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Artificial Intelligence Technology to Predict the Financial Crisis in Business Companies

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Abstract: It is difficult to imagine a business in the modern world of digitization that does not use technology and artificial intelligence in some capacity. Business transformation brought a severe time of trouble for small and medium-sized enterprises all over the world. Throughout our study, we have based analysis on factual information that highlights the critical function that the Information Technology (IT) industry plays in maintaining corporate relevance and encouraging customer involvement. Our investigation goes beyond merely highlighting the value of using big data to analyze financial crises in a predictive manner. It also emphasizes the proactive incorporation of artificial intelligence (AI) into corporate operations as a preventive step to avoid them. Our study includes the examination of viewpoints from people who were actively involved in their careers before lockdown procedures were implemented and incorporated into our research the opinions of people who work for small and medium-sized businesses and government agencies. Based on the literature that already exists on the critical role that Artificial Intelligence (AI) plays in protecting companies from disasters, we looked closely at a particular case study. The case study's conclusions highlight how important corporate automation is. In this article, we provide case studies of well-known, globally renowned companies that demonstrate how they skillfully employ new technology to maintain their competitive position. These model organizations include both internationally recognized companies like Google and Facebook and local organizations like Sberbank. In conclusion, our research adopted an artificial intelligence framework that can help business organizations to predict problems and financial crises.

Keywords: Artificial intelligence, Information technology, Digitization, Financial crises, Developing models

Introduction

The term Artificial intelligence appeared at the same time as the development of digital machines in the 1940s. Artificial intelligence is the property of intelligent systems to perform creative functions that are traditionally considered the prerogative of a human; science and technology of creating intelligent machines, especially intelligent computer programs. Early AI research in the 1950s included topics like problem-solving and it paved the way for the opportunities of computers nowadays: smart searches, decision-making, data analysis, visualization of information, and so on. Hollywood films always demonstrate to us human-like robots that can take over the world in the future, but the reality with automized computers promises to be more fascinating and easier.

AI is applied in various fields, beginning with a win in World War II by Alan M. Turing's Enigma machine and ending with Smart Assistance like Siri or self-driving cars. If earlier computers could make decisions based on people's experiences, now they can use the warehouses of databases and rapidly increase as an individual. Sometimes, huge machines with many wires were considered a huge step for humanity, but now we use AI in

everyday life and the development of IT does not stop there. Both established economies and emerging economies have been impacted by the crisis (Saleh, 2023).

As companies implement AI into their business processes, the capabilities of technology continue to grow. Therefore, if executives want to keep their business relevant, they must maintain a good relationship between their employees and digital technologies. AI can Boost Financial transformation with digital technology for crisis management (Dafri & Al-Qaruty, 2023). Furthermore, AI in business can be applied in various industries and perform different functions:

- **Automation of operational processes:** It is mainly used in the back office to control the interactions of internal processes: CRM system, storage and creation of a database, payroll, and payment to suppliers, control of time shifts, and so on.
- **Analysis:** This function is more related to crisis prediction in companies. Data visualization, analysis of customer choice, analysis of supply and demand in the market, targeted marketing - all this work was taken over by computers.
- **Interaction:** These AI functions are capable of expanding and improving the services that businesses provide and the companies that implement these technologies always have advantages over the competition. The main ones are chatbots for 24/7 customer support and suggestions based on their previous orders robots, which can serve you in a restaurant.

Unfortunately, the situation with COVID-19 has been disastrous for many companies. We were able to see a real crisis situation in the business companies in the whole world. Those companies that didn't underestimate the importance of using digital technology suffered from the most losses, they hoped for a quick end to the pandemic. At the same time, some executors realized that the world is changing forever and the only solution to hold on in a crisis moment is to introduce AI and automatize most of their processes. Particularly interesting that many companies are still cutting their budgets for IT instead of expanding their functions and services because in the future it can help to save more time and money. In this research, we will investigate how AI can help predict a crisis in companies and explain cases where it helped to increase the profit of companies even during the lockdown.

Literature Review

The study of the possibilities of AI began with its first use. We have many resources, articles, and books that are used in this research. A huge amount of information and research was written. In 2023, James and Menzies offered novel mathematical approaches and examined the similarities in market dynamics and the ensuing implications for equity investors between different financial market crises. In order to achieve the best possible systematic risk reduction, they first examine the strength of collective dynamics during various market crises and contrast appropriate portfolio diversification strategies based on the distinct number of sectors and stocks (James & Menzies, 2023). Tolo in 2020, introduced a predicting systemic artificial model for financial crises based on neural networks, He demonstrated that the Long-Short Term Memory (RNN-LSTM) and the Gated Recurrent Unit (RNN-GRU) neural nets may be utilized to greatly enhance such predictions (Tolo, 2020).

Zhailybayevich and Hamada introduced the application of extremely efficient neural network technologies as one possible resolution to the problem of financial crises. In this study, eleven input criteria were used to create a mathematical neural network model that predicted bank bankruptcy (Zhailybayevich & Hamada, 2023). About the role of Artificial Intelligence in a crisis and its onset in the modern world nowadays, this topic is more relevant than ever. All works describe algorithms and prevention methods differently. Most of the current work on predicting a business crisis points to the importance of big data analytics. Not only private companies need to calculate algorithms for the behavior of their business, but government agencies must monitor and analyze the financial conditions of all sectors of the economy based on all information (Kakavand, et al, 2017). Big data and its analytic capabilities in real-time interpretation of events bring value to management (Akter & Wamba, 2016).

Wu and others investigated the risks involved into artificial intelligence applications specially the business intelligence they defined a crisis or disaster as "a triggering event that is so important that it challenges the existing structure, routine, or survival of the organization." In corporate finance, data science is widely used to assist

management in tasks such as fraud detection and credit risk assessment (Wu et al., 2014). The first step to analyzing and predicting a company crash is collecting network data. For large organizations, the main data issues are scale (volume), streaming (speed), shapes (variety), and uncertainty (fidelity) (Ezerins et al., 2022). Media, web analytics and media have been effective marketing tools for increasing brand awareness, loyalty, engagement, sales, impact on customer satisfaction, and business-to-business (B2B) and business-to-customer (B2C) communication. Interactions (Agnihotri et al., 2016; Järvinen & Taiminen, 2016).

The interaction of businesses with digital solutions, statistics show that not all entrepreneurs appreciated the importance of automation before the onset of the pandemic. “It is difficult to conduct a constant analysis of activities, sources of income and expenses to make quick management decisions without using information technology. At the same time, in times of crisis, a significant factor for maintaining the sustainable development of an organization is the prompt adoption of balanced management decisions. The main goal of introducing AI into the processes of companies doesn’t imply a complete replacement of people and their labor, but the optimization of the processes of integration of human and technology. Zhang in 2022, constructed the quantitative warn-supporting system of enterprise financial crisis in the enterprise's internal and external environments, case reasoning artificial intelligence technology (CRAIT) is introduced into the intelligent warn-supporting system based on expert knowledge and experience (Zhang, 2022).

Research Methodologies

In general terms, AI can support three important business needs: automate business processes, obtain information through data analytics, and interact with customers and employees. So, a survey was conducted in which about 30 people took part. The crisis situation was taken into account both for companies and for all people - Covid-19. How life has changed before and after the human pandemic and how artificial intelligence has affected this situation.

By 2030, automation will displace about a third of all workers in the United States, predicted back in 2017 by McKinsey experts (Mindell & Reynolds, 2023). It is now clear that this and, probably, the next pandemics will only accelerate this process. And the Spot robot is one example. Among his tasks is to reduce the number of patrolmen, because this reduces the risk of infection. The reliance on robots becomes even more attractive. The isolation regime led to the temporary closure of non-vital factories and offices in many countries, those employees who could have switched to a remote mode of work. But even in developed countries, the number of those who can fully work remotely is only about 27%. In this research significant questions were covered in the survey:

1. What industry are you currently working in?
2. In which industry did you work before the crises?
3. Did you have the opportunity to work online? And which programs did you use to work online?
4. Do you think these programs helped you keep your job?

Special attention should be paid to programs used. According to survey, most of the people who passed it were able to work online and used various types of platforms, in general around 78% have ability to work online this can support the using of AI techniques as shown in Figure1.

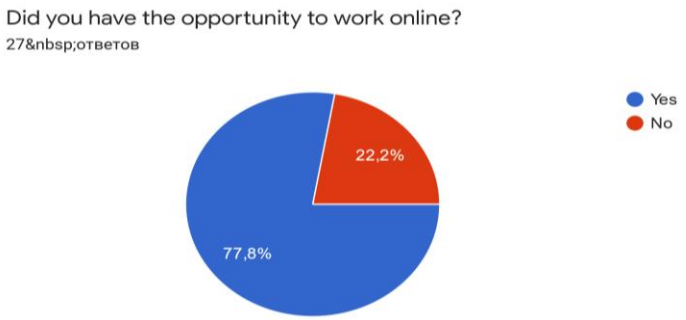

Figure 1. Opportunity to work online

Figure 2 explains the percentage of used platforms such as zoom, skype, Microsoft Teams were used mostly.

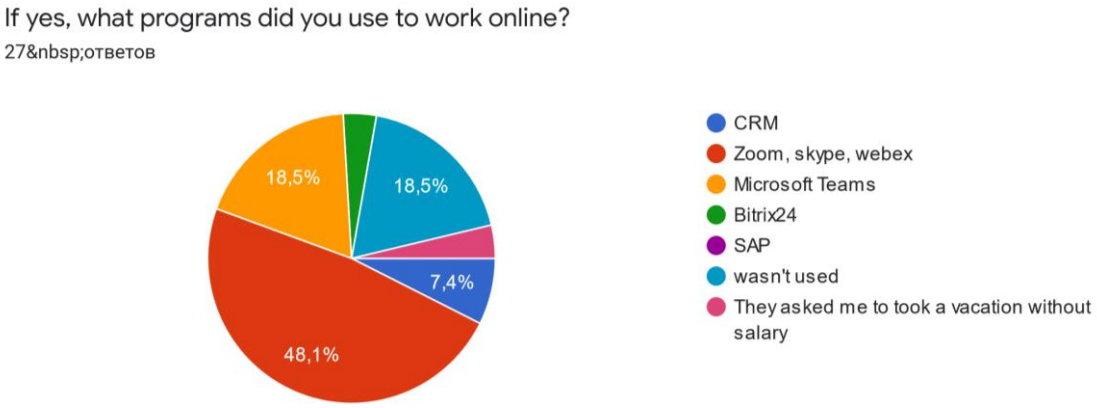

Figure 2. Programs to use in order to work online

Regarding the importance of artificial intelligence to support and boost the companies' duties, figure 3 shows the results that the artificial intelligence is a significant part of companies that were developed.

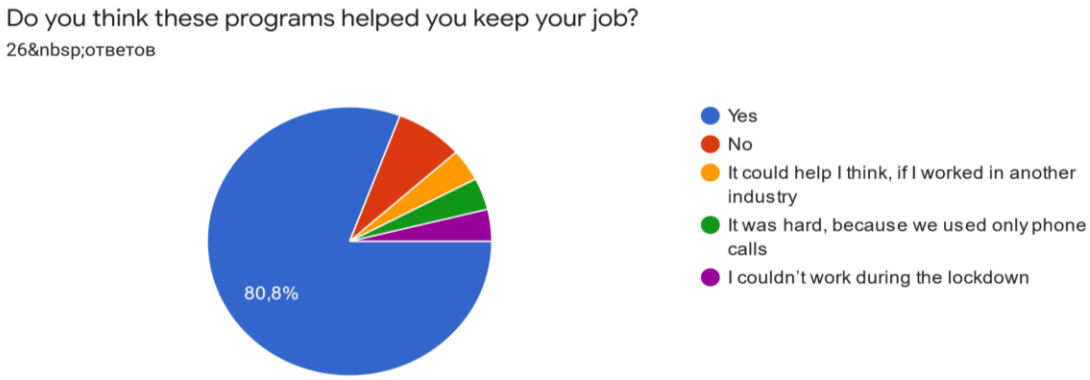

Figure 3. AI can keep work opportunity.

Figure 4 represent the answers of participants about job changes within crises for the different work sector as the following:

1) most of the participants keep working since Covid-19;
2) the biggest amount were able to use online platforms, which means that artificial intelligence is being developed in companies;
3) people could save the same job as before the pandemic.

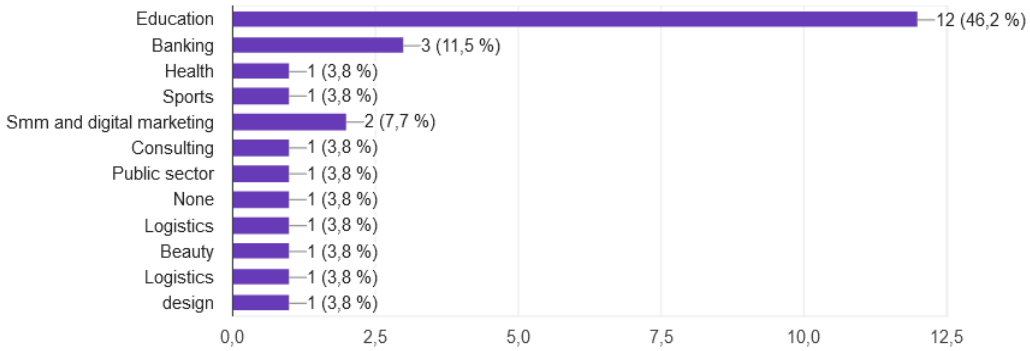

Figure 4. Industries in which people still working through the crises.

Companies, large and small, are expanding the use of robots in the context of social distancing to reduce the number of staff who need to come to work. Robots are also used to perform functions that employees cannot perform from home. For example, now robots are used to measure temperature in humans, as well as to distribute hand sanitizers. Also, artificial intelligence systems are now being created that can replace teachers, fitness instructors and financial consultants. Artificial intelligence applications and large technology companies are expanding. For example, Facebook and Google use it to moderate inappropriate posts, because human moderators working from home may not check everything.

For many enterprises, improving the work of the company, financial planning processes (including financial planning and analysis, sales planning and operational planning, integrated business planning and forecasting) is one of the highest priorities. Automation, better integration between systems, and more efficient processes seem to be an ongoing effort. Therefore, the development of artificial intelligence is growing rapidly (Aydin & Cavdar, 2015). Also, in this research we will demonstrate the suitable framework for applying artificial intelligence models and concepts in predicting the financial crises in business companies to mitigate the risks and failures in the market.

Research Framework Design

Nowadays the most appropriate method to get the direction of the current economic situation looks like a bet on the digital economy and new achievements in the field of creating artificial intelligence. Optimization in this case can be carried out by more advanced methods: by reforming the structure of the labor market with the use of various high-tech solutions for automating intellectual and physical work. Thus, to make up for the decline in the share of the working-age population in theKazakhstanthrough the robotization of production, including employees of "intellectual labor".

First of all, the progress of algorithms that can emulate information processing methods and can reproduce a "virtual employee". Already, the improvement of machine learning technologies, as well as voice and face recognition, is leading to the fact that robots are beginning to replace people even in professions that require interaction with customers.

Digital technologies like artificial intelligence models have primarily permeated organizational activities, cutting costs and times associated with producing and delivering goods and services. However, the process of designing those goods and services has mainly remained labor-intensive (Verganti et al., 2020). By 2020, 2 million jobs will be added to the global labor market, but about 7.1 million will disappear, according to The Future of Jobs study published by the World Economic Forum (WEF) in early 2017. According to a Bank of America report last year, in 10 years robots will perform 45% of manufacturing tasks in the United States. Now this figure is 10%. Most researchers consider jobs that involve a high degree of creativity, analytical thinking, or interpersonal communication to be the most stable (Sun & Scanlon, 2019).

The financial sector in central Asia is adapting to new technologies faster than other industries. The underwriting profession is a thing of the past, and the decision-making operation is almost completely automated. The use of such services in risk management allows banks and insurance companies to further reduce losses by 12-15%, even when using advanced risk analysis systems from world market leaders (Gertseva, 2020). Machine learning of all kinds can radically change the global economy and increase income inequality. In particular, it makes no economic sense to move production facilities to regions with cheap labor (Jain et al., 2018).

First of all, low-skilled and low-paid employees suffer from labor automation, the import of which to developed countries is becoming less and less justified, taking into account technological progress and the increase in the volume of the digital economy. The fear of unemployment following increasing automation is justified in emerging economies, but in the case of central Asia is not talking about replacing people with technology, but about filling the lack of human capital. The coming transformation of the labor market does not mean the dismissal of people, but an adjustment in specialization and the emergence of demand for other types of work (Soni et al., 2019; Bhosale et al, 2020).

High technologies, in particular solutions in the field of artificial intelligence, are one of the few sectors of the central Asia economy that is currently actively growing. Our products have always been and remain competitive in

the global market, which allows us to count on a significant share in this segment. According to Tractical trading, the segment of artificial intelligence solutions in the world will grow to $59.75 billion by 2025 (Agrawal et al., 2019; Korobeynikova, et al., 2021).

Construction the Intelligence Framework

In fact, to develop an intelligence framework that depicts the interaction between financial forecasting and artificial intelligence (AI) technology has become an important requirement, especially when it comes to anticipating and handling financial crises. significant contributions that shed light on how AI can improve financial models' predictive skills and have ramifications for both foreseeing and mitigating crises. This framework should include the following phases and contents as explained in Figure 5:

Here are key components included in AI research model that designed for predicting financial crises:

Data Collection and Preprocessing

* Financial Indicators: collect relevant financial data like stock prices, interest rates, inflation rates, GDP growth, and other macroeconomic indicators.
* Market Sentiment Data: contains the sentiment analysis from news articles, social media, and other textual sources to gather investor sentiment.
* Historical Data: use historical financial data to identify patterns and trends that may precede financial crises.

Feature Selection and Engineering

* Identify Relevant Features: pick up the features that have been historically indicative of financial crises, such as volatility, liquidity, and credit risk.
* Create New Features: develop new features that may enhance the model's ability to capture complex relationships in the data.

Machine Learning Algorithms

* Supervised Learning Algorithms: build machine learning algorithms such as decision trees, random forests, support vector machines, and neural networks for predictive modeling.
*Unsupervised Learning Algorithms: Consider clustering techniques or anomaly detection methods to identify abnormal patterns in the data.

Integral Methods

* Combine Models: employ the integral methods like bagging or boosting to combine multiple models and improve overall prediction accuracy.
* Stacking Models: Stack multiple models together to leverage the strengths of different algorithms.

Time Series Analysis

* Temporal Patterns: develop time series analysis to capture temporal dependencies in the financial data.
* Autoregressive Models: Utilize autoregressive integrated moving average (ARIMA) or other time series models to account for sequential dependencies.

Deep Learning Models

* Neural Networks: investigate the use of neural networks, especially deep learning architectures, to capture intricate patterns in large and complex financial datasets.
* Long Short-Term Memory (LSTM): Employ LSTM networks for their ability to capture long-term dependencies in sequential data.

Model Validation and Evaluation

* Cross-Validation: Implement cross-validation techniques to assess the model's performance on different subsets of the data.
* Metrics: Use appropriate evaluation metrics such as accuracy, precision, recall, F1 score, or area under the receiver operating characteristic curve (AUC-ROC).

Interpretability and Explainability

* Feature Importance Analysis: Conduct feature importance analysis to understand the variables contributing most to predictions.
* Explainable AI (XAI): Utilize XAI techniques to make the model's decision-making process interpretable.

Risk Management Strategies

* Portfolio Optimization: Integrate portfolio optimization strategies that consider the predicted risks when allocating assets.
* Dynamic Hedging Strategies: Develop strategies for dynamically adjusting portfolios based on changing risk conditions.

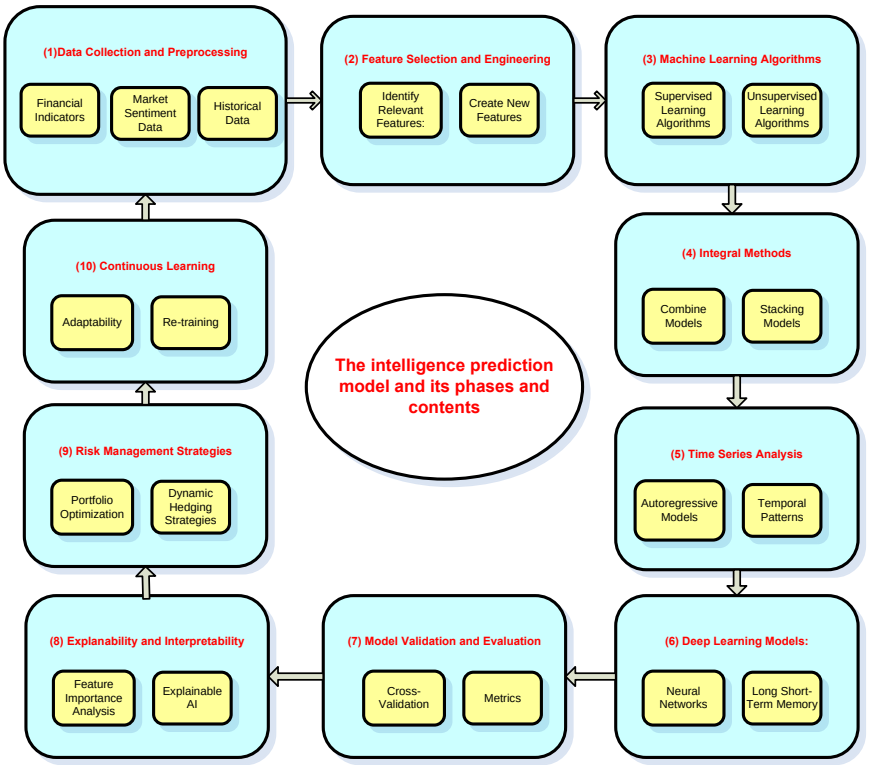

Figure 5. The contents of the intelligence framework and its ten phases

Continuous Learning

* Adaptability: Design the model to adapt to evolving market conditions and incorporate new information as it becomes available.
* Re-training: Implement regular re-training of the model to ensure it remains relevant and effective over time.

Research Results and Analysis

Information technology pattern is possible to train qualified IT personnel through joint efforts of the state and major technology companies. However, the problem of lack of qualified specialists can be solved not only through education, but also with the help of the same artificial intelligence that can automate routine tasks of programmers, freeing up the potential to solve complex technological issues, create more advanced artificial intelligence, products with higher added value. A whole technological spiral, which the sooner you start to unwind, the faster you will reach a new stage of progress. Also using virtual assistants is one of the AI tools that will eventually be more widely implemented in business processes and everyday life of a modern person. According to Facebook statistics, more than 10 thousand companies are developing chatbots. Actually, adopting the suggested artificial intelligence (AI) model to predict financial crises in business organizations has a number of possible advantages. It's crucial to remember that the model's efficacy is dependent on several variables, such as the quality of the data, the resilience of the model, and the volatility of the financial markets. Here are a few anticipated findings and outcomes:

Early Alert Signals

By spotting trends and abnormalities in financial data, the AI model can offer early warning signs of impending financial catastrophes. Businesses are able to take preventative action before the situation gets worse because to this early detection.

Risk Reduction

Businesses can pinpoint specific risk areas in their operations and portfolios by using AI forecasts. This gives them the ability to put specific risk reduction plans into action, such diversifying assets, modifying financial policies, or modifying investment portfolios.

Making Strategic Decisions

The AI model can help with strategic decision-making by offering perceptions into future changes in the economy and market dynamics. Businesses are able to optimize resource allocation and operational plans by modifying their business strategy in response to anticipated financial conditions.

Improved Distribution of Resources

Businesses are able to maximize the allocation of resources, such as capital expenditures, staffing levels, and financial investments, when they possess excellent forecasting capabilities. This guarantees that resources are allocated more effectively in advance of recessions.

Better Financial Organization

Businesses might improve their financial planning procedures by utilizing AI forecasts. Organizations may create more robust financial plans that take uncertainties and future crises into account by integrating AI insights into forecasting and budgeting processes.

Confidence among Customers and Stakeholders

Gaining the ability to anticipate and manage financial crises can boost stakeholder and customer confidence. Fostering trust and showcasing the company's dedication to prudent financial management can be achieved by open and honest communication regarding preventive steps implemented based on AI predictions.

Regulatory Compliance

AI algorithms that predict financial crises can help businesses stay in line with financial regulations. Legal problems and regulatory fines can be avoided by proactive risk management that complies with regulations.

Mitigate the Money and Investment Losses

Businesses can lessen the effect of crises on their financial performance by recognizing and resolving possible financial risks early on. This entails reducing investment losses, preventing liquidity issues, and safeguarding the company's overall financial stability.

A Competitive Advantage

Businesses may obtain a competitive edge if they successfully incorporate AI for financial crisis prediction. A company can stand out from rivals by projecting an image of resilience and forward-thinkingness through its improved ability to handle economic uncertainty.

Ongoing Learning and Adjustment

AI models can be created with ongoing learning and adaptability in mind. The model continues to be applicable and useful in offering continuous insights into future financial crises as it learns from real-time data and adapts to shifting market conditions. Another area of application of artificial intelligence algorithms is predictive analytics. AI-algorithmic technologies can operation huge amounts of data, identify patterns, and perform predictive functions. Promising areas of application of artificial intelligence are those processes in which human actions are tracked and repeated. Some companies' examples are shown in Table 1.

Table 1. Prospects for using artificial intelligence in digital companies

No.	Company name	Project name	Areas of application of artificial intelligence
1	Google	Google Health	Diagnostics of health status, plotting a route to the nearest hospital, reminder of medication intake time, assessment of progress in fitness classes
		Medical Brain	Analysis of the patient's condition, determination of prospects for the further course of the disease, prediction of the probability of an unfavorable outcome
2	Sberbank of Russia	The Sberbank Online app	Analysis of preferences of 50 million users by 1000 parameters and personalized formation of a package of services and information, making transfers and payments, maintaining spending statistics Provision of all loans (starting from 2021) based on the client's biometric data, study of credit history, income, expenses Conducting a preliminary interview with candidates for mass vacancies
3	Facebook	Online App	Correction of the eye image in the photo of a blinked customer

It should be noted that the progress of AI and Big Data is closely linked. Machine learning requires huge amounts of data. The ability to correctly select raw data for the neural network training operation is one of the specific competencies of specialized specialists, but not the only one. The AI training operation also needs to be monitored and adjusted. For example, if incorrect or questionable results are obtained because of neural networks, it is necessary to change the source data sets and "retrain" the system. The learning operation can also not always be fully automated. For most tasks, along with "machine learning", "expert" training is also required, during which a person manually indicates to the artificial intelligence system which solutions for this problem are correct and which are not. Furthermore, the answers of participants of this research study supported the importance and the crucial benefits of this developed intelligence model as the following:

In figure 6, 82% of participants confirmed to the importance of applying this model to mitigate and prevent the financial crises,

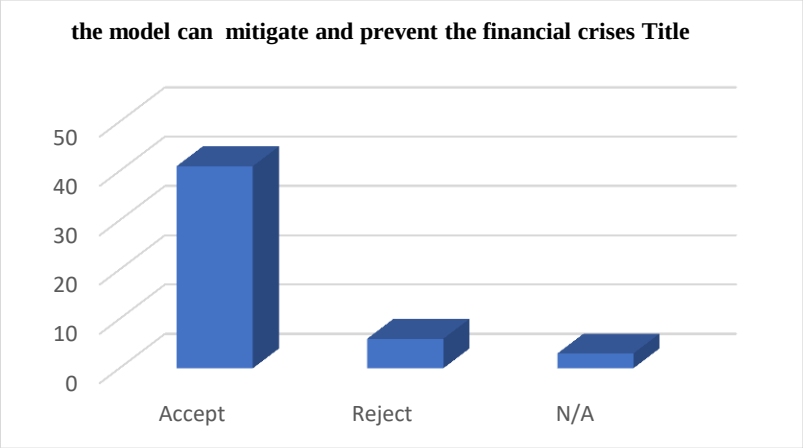

Figure 6. The importance of applying this model to mitigate and prevent financial crises

Regarding the main benefits that business companies can attain through applying this model are shown in Figure 7.

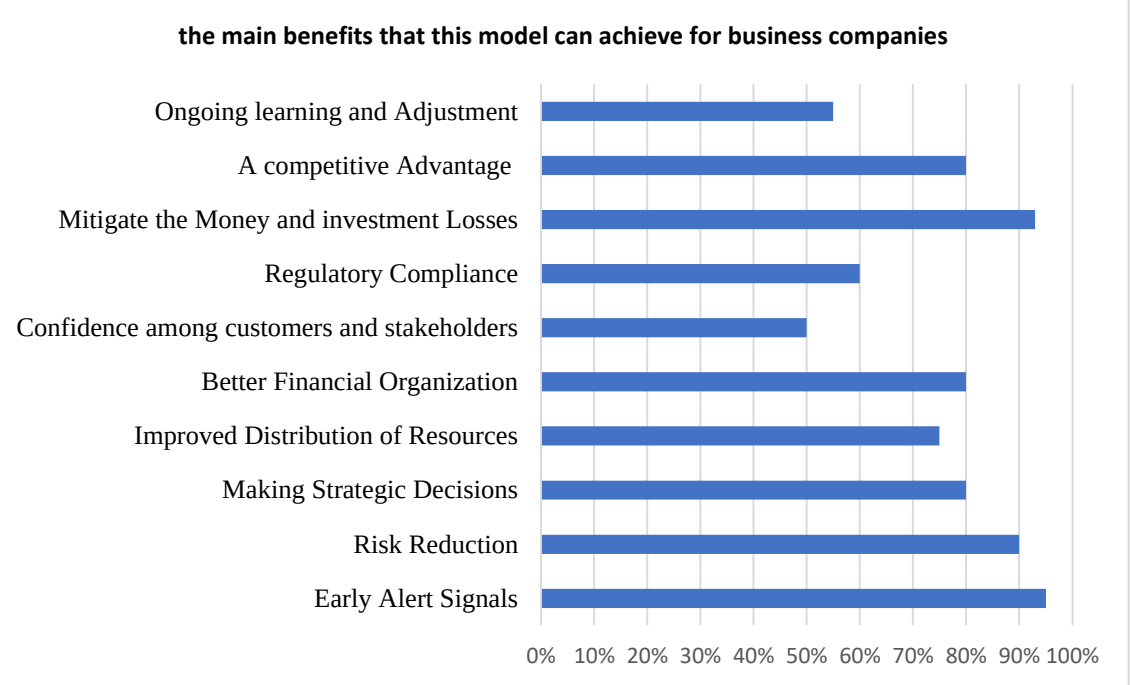

Figure 7. The main benefits that this model can achieve for business companies.

Research Conclusions

There is more interest about the research of the benefits of using artificial intelligence in business and predicting the financial crisis. The majority argues for the need to automate processes and data analysis for analytics. Many companies do not really trust the transition to new technologies, but this is what can help them stay competitive. Some of them believe that investing in process automation requires a lot of money, but this will help to build the right steps to avoid a crisis and bankruptcy of the company. In this paper, we have mentioned an example based on the statistics of the Yandex company. It tells how important it is to switch all your attention and budget on time to the development of a convenient and automated work format.

Many entrepreneurs mistakenly assume that there is no need to implement AI, since they have enough human resources to support the business, but this is a big misconception. Automation does not entail a reduction in employees, it entails an increase in work efficiency. Yes, big data analysis does all the analytical work on its own, but there are always people who know the basic principles of analytics through Data analysis. IT specialists are divided into many different directions and now this professional area is considered one of the most stable and in high demand.

Also, artificial intelligence systems are now being created and can replace teachers, fitness instructors and financial consultants. Artificial intelligence applications and large technology companies are expanding. For example, Facebook and Google use it to moderate inappropriate posts, because human moderators working from home may not check everything. Of course, companies cannot predict any events 100%, but the sooner companies start using statistical data and cloud solutions, the more accurate the probability of crisis situations will be.

This research introduced an intelligence model to help business companies to mitigate the risks of financial crises, this model based on artificial intelligence algorithms and components like neural network, time serious and artificial intelligence.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Acknowledgements or Notes

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