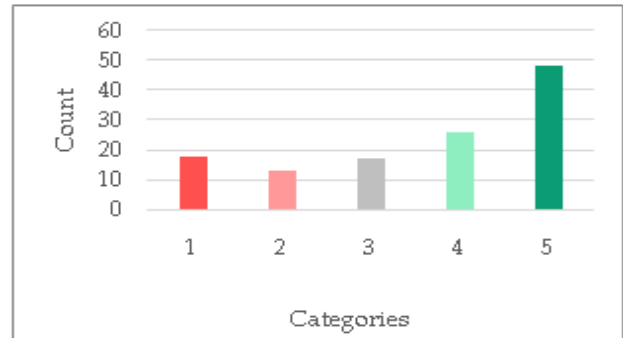


Fig. 3: Bar chart with the dependent variable y

Source: Authors

On the Confusion matrix, Table 7, it is observed that the Overall Accuracy is 91.89%. It is also observed that in all categories (1: Not at all, 2: Not Really, 3: Undecided, 4: Somewhat, 5: Very much) the data was classified with a very high success rate. Also, in category 4 the most misclassifications are found.

Table 7. Confusion matrix of the neural network model

Parameters	Value/Type
Input Layers	5
First Hidden Layers	5
Second Hidden Layers	2
Output Layers	5
Input Layer Activation Function	ReLU
Hidden Layers Activation Function	ReLU
Output Layer Activation Function	Softmax
Neural Network Model Type	Sequential Categorical
Loss Function	Cross Entropy
Optimizer Algorithm	Adam
Epochs	1000

6 Discussion

According to the literature, ML models are applied to automatically analyze data, find patterns, and estimate them with the ultimate goal of making decisions about a problem. By developing a better strategy, the above can help businesses improve their production and economic growth. Furthermore, automation frees up more time for analysts to focus on other aspects of the business plan, allowing them to make better decisions. It also lowers costs and improves the customer experience.

In this research work, the evaluation of the success of an online product using KPIs was carried out by applying ML methods. Eventually, the ML algorithm showed a high validity rate regarding whether the majority of the population interested in obtaining a loan would use this platform to find the most suitable one.

Furthermore, the threshold that would determine whether the new product will finally be created or not was set to 60%. The specific threshold was selected on the basis that it is marginally higher than the average (50%). Given that the findings revealed that 7 out of 10 people (70%) would use this online platform, it is deduced that it is worthwhile to proceed with its development if just over half of respondents reply favourably to its implementation. Hence, this study demonstrated that it is preferable to develop the new platform.

According to this research, since it is necessary for a company to adapt to changes in its environment, a company's change management should be appropriate for the company in question. This means that on the one hand it should follow some general market rules but on the other hand it should be personalized. By having an appropriate change management and applying the BSC tool, this can be achieved because this tool presents a comprehensive overview of how to define, measure and implement its objectives.

Therefore, the significance of this study is to apply ML to the survey's results while viewing them through the lens of BSC. Generally, the vast majority of current studies on the subject use BSC in a conventional manner, i.e. without the use of ML. In comparison to them, the current study integrates the ML procedures and the business component of a BSC in order to contribute to the success of the new product before its market launch, which also reduces the financial risk. Also, companies can use this approach because the study's findings indicated that machine learning is a useful tool for predicting various aspects of a business, especially when combined with the information contained in the BSC.

A company's change management process is a crucial component. If a company does not properly and promptly manage it, it may stray from its objectives and have disastrous consequences for its future wellbeing. Given that a company must effectively coordinate all BSCs' aspects in order to achieve its goals, additional information can be derived from these aspects and applied to improve its products, especially when it wants to introduce a new product to the market. As a result, the business plan will be stronger, but since the market and the environment are always changing, research and BSC improvement are integral.

Therefore, given the results of this study, the use of ML in business has proven to have the potential to improve many processes by offering speed, accuracy, and creativity by discovering patterns in the data used in the analysis. The

combination of these capabilities is particularly useful for decision making in a business where many parameters need to be taken into account so as to make a decision that is personalized and will lead to the optimal solution for customer satisfaction and thus increase profits.

Similarly to the majority of the past studies on the subject, this research also presents some limitations. The research's sample size is one of them. Although snowball sampling is an effective way to gather data, it would be preferable if the sample size was larger and more random i.e., more representative. Another limitation is the absence of cross validation, which evaluates how the prediction model performs with an unknown dataset, i.e., it examines the model's ability to generalize to an independent dataset. Cross validation is a resampling method that tests and trains a model on different iterations using different segments of the data [42] that can be used in future work. Another task for the future is to perform requirements analysis of this new product, in order to define the functional and non-functional requirements that the product needs to fulfill. Eventually, a future work that can be done after the product is implemented is to involve the actual customers of the platform in this research, not just the potential ones. In addition, regarding the business plan, it can be further explored in the other three aspects of the BSC: financial, internal processes and learning and innovation.

7 Conclusion

In this research, the BSC was presented in a way that not only takes into account the most important changes that should be made in the company, but also how its use helps to predict and prevent certain behaviors. This is achieved with the help of AI and in this case with the deep learning algorithm ANN. Therefore, the BSC can be combined with technology and go a step beyond its traditional uses. From the collected data, five KPIs were created, and an ANN model was used to classify the categories of the dependent variable y (KPI1) using the independent variables X_i (KPI2 – KPI5). Furthermore, the questionnaires revealed that 7/10 people would use this online platform, indicating that it would be successful. However, using ML, it was discovered that with 91.89% accuracy, the company's product will be successful. Additionally, category 4 (4: Somewhat) was found to be the category that the algorithm misunderstood the most, which is probably due to its shared traits with the other categories.

Furthermore, given that the threshold that would determine whether the new product would be built or not was set at 60%, and the results revealed that 70% of people would use this online platform, it is concluded that the technology firm of this study would proceed with the development of the new product. It is also worth noting that the presence of high accuracy in the ML model indicates that the development of the new product will have less financial risk compared to not using ML for this analysis.

In conclusion and based on all of the findings of this study, the application of ML in business is very important. For optimal results, businesses should strive to combine accurate results interpretation by qualified analysts and proper data management techniques that should be applied before building the models. Finally, it is important for a business to keep up with technological advances in order to reap the benefits and gain a competitive advantage.

References:

- [1] Kitsios, F.; Kamariotou, M., "Digital Business Strategy and Information Systems Planning: Determinants of Success," in *Paper presented at the 14th European Conference on Innovation and Entrepreneurship (ECIE19), Kalamata, Greece, vol. 1*, 2019.
- [2] Magumba, M. A., "WEB 2.0 For Small And Medium Sized Companies: A practical Case Study.," *arXiv*, p. arXiv:1611.02421, 2016.
- [3] Bakker, E.; Zheng, J.; Knight, L., "Putting e-commerce adoption in a supply chain context.," *International Journal of Operations & Production Management* 28(4);, p. 313–330, 2008.
- [4] Ismail, M.; Khater, M.; Zaki, M., "Digital Business Transformation and Strategy: What Do We Know So Far? Working Paper," *University of Cambridge: Cambridge Service Alliance.*, 2018.
- [5] Borges, M.; Hoppen, N.; Luce, F., "Information technology impact on market orientation in e-business.," *Journal of Business Research* 62, p. 883–890, 2009.
- [6] Brzozowska, A., "E-business as a new trend in the economy," in *International Conference on Communication, Management and Information Technology (ICCMIT)*, 2015.
- [7] Stolz, L.; Sternberg, R., "Do the Winners Really Take It all? Exploring Entrepreneurial Learning in Start-Up Competitions," *Entrepreneurship Education and Pedagogy*, pp. 5: 599-626, 2022.
- [8] Balog, K., "The concept and competitiveness of agile organization in the fourth industrial revolution's drift," in *International Scientific Conference Strategic Management and Decision Support Systems in Strategic Management.*, 2020.
- [9] Božič, K.; Dimovski, V., "Business intelligence and analytics use, innovation ambidexterity, and firm performance: A dynamic capabilities perspective," *The Journal of Strategic Information Systems*, p. 28, 2019.
- [10] Weber, M.; Moritz, B.; Weking, J.; Böhm, M.; Kremer, H., "AI Startup Business Models: Key Characteristics and Directions for Entrepreneurship Research," *Business & Information Systems Engineering*, pp. 64: 91-109, 2022.
- [11] Psarras, A.; Anagnostopoulos, A.; Tsotsolas, N.; Salmon, I.; Vryzidis, L., "Applying the Balanced Scorecard and Predictive Analytics in the Administration of a European Funding Program," *Administrative Sciences*, p. 10(4):102, 2020.
- [12] Kaplan, R. S.; Norton, D. P., "Using the Balanced Scorecard as a Strategic Management System," *Harvard Business Review*, pp. 74: 75-78, 1996.
- [13] Salmon, I.; Pappas, I. O.; Spyridakos, A.; Vryzidis, I., "Applying multicriteria decision aid in a weighted balanced scorecard method for supporting decision making in change management," *Journal of Applied Research Review*, 2019.
- [14] Sevilla-Bernardo, J.; Sanchez-Robles, B.; Herrador-Alcaide, T. C., "Success Factors of Startups in Research Literature within the Entrepreneurial Ecosystem," *Administrative Sciences*, pp. 12, 102, 2022.
- [15] Gilsing, R.; Wilbik, A.; Grefen, P.I.; Turetken, O.; Ozkan, B.; Adali, Onat E.; Berkers, F., "Defining business model key performance indicators using intentional linguistic summaries," *Software and Systems Modeling*, pp. 20: 965-996, 2021.
- [16] Quesado, P.; Marques, S.; Silva, R.; Ribeiro, A., "The Balanced Scorecard as a Strategic Management Tool in the Textile Sector," *Administrative Sciences*, p. 12(1):38, 2022.
- [17] Gębczyńska, A.; Brajer-Marczak, R., "Review of Selected Performance Measurement Models Used in Public Administration," *Administrative Sciences*, p. 10(4):99, 2020.
- [18] Psarras, A.; Anagnostopoulos, A.; Salmon, I.; Psaromiligkos, Y.; Vryzidis, Y., "A Change Management Approach with the Support of the Balanced Scorecard and the Utilization of Artificial Neural Networks," *Administrative Sciences*, p. 12(2):63, 2022.
- [19] Ramosaj, B.; Karaxha, H.; Karaxha, H., "Change Management and Its Influence in the Business Environment," *ILIRIA International Review*, vol. 4, no. 2, 2014.
- [20] Errida, A.; Lotfi, B., "The determinants of organizational change management success: Literature review and case study," *International Journal of Engineering Business Management*, 2021.

- [21] Zhengxiaoming, A.; Fernando, Y., "A Concept Paper of Balanced Scorecard for New Product Development," *KnE Social Sciences*, 2019.
- [22] Kaplan, R. S.; Norton, D. P., "The strategy-focused organization," *Strategy & Leadership*, 2001.
- [23] Lee, I.; Shin, Y. J., "Machine learning for enterprises: Applications, algorithm selection, and challenges," *Business Horizons*, pp. 157-170, 2020.
- [24] Whig, P., "Artificial Intelligence and Machine Learning In Business," *International Journal on Integrated Education*, 2019.
- [25] Punitha, N. J.; Preethi, D. M. D., "Artificial Intelligence and Machine Learning Techniques for COVID-19 Prediction," in *2022 International Conference on Advanced Computing Technologies and Applications (ICACTA)*, IEEE, Coimbatore, India, 2022.
- [26] Goodfellow, I., "Deep Learning," Cambridge, MIT Press, pp. 1-16, 2016.
- [27] Chellapa, R.; Theodoridis, S.; van Schaik, A., "Advances in Machine Learning and Deep Neural Networks," *IEEE*, vol. 109, pp. 607-611, 2021.
- [28] Villazón, C. C.; Pinilla, L. S.; Olaso, J. R. O.; Gandarias, N. T.; de Lacalle, N. L., "dentification of Key Performance Indicators in Project-Based Organisations through the Lean Approach," *Sustainability*, pp. 12(15), 5977, 24 July 2020.
- [29] Ekinci, Y., *Designing Research Questionnaires for Business and Management Students*, Sage, 2015.
- [30] Fawcett, T.; Provost, F., *Data Science for Business*, O'Reilly Media, Inc., 2013.
- [31] Davino, C.; Fabbris, L., *Survey Data Collection and Integration*, Berlin: Springer, 2013.
- [32] Sauce, B.; Matzel, L. D., "Inductive Reasoning," in *Encyclopedia of Animal Cognition and Behavior*, Springer, 2017, pp. 1-8.
- [33] Gholamy, A.; Kreinovich, V.; Kosheleva, O., "Why 70/30 or 80/20 Relation Between Training and Testing Sets: A Pedagogical Explanation," *Departmental Technical Reports Computer Science at ScholarWorks@UTEP.*, 2018.
- [34] Fausett, Laurene V., *Fundamentals of Neural Networks: Architectures, Algorithms And Applications*, Pearson, 1994.
- [35] Cantareira, G. D.; Etemad, E.; Paulovich, Fernando V., "Exploring Neural Network Hidden Layer Activity Using Vector Fields," *Information*, p. 11: 426, 2020.
- [36] Nielsen, M., *Neural Networks and Deep Learning*, Determination Press. pp. 1-12, 2018.
- [37] Agarap, M., "Deep Learning using Rectified Linear Units," *ArXiv*, p. arXiv:1803.08375, 2019.
- [38] Hagan, M.; Demuth, H.; Beale, M., "Neural Network Design (2nd Edition)," Martin Hagan, pp. 889-890, 2014.
- [39] Zargar, S. A., *Introduction to Sequence Learning Models: RNN, LSTM, GRU*, 2021.
- [40] Afaq, S., "Significance Of Epochs On Training A Neural Network," *International Journal of Scientific & Technology Research*, pp. 485-488, 2020.
- [41] Markoulidakis, I.; Rallis, I.; Georgoulas, I.; Kopsiaftis, G.; Doulamis, A.; Doulamis, N., "Multiclass Confusion Matrix Reduction Method and Its Application on Net Promoter Score Classification Problem," in *The 14th Pervasive Technologies Related to Assistive Environments Conference*, Corfu, Greece, 2021.
- [42] Xu, Y.; Goodacre, R., "n Splitting Training and Validation Set: A Comparative Study of Cross-Validation, Bootstrap and Systematic Sampling for Estimating the Generalization Performance of Supervised Learning," *Journal of Analysis and Testing*, pp. 2: 249-262, 2018.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

-Eleni Tagkouta, Panagiotis – Nikolaos Psycharis were the main authors and were responsible for the conceptualization, the writing of the original project, the investigation, the statistics, the formal analysis, the resources, the software, the methodology and the visualization.

-Alkinoos Psarras was responsible for the conceptualization, the methodology, the resources and the writing review & editing.

-Theodoros Anagnostopoulos was responsible for the review of the statistics, the methodology, the validation, the supervision and the writing review & editing.

-Ioannis Salmon was responsible for the methodology, the supervision, the project administration, the writing review & editing and the funding acquisition.

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