

# IMPLICATIONS OF IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN THE BANKING BUSINESS IN RELATION TO THE HUMAN FACTOR

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Critical Review

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**Abstract:** The banks are known as monetary management institutions because they deal with money. There is a number of customers that a bank daily interacts with. In this technology era, when everything is moving to automation from the beginning step to final product manufacture, medical checkups, medical reports, and evaluation, the banking system is still working on the legacy system. Instead, with the participation and implementation of new Virtual Assistant-powered with AI and Machine Learning technology in the banking sector, the institutions are again using the legacy system or may be bound to use the legacy system. This research will help to elaborate and emphasize the impact of the implementation of automation, using artificial intelligence in the banking business process. This research will be based on the quantitative as well model base proof of system performance using different analytical tools like SPSS. This automation process will help the institutions to enhance profitability, performance, and reduce human dependency. In a nutshell, Virtual Assistants powered with Artificial Intelligence will improve the business process performance in every sector of business, especially the banking sector.

**Keywords:** AI, Machine Learning, Automation, Banking Systems, Virtual Assistants, Chatbots.

## INTRODUCTION

The whole banking sector is based on rules and regulations. Artificial intelligence helps to process the low level of information but the high level of volume in the data process, which results in lower the cost but also provides accurate and quick results instead of a human. By using the Algorithms, the AI is implemented in the banking sector with great success in customer management services, Credit Information Service, FAQ service, Financial Assistance Series, etc. All these types of services implemented using the Chatbot, AI Agents, and Self-learned system. Nowadays, the Banking sector is trying to enhance the performance by applying the AI in all fields like cybersecurity, risk management, fraud management, sales, Internal Audit, Financial Assistance, Asset Management, Loan Management, and Customer Management [5].

This research paper will elaborate on the framework of an AI system that will be implemented in all

fields of banking sectors that has been discussed earlier. These models will be pre-testing using historical data and survey forms. These models can be applied in any or all fields of the banking sector to automate the business process using a robot – processing, Chatbot, and AI agent.

To enhance the customer services, the customer doesn't need to visit the branch, they just need to visit the website, and the pre-define Chatbot will get the required data according to the model. When the primary data is gathered, the Chatbot will ask about the problem statement and check if it meets the edibility criteria to communicate or stop communication. If the problem statement is matched with the Chatbot algorithm, then the Chatbot will proceed and guide the customer according to the written instructions. But in another case, the Chatbot will guide the customer to visit the nearby branch physically to get the problem solved.

A Chatbots will pull the data from the data warehouse much faster than a human, which leads us to performance. Performances are another critical aspect of the data warehouse as it is based on proper structure and great query engines that are fully optimized for reading and are supporting various incremental changes in the data. Another great characteristic is usability as users may not be familiar with how to get information from source data, but with the analytical approach of the data warehouse, users can by transforming, filtering, or slicing the data to find the information they need. In this way, users are getting a single source of data, which will be processed by AI instead of matching various sources of data, trying to find the information they are looking for [8].

To prevent the fraud, an AI system will monitor all the traffic and transaction within the organization, and if the blacklist transaction allowed by the employee multiple times, the system will record the logs, and by using the woods, the AI data analysis will catchup the fraud. This system will work intelligently without influence the working of the transaction; this system will also learn by experience in the system.

Finding information using computational methods gives immeasurably better results compared to data retrieval that relies only on classical methods [2].

To improve the operation efficiency, the front-end system will be integrated with the AI system in which the user will only input the single field information, and all the other fields will populate by using the intelligent learning. All the data will be filled in all the fields automatically. It will provide insight and analysis very fast so that an immediate decision can be taken. The process of tracing documents in real-time is much time consuming, but AI makes this process more comfortable and more efficient [7].

The commercial banks are moving to cutting edge technologies and process automation. Unicredit Bank has launched its Emerging Opportunities Engine (EOE) that is used to predict the investment recommendation and primarily focuses on the capital market. It also guides the customer to purchase the shares or sales in the stock market, and it is beneficial for the trading brokers. The initial results of this software are good, and now this software is going to implement in the financial institutes [3][4].

The artificial intelligence adaption can help to bank and finance industry to make the consistent and fast-

er engagement of customers to their business by following the quick address of their problems. All the AI base software are used Machine Learning Algorithms that help the system to understand the procedure of problem and solve it according to the algorithm set of instructions. The natural language Chatbot and search engines can overcome client issues and allow the customer to get the desired information [1].

Rapid developments of techniques and technologies have driven the needs for the application of new knowledge in workplaces. In modern businesses, increasing standards, automation, and technologies have led to vast amounts of data becoming available. This explosive growth has generated an even more urgent need for techniques and tools that can assist us to convert this data into useful information and knowledge which can meet customer requirements [6]. All those data should be processed fast and in real-time. The only tool that can do this at present is AI powered with Machine learning algorithms.

## PROBLEM STATEMENT

Management of traditional manual banking practices with the implementation of state-of-the-art AI systems Hypothesis.

The problem with the existing and old banking system is to decide based on massive data, is very expensive in term of cost as well as about twenty to thirty percent decision goes wrong due to incomplete and inappropriate information on the organizational plan. The AI state of the art system will deal with these issues intelligently and monitor all the information related to stakeholders to process the reports. This AI system will use real-time data to coordinate and guide the customer to take immediate decisions and govern according to the rules and regulations. This system will also maintain the profitability of the organization by increasing the credit by conducting multiple customers at the same time on the right way to immediately invest the money in the banking sector.

## HYPOTHESIS

Information systems of financial institutions with a strong artificial intelligence are an autonomous set of individual subsystems of all stakeholders of a financial organization, which has to cognitively/logically make the relevant decision regarding a particu-

lar procedure based on the investigated parameters at the macro and microeconomic level. The system should achieve interoperability of all components in order to function smoothly and safely. Interoperability at the organizational, logical, research and technological level creates essential technical and human preconditions for achieving full system interoperability as ideal. The assumption is that the system may be so ideal that it can completely replace the human factor through defined safety limits by manually checking individual procedures when resolving financial procedures.

The use of controls of organizational, financial and technological interoperability through the regular security procedures of the information system ensures a smooth, fast, accessible and secure operation of the information system in the domain of financial institutions.

Such hypotheses will be tested by research to be conducted in a leading bank in the CEE market, based on the example of the Informatics Division.

### **OBJECTIVES OF THE RESEARCH**

The purpose of this research is to highlight the need and opportunities to improve the efficiency, effectiveness of service delivery and increase the profits of financial institutions and replace human factors with automatic Virtual Assistants and Chatbots. Full automation electronic services are the future of the functioning of all systems within financial organizations. On the other hand, the research goals are oriented towards the improvement of the model of information systems audit in public administration and its specific business.

One goal is to show how financial institutions with widespread machine learning models (which replicate human intuition and intelligence) provide digital platforms (information systems) with a way to reduce costs, reduce the workforce, improve banking experience and maximize profits.

The second objective of the research is to further improve the existing information system modules in order for the results to be realistic and, in scientific postulates, a finding that will improve the system and improve the degree of customer service provision.

The third objective of the research is to make a scientific and professional contribution to the development of artificial intelligence within financial

institutions. This will be achieved by the aforementioned enhancement of the model that is currently generally and widely applicable.

The fourth objective of the research will be to contribute to improving the quality of service delivery of financial institutions at all levels, since the model will ensure system interoperability.

The offered extension and improvement do not refer to the steps in the internal processes of financial institutions, that is, does not create a completely new model of internal processes that has some special or special steps, but rather this improvement relates to its essence, subject and scope. In other words, the model offered will follow existing practices and contribute to expanding the scope of issues that test system interoperability and the effects of interoperability implementation in line with other entity functionalities, and in particular, the security of the system itself.

The offered model will be specific for financial institutions, but it will be possible to apply it to other types of organizations (agencies, credit unions, credit rating companies). The issue of semantic interoperability is a challenge that is central to new and emerging technologies (especially when it comes to the "Internet of Things" paradigm) but also to ensuring "intelligibility" between different systems. It is a universal paradigm, and therefore can be applied to different systems, thus creating an environment in which the system will function and communicate in an understandable "language".

### **RESEARCH**

In the modern era of technology, automation, and utilization of technology in the field of banking has increased. Because the world is moving to the Global Village concept in which anyone from anywhere can get its desired product without lifting the boxes of cash in hand. The banking sector now a day have been completely transferred over the technology; due to this, it would make it possible to purchase any product from anywhere in the world. Several algorithms are working behind the technology to process the information and customer request on all types of banking services like online banking, android apps banking, digital banking, ATM transfer, Wire transfer, etc. All these types of services have been synchronized with the banks using machine

learning algorithms that automatically track data, verify the integrity of data, and synchronize it with the central database of the concerned bank. For all demanded that we mentioned, we need to utilize workforce which needs to be available 24/7. Availability of manpower 24h in a day increases banks operational costs and decreases profit. The purpose of the research is to find out will customers accept to use robots, Virtual Assistants and Chatbots instead of real human beings.

### ALGORITHMS

Several algorithms can be used for data mining in Machine learning, but some of specific that those are only used within the banking sector. There are two main types of machine learning data mining algorithms that we use in building new AI Framework.

1. Supervised Learning Algorithms
2. Unsupervised Learning Algorithms

### DATASETS

Dataset consists of 517 observations are obtained from the Survey. This dataset consists of 37 different questions from the personal info to business info, and Chatbot uses. The survey questions which are most related to our research belong to the Chatbot. Such as:

- Have you ever chatted with a Chatbot?
- Has your bank had offered Chatbot functionality/support?
- Do you prefer using Chatbots in a Banking Business?
- If you can do most of your Banking Business through Chatbot, would you still go to the Bank branch office?
- Would you like that you can talk to your Bank virtual assistant like you are chatting with a Chatbot?

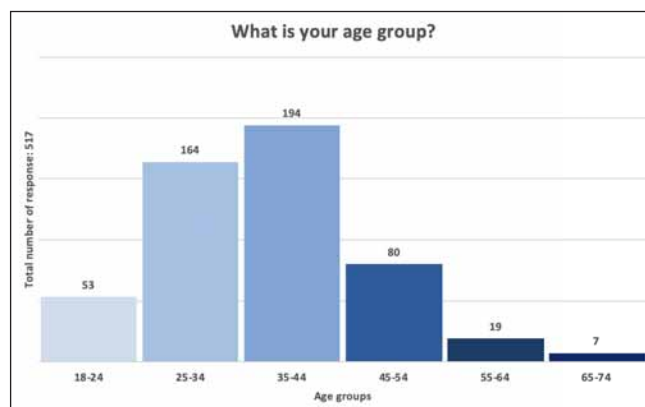
As they are within the scope of research topic, these questions are most important in the statistical analysis. This hypothesis testing will be done using the IBM SPSS V.23 statistical analysis tool. SPSS is an abbreviation of Statistical Package for the Social Science that has many versatile and automated analysis algorithms for both the qualitative and quantitative analysis. There are many features of SPSS like it can handle a large amount of data and manipulate the human-understandable logical results according to

the applied algorithm. It used elementary statistics function as well as advanced features to measure the output. The most appropriate models like ANOVA, Correlation, Means, Chie Square Test, and multiple regression test, can be implemented in SPSS.

### METHODS AND TECHNIQUES

In order to analyze the validity of the dataset as well as the hypothesis, there is the dataset is survey responses and an ordinal dataset, so two models are designed on this dataset. For the validity of the dataset, the frequencies algorithm is applied to validate the ratio of each attribute. Later on, the Multinomial Logistic Regression is applied to learn the validity of the hypothesis statement; either the hypothesis is accepted or rejected.

### Frequencies Analysis What is your age group?

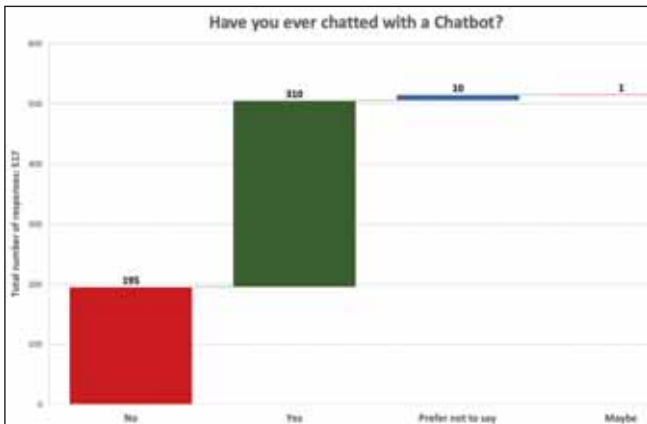


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24 years old	53	10.1	10.1	10.1
	25-34 years old	164	31.7	31.7	41.8
	35-44 years old	194	37.5	37.5	79.3
	45-54 years old	80	15.5	15.5	95.0
	55-64 years old	19	3.7	3.7	98.6
	65-74 years old	7	1.4	1.4	100.0
	Total	517	100.0	100.0	

Figure 1: Graph and frequency: What is your age group?

In the above table, 6 different age groups are given in which the first group response consists of 53, while the second group consists of 164, and third group consists of 194 participants. The second column shows the frequency of how many participants are there in each age group. The percent column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of total dataset. The total valid percentage dataset set is 100%.

**Have you ever chatted with a Chatbot?**

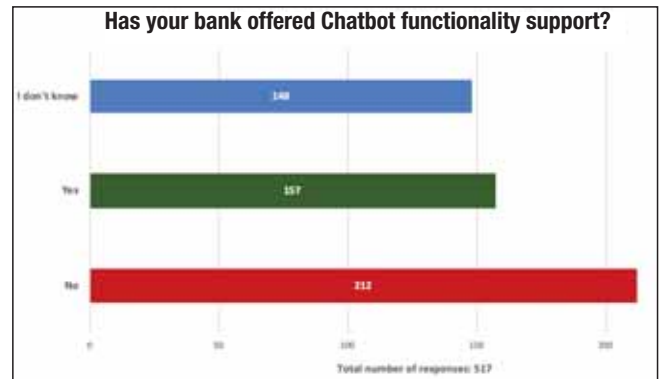


	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	.2	.2	.2
Maybe	1	.2	.2	.4
No	195	37.7	37.7	38.1
Prefer not to say	10	1.9	1.9	40.0
Yes	310	60.0	60.0	100.0
Total	517	100.0	100.0	

Figure 2: Graph and frequency: Have you ever chatted with a Chatbot?

In the given table, the status of chat over Chatbot is discussed. According to it, most persons use Chatbot for chat purposes for meeting their frequently asked question. The second column shows the frequency of how many participants are there in the related group. The percentage column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of the total dataset. The total valid percentage dataset set is 100%.

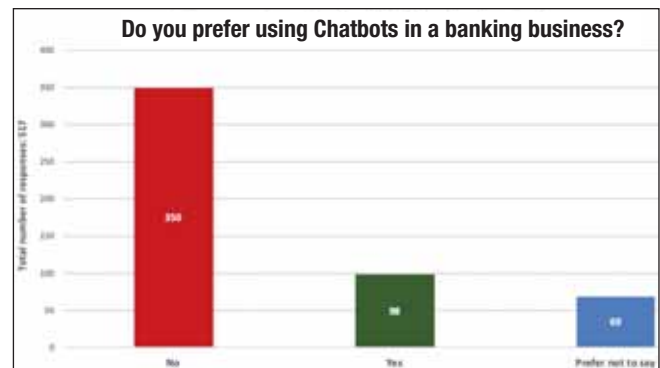
**Has your bank offered Chatbot functionality support?**



	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I don't know	148	28.6	28.6	28.6
No	212	41.0	41.0	69.6
yes	1	.2	.2	69.8
Yes	156	30.2	30.2	100.0
Total	517	100.0	100.0	

Figure 3: Graph and frequency: Has your bank offered Chatbot functionality/support?

In the given table, the total values are 517, out of which the majority belong to no answer. That means the results are not favorable in this table. The second column shows the frequency of how many participants are there in the related group. The percentage column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of the total dataset. The total valid percentage dataset set is 100%.



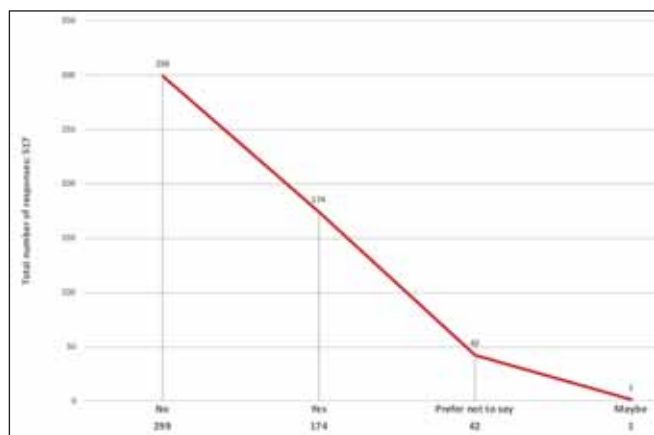


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	350	67.7	67.7	67.7
	Prefer not to say	69	13.3	13.3	81.0
	Yes	98	19.0	19.0	100.0
	Total	517	100.0	100.0	

Figure 4: Graph and frequency: Do you prefer using Chatbots in Banking Business

In the given table, the total values are 517, out of which the majority belong to no answer. That means the results are not favorable in this table. The second column shows the frequency of how many participants are there in the related group. The percentage column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of the total dataset. The total valid percentage dataset set is 100%.

**Doing banking business with Chatbot, or going to the bank branch office?**



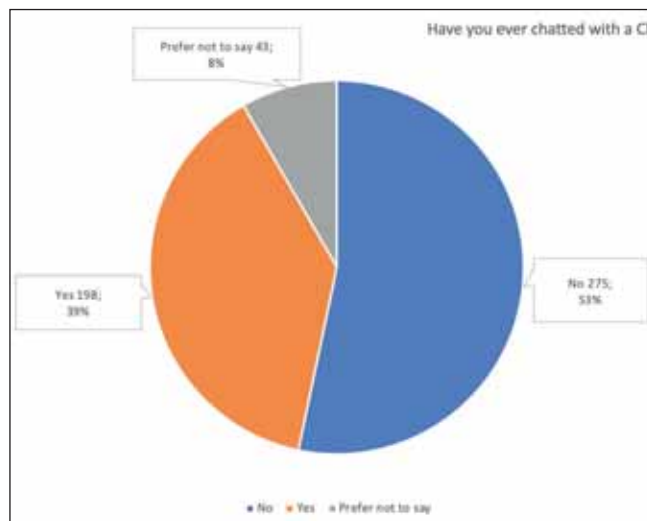
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	.2	.2	.2
Maybe	1	.2	.2	.4
No	299	57.8	57.8	58.2
Prefer not to say	42	8.1	8.1	66.3
Yes	174	33.7	33.7	100.0
Total	517	100.0	100.0	

Figure 5: Graph and frequency: Doing banking business with Chatbot, or going to the bank branch office?

In the given table, most of the responses belong to the Chatbot in which the user prefers to use Chatbot

instead to visit the branch, as about 299 are disagree with visiting branch, but they prefer to use Chatbot for the problem solution. The second column shows the frequency of how many participants are there in the related group. The percent column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of the total dataset. The total valid percentage dataset set is 100%.

**If you could talk anytime with VA, would you prefer to go to branch office?**



	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	.2	.2	.2
No	275	53.2	53.2	53.4
Prefer not to say	43	8.3	8.3	61.7
Yes	198	38.3	38.3	100.0
Total	517	100.0	100.0	

Figure 6: Graph and frequency: If you could talk anytime with VA, would you prefer to go to branch office?

In the given table, most of the want to use Chatbot to talk as a virtual assistant and get prompt responses instead of waiting for a long time. The second column shows the frequency of how many participants are there in the related group. The percent column displays the percentage of overall data, while the valid percentage column shows the data validity percentage of the total dataset. The total valid percentage dataset set is 100%.

### Multinomial Logistic Regression

Multinomial Logistic Regression is used to predict a nominal dependent variable given one or more independent variables. As the dataset consists of the many string values, so the best model that fits for the analysis of dataset validity is multinomial Logistic Regression.

For the purpose of model validity, two variables are selected for this test.

- Sex
- Do you prefer using Chatbot in a banking business?

The first variable is used as an independent variable, and the second is used for the dependent variable. The results of the test are given below.

**Case Processing Summary**

		N	Marginal Percentage
Do_you_prefer_using_ChatBots_in_a_Banking_Business	No	351	67.8%
	Prefer not to say	69	13.3%
	Yes	98	18.9%
Sex	Female	197	38.0%
	Male	318	61.4%
	Prefer not to say	3	0.6%
Valid		518	100.0%
Missing		0	
Total		518	
Subpopulation		3 <sup>a</sup>	

a. The dependent variable has only one value observed in 1 (33.3%) subpopulations.

In the above result table, column N provides the number of observations used in the model. Three types of observations are used, male, female, and prefer not to say. The next column, Marginal Percentage, provides the list of valid observation funds in each outcome variable. The validity is calculated by dividing the total observation with the number of observations per category. In this table, the valid means of how much data or observations are valid from the total observations. The dataset validity rate is 100%. The next result indicates the number of subpopulations contained in the data. A subpopulation of the data consists of one combination of the predictor variables specified for the model.

**Model Fitting Information**

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	41.760			
Final	21.299	20.461	4	.000

In this table, the first column is a model that contains two parameters - the Intercept Only and Final. This indicates the parameters of the model for which the model fit is calculated. "Intercept Only" describes a model that does not control for any predictor variables and simply fits an intercept to predict the outcome variable. "Final" describes a model that includes the specified predictor variables and has arrived at through an iterative process that maximizes the log-likelihood of the outcomes seen in the outcome variable. By including the predictor variables and maximizing the log-likelihood of the outcomes seen in the data, the "Final" model should improve upon the "Intercept Only" model. This can be seen in the differences in the -2(Log-Likelihood) values associated with the models.

The second column is about the model fitting criteria by which the model results are produced. This is the product of -2 and the log-likelihoods of the null model and fitted "final" model. The likelihood of the model is used to test whether all predictors' regression coefficients in the model are simultaneously zero and in tests of nested models.

Chi-Square – This is the Likelihood Ratio (L.R.) Chi-Square test in which at least one of the predictors' regression coefficient is not equal to zero in the model. The L.R. Chi-Square statistic can be calculated by  $-2 * L(\text{null model}) - (-2 * L(\text{fitted model})) = 41.760 - 21.299 = 20.299$ , where  $L(\text{null model})$  is from the log-likelihood with just the response variable in the model (Intercept Only) and  $L(\text{fitted model})$  is the log-likelihood from the final iteration (assuming the model converged) with all the parameters.

df – This indicates the degrees of freedom of the chi-square distribution used to test the L.R. Chi-Square statistic and is defined by the number of predictors in the model.

Sig. – This is the probability of getting a Multinomial Regression test statistic being as extreme as, or more so, than the observed statistic under the null hypothesis. This model indicates the p-value. The p-value is used to determine the model authentication and hypothesis; either the hypothesis is accepted or not, and the results are significant or not. The standard value of p should be  $p\text{-value} \leq 0.05$  for the significance of the model. In this case, the sig value is lower than 0.05 which indicates that the null hypothesis is rejected, and results are significant.

Parameter Estimates									
Do_you_prefer_using_ChatBots_in_a_Banking_Business <sup>a</sup>	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)		
							Lower Bound	Upper Bound	
No	Intercept	15.916	.146	11916.015	1	.000			
	[Sex=Female]	-14.826	.236	3959.175	1	.000	3.639E-7	2.293E-7	5.776E-7
	[Sex=Male]	-14.547	.000	.	1	.	4.811E-7	4.811E-7	4.811E-7
	[Sex=Prefer not to say]	0 <sup>b</sup>	.	.	0	.	.	.	.
Prefer not to say	Intercept	-.351	1967.015	.000	1	1.000			
	[Sex=Female]	.425	1967.015	.000	1	1.000	1.530	.000	. <sup>c</sup>
	[Sex=Male]	-.431	1967.015	.000	1	1.000	.650	.000	. <sup>c</sup>
	[Sex=Prefer not to say]	0 <sup>b</sup>	.	.	0	.	.	.	.

a. The reference category is: Yes.  
 b. This parameter is set to zero because it is redundant.  
 c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

In this table, the second column indicates the relationship between the dependent and independent variables. These are the estimated multinomial logistic regression coefficients for the models. An important feature of the multinomial logit model is that it estimates k-1 models, where k is the number of levels of the outcome variable. At the bottom of this table, it is indicated that the YES is used as a reference category that is significant with the results. The standard error of the individual regression coefficients for the two respective models estimated. In the next column, Wald chi-square test that tests the null hypothesis that the estimated equals. On the other hand, the df is the list of columns that have the degree of freedom of each variable in the dataset. The degree of freedom used in this dataset is 1.

The most important column in this table is sig that is also known as the p-value table. It is the coefficient of the probability that is given in the model. For the best fit and result from the model, sig value should be  $sig \leq 0.05$ , which is given in the table. According to this, it can be concluded that the model is significant and the null hypothesis is rejected.

### CONCLUSION

Interpretation of the obtained results proved the hypothesis, using statistical models such as ANOVA, T-Test, and the latest possibilities of SPSS tools such as multinomial regression tests and regular regression tests. In addition to this statistical evidence, this paper shows how the unification of human work functions with the artistic intelligence of the present, and there is no word on the concept of the future.

The future is today. On the examples of world banking conglomerates, it has emerged how artificial intelligence tools currently on the market are used. It is evident that substantial financial resources are being invested in reducing the company's operating expenses and increasing productivity.

The only possibility for such a thing in the coming times is explored in artificial intelligence that will cover vacation, pre-war sites, maternity leave, and all the other things a human being needs. Virtual assistants, Chatbots, holograms, physical robots will upgrade over the years to flood the market due to all the cheap technologies. A man as an individual will become conceptually obsolete and will not be able to fulfill the need to practice a large amount of information that will overwhelm us daily. Each of us will need a personal assistant who will take care of things for us, from arranging a meeting, reminders, providing information, all the way to a mentor or educator for a particular area of interest.

An army of people who, about ten years ago, processed data in the FinTech industry and pulled that data from databases, will be engaged with other creative jobs. Repetitive manual work can be disassembled into a segment that artificial intelligence can absorb and serve as a ready-made solution in any number of users. Today it is no longer essential to have banks in a small community. Today, it is only relevant that this small community has an Internet connection, and spare time that they can utilize as they want.

A survey of 517 respondents resulted in the majority of users who worked while sitting at home and setting up their virtual existence to do the work



for them. The days of visiting commercial banks and wasting time waiting for someone behind the counter to shout "Next" are already gone.

## REFERENCES

- [1] AI Innovation Playbook, URL: [https://www.pymnts.com/wp-content/uploads/2019/06/AI-Innovation-Playbook\\_June-2019.PDF](https://www.pymnts.com/wp-content/uploads/2019/06/AI-Innovation-Playbook_June-2019.PDF), date of access: 11.12.2019.
- [2] Avramović Zoran Ž, Dražen Marinković, Igor Lastrić (2017), Use of computer search algorithms in the research of statistical, semantic and contextual rules of language in digital information space. JITA – Journal of Information Technology and Applications Banja Luka, PanEuropien University APEIRON, Banja Luka, Republika Srpska, Bosna i Hercegovina, JITA Volume 7, Number 1 (2017)
- [3] HINA, *UniCredit predstavlja strateški plan, 2019.*, URL: <https://www.glasistre.hr/gospodarstvo/unicredit-predstavio-strateski-plan-ukida-8000-radnih-mjesta-do-2023-608293>, date of access: 11.12.2019.
- [4] Pavlou Lie, D.; *What Drives Mobile Commerce; 2007.*, URL: <https://doi.org/10.2139/ssrn.2380712>, date of access: 28.11.2019.
- [5] Parsons, G.; Productivity and Computers in Canadian Banking; *Productivity Issues in Services at the Micro Level*; 150., 1993.
- [6] Rostami, N. A.; *Integration of Business Intelligence and Knowledge Management – A literature review*, Isfahan University, Iran Journal of Intelligence Studies in Business Vol 4, No 2 30-40; 2014.; URL: <https://pdfs.semanticscholar.org/1c9b/85e5519bd0bdee7ebbbddfea77695ddef2fb.pdf>, date of access: 28.11.2019.
- [7] Schank, R. (2016) „Once upon a time in AI “ URL: <https://www.sciencedirect.com/science/article/pii/S0004370206000919?via%3Dihub>, date of access: 28.11.2019.
- [8] Šikanjić N., Avramović Ž. Z., New Approach of Storing and Retrieving Large Data Volumes, JITA – Journal of Information Technology and Applications Banja Luka, PanEuropien University APEIRON, Banja Luka, Republika Srpska, Bosna i Hercegovina, JITA 9(2019) 2:89-98, (UDC: 004.6:658.4]:519.8), (DOI: 10.7251/JIT1902089S), Volume 9, Number 2, Banja Luka, december 2019 (49-128), ISSN 2232-9625 (print), ISSN 2233-0194 (online), UDC 004

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**Željko Stanković** was born in Belgrade. He finished primary and secondary school in his hometown. He received his higher education in Cleveland, Ohio, USA, where he graduated in 1981. In 2006, he defended his master's thesis at the University of Novi Sad. He defended his doctoral dissertation at Singidunum University in 2010. He has been programming since 1984. making programs for his first computer Commodore 64. Robotics and bioengineering are a long-standing field of work and interest.



**Zoran Ž. Avramović** has published 319 scientific and professional papers:

- 9 papers in WoS (SCI) journals,
- 14 papers in journals cited in Scopus bibliographic database,
- 25 papers in international scientific journals,
- 31 papers in domestic scientific and peer-reviewed journals,
- 124 papers on international conferences held abroad and
- 116 papers on domestic scientific and professional conferences (38 of which are by invitation).

As a leader, author, co-author or contributor, he participated in the design of 150 studies and projects. He has applied for five patents. He has published three scientific monographs, one university textbook and one manual.

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