


**DESIGN AND IMPLEMENTATION OF ENTERPRISE FINANCIAL DECISION SUPPORT SYSTEM BASED ON BUSINESS INTELLIGENCE**

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ARTICLE INFO	ABSTRACT
<p><b>Article history:</b></p> <p><b>Received</b> 27 January 2023</p> <p><b>Accepted</b> 23 March 2023</p>	<p><b>Purpose:</b> Business intelligence and decision support systems are now recognized as critical enterprise infrastructure. Data is increasingly being used by business enterprises to react to key operational and strategic operations of their customers, markets, and stakeholders.</p>
<p><b>Keywords:</b></p> <p>Enterprise; Financial Decision; Business Intelligence; Artificial Intelligence.</p>	<p><b>Theoretical framework:</b> Business intelligence has advanced as the volume of data generated by smart technologies and the Internet has increased exponentially.</p> <p><b>Design/Methodology/Approach:</b> When using AI in the business world, privacy concerns arise when sensitive data is transmitted to a third-party vendor who has no connection to the company. Financial decision support data is managed by these AI service providers. Even while it may seem like a drawback, artificial intelligence technology actually has several advantages.</p>
	<p><b>Findings:</b> The results of this research show that a network can improve the financial management of a corporation. Using many applications of AI technology helps bring down the overall cost of operations. When it comes to financial services, both the number of IT workers needed and the number of necessary pieces of hardware (servers) can be reduced, resulting in a marginal drop in capital expenditures.</p> <p><b>Research, Practical &amp; Social implications:</b> When it comes to financial services, both the number of IT workers needed and the number of necessary pieces of hardware (servers) can be reduced, resulting in a marginal drop in capital expenditures. It is now simpler and quicker to get your hands on relevant financial information, which should lead to greater efficiency.</p> <p><b>Originality/value:</b> With our proposed approach, the accuracy of financial decision support in company increases to 99.84% from 88.94%, while the implementation time and cost are reduced.</p> <p>Doi: <a href="https://doi.org/10.26668/businessreview/2023.v8i4.873">https://doi.org/10.26668/businessreview/2023.v8i4.873</a></p>

**PROJETO E IMPLEMENTAÇÃO DE SISTEMA DE APOIO À DECISÃO FINANCEIRA EMPRESARIAL BASEADO EM INTELIGÊNCIA EMPRESARIAL**

**RESUMO**

**Objetivo:** A inteligência empresarial e os sistemas de apoio à decisão são agora reconhecidos como infra-estrutura empresarial crítica. Os dados estão sendo cada vez mais utilizados por empresas comerciais para reagir às principais operações operacionais e estratégicas de seus clientes, mercados e partes interessadas.

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**Estrutura teórica:** A inteligência empresarial avançou à medida que o volume de dados gerados por tecnologias inteligentes e a Internet aumentou exponencialmente.

**Design/Methodologia/Proteção:** Ao utilizar a IA no mundo dos negócios, surgem preocupações com a privacidade quando dados sensíveis são transmitidos a um fornecedor terceirizado que não tem conexão com a empresa. Os dados de apoio à decisão financeira são gerenciados por esses fornecedores de serviços de AI. Mesmo que possa parecer uma desvantagem, a tecnologia de inteligência artificial na verdade tem várias vantagens.

**Descobertas:** Os resultados desta pesquisa mostram que uma rede pode melhorar a gestão financeira de uma corporação. O uso de muitas aplicações da tecnologia de inteligência artificial ajuda a reduzir o custo total das operações. Quando se trata de serviços financeiros, tanto o número de trabalhadores de TI necessários quanto o número de peças de hardware (servidores) necessários podem ser reduzidos, resultando em uma queda marginal nos gastos de capital.

**Pesquisa, implicações práticas e sociais:** Quando se trata de serviços financeiros, tanto o número de trabalhadores de TI necessários quanto o número de peças de hardware (servidores) necessárias podem ser reduzidos, resultando em uma queda marginal nos gastos de capital. Agora é mais simples e mais rápido colocar as mãos em informações financeiras relevantes, o que deve levar a uma maior eficiência.

**Originalidade/valor:** Com nossa abordagem proposta, a precisão do apoio à decisão financeira na empresa aumenta para 99,84% de 88,94%, enquanto o tempo e o custo de implementação são reduzidos

**Palavras-chave:** Empresa, Decisão Financeira, Inteligência Comercial, Inteligência Artificial.

## DISEÑO E IMPLANTACIÓN DE UN SISTEMA EMPRESARIAL DE APOYO A LA TOMA DE DECISIONES FINANCIERAS BASADO EN BUSINESS INTELLIGENCE

### RESUMEN

**Propósito:** La inteligencia empresarial y los sistemas de apoyo a la toma de decisiones se reconocen actualmente como infraestructuras empresariales críticas. Las empresas utilizan cada vez más los datos para reaccionar ante las operaciones operativas y estratégicas clave de sus clientes, mercados y partes interesadas.

**Marco teórico:** La inteligencia empresarial ha avanzado a medida que el volumen de datos generados por las tecnologías inteligentes e Internet ha aumentado exponencialmente.

**Diseño/metodología/enfoque:** Al utilizar la IA en el mundo empresarial, surgen problemas de privacidad cuando se transmiten datos confidenciales a un proveedor externo que no tiene ninguna relación con la empresa. Los datos de apoyo a las decisiones financieras son gestionados por estos proveedores de servicios de IA. Aunque pueda parecer un inconveniente, la tecnología de inteligencia artificial tiene en realidad varias ventajas.

**Conclusiones:** Los resultados de esta investigación muestran que una red puede mejorar la gestión financiera de una empresa. El uso de muchas aplicaciones de la tecnología de IA ayuda a reducir el coste global de las operaciones. Cuando se trata de servicios financieros, se puede reducir tanto el número de trabajadores de TI necesarios como el número de piezas de hardware necesarias (servidores), lo que se traduce en un descenso marginal de los gastos de capital.

**Investigación, implicaciones prácticas y sociales:** En el sector de los servicios financieros, tanto el número de informáticos como el de equipos necesarios (servidores) pueden reducirse, lo que se traduce en una disminución marginal de los gastos de capital. Ahora es más sencillo y rápido acceder a la información financiera pertinente, lo que debería redundar en una mayor eficiencia.

**Originalidad/valor:** Con nuestro planteamiento propuesto, la precisión del apoyo a la toma de decisiones financieras en la empresa aumenta del 88,94% al 99,84%, al tiempo que se reducen el tiempo y el coste de implantación.

**Palabras clave:** Empresa, Decisión Financiera, Inteligencia Empresarial, Inteligencia Artificial.

## INTRODUCTION

### Background

Enterprise financial management is a crucial part of any company's operations, and it is directly linked to production and growth as the information age continues to advance modern businesses and rivalry among enterprises begin to develop enterprise management methods and

the development of the aforementioned work efficiency. The software industry is focusing on how to make the various aspects of company finance administration more efficient, effective, and comprehensible. As the infrastructure for managing information networks improves, it has become an integral part of modern business operations. Historically, enterprise automation management systems have included the creation of a financial management related function; however, this related function has been unable to meet the requirements of business applications because of the complexity of the financial management process(Liu,2020).

When a market economy expands, it tends to bring with it a corresponding increase in complexity for businesses' financial management operations. Automatic management systems with their novel wealth-management capabilities have had a major effect on the productivity of the information manager's job in the business. Therefore, it is essential to create a decentralised financial management system to streamline the management of complex funds, store massive volumes of data, and serve as a pivotal resource for company decisions(Jahmane & Gaies,2020). As for the blueprint, first and foremost, the organization's financial management is investigated in the associated business; second, during the application phase, the design proposes the need for further study of the design of the firm's financial plan; and third, it obtains most of the current difficulties existing in the firm's financial plan(Suh & Shim,2020). Specifications for modules such as business data management, statistical analysis, and flow management, as well as the requirements for finance management, etc. Knowledge of financial management and software development design are then applied to the design of the various parts of the system.

The systems engineering methodology builds upon a foundation of J2 EE development technology and the SSH template for use in parallel technological contexts. Developing the system's front end with tools like Ajax and JQuery. Data flow diagrams are also employed when developing a system's constituent parts(The Federal Register / FIND,2020)

Last but not least, use QTP testing tools, which incorporate such test system, to guarantee the system's regular operation and stability(Financial Corp,2020).

Decision making is the process of identifying needs and weighing potential solutions to those needs in order to settle on a course of action. The cognitive components of decision-making, such as judgement, are typically employed in response to a difficulty, or the existence of a discrepancy between a desired and actual outcome. In the world of artificial intelligence, choices can either be predetermined or left up to chance. Decisions that can be solved mechanically, such as by applying rules to ascertain the best course of action, fall under the

category of "programmed decisions." The majority of managerial judgments can be automated. Judgments that are not part of a predetermined set are made only in exceptional circumstances, such as during times of crisis when more standard operating procedures are not in place (Zhao, 2020).

### **Objective of the work or research problem**

Managers who need to make decisions outside of a predetermined set should rely on their own discretion, creativity, and intuition. While the scope and time restrictions of any given set of judgements are guaranteed to be one-of-a-kind, there are nevertheless universal approaches and best practises that can be uncovered. Any manager can use the following methods to overcome the obstacles to effective decision making:

- Expand your knowledge. Any person's decision-making might be negatively impacted by a lack of knowledge on the topic at issue.
- Take care not to judge favourably or unfavourably. Understanding the possibility of bias, understanding how bias can affect judgement, evaluating previous decisions to identify how bias may have influenced them, and acknowledging that while biases exist, they can be lessened by diligence are the four steps to de-biasing judgement.
- Be imaginative. To be creative is to generate new and interesting ways to address challenges.
- Decision-making tasks like weighing alternatives and describing challenges cannot proceed without it. In order to foster creativity, it is helpful to challenge one's own preconceptions and methodically tackle problems.
- Do not discount your gut instincts. When we use our acquired knowledge and experience to make decisions on the fly, we are engaging in a cognitive process known as intuition.
- Don't overstate how definitive the decision is in your mind. Few evaluations are irreversible, and most choices have more wiggle room than most people give them credit for.
- Please verify the timing. Managers should not let their emotions cloud their judgement (Gu, 2022)

Although all software programmes include automating choice phases that humans would take, most computer systems in general struggle with the development of those software programmes themselves (Gao & Fan, 2020). In the early days of the mainframe era, computers

were used for business purposes primarily to automate calculations and choices including calculating sales, updating accounts payable, determining wages, and recording credit card fees and payments (Hasan, 2020). Since the 1960s, computers have been used to aid in decision making, and this process has progressed to the point that it can either completely replace humans in making difficult judgements or at least help them along the way. The world of decision-making aids is large and replete with specialised terminology.

The significance of conventional definitions varies with the era in which they were first formulated (Si & Shi, 2021). Moreover, there are no clear and detailed descriptions of the necessary features for any type. The confusion between tools is increased by software development businesses. Decision support systems (DSS) and business intelligence (BI) are the focus of this paper since they are two of the most fundamental types of software solutions that may be used to enhance decision making (Danenas & Garsva, 2016). The term "business intelligence" (BI) is used to describe a wide range of resources designed to help businesses and their employees make more informed decisions by collecting, storing, analysing, and making available relevant data.

### **Justification**

To aid in the process of making sound business judgments, several companies have turned to the usage of computerised decision support systems (DSSs). Both definitions emphasise on improving and simplifying the process of making business decisions, which is the common thread between both. A further common feature is the use of "data-driven" decision making in both cases (Garcia, 2015). This study focused on the implementing enterprise financial support system based on the business intelligence.

### **RELATED WORKS**

A DSS is an information system that provides interactive analysis of massive datasets to aid in business decision-making. With the use of a DSS, the management, operations, and planning levels of an organisation can evaluate the weight of various uncertainties and the costs and benefits of potential courses of action (Brijs, 2016). Raw data, files, user-provided information, and business models are all used by DSSs to aid in decision-making. Relational databases, data warehouses, EHRs, forecasts of finances and revenues, and other types of information may all be utilised by a DSS. A DSS is used in businesses to help employees make better decisions by analysing and synthesising large amounts of data.

The information is used to create reports that can be used for forecasting purposes (such as sales, earnings, or stock levels). Different outputs can be generated by a DSS based on the company's historical data and the present inputs. To put it simply, decision support systems help people make wiser choices (Mishra, 2018). Decision support systems (DSS) are commonly used by upper and middle management to develop alternative outcomes based on pre-existing and historical business data. At the same time, DSS can be used to make reports that are clear to readers and can be adjusted to suit individual tastes.

## **MATERIAL AND METHODOLOGY**

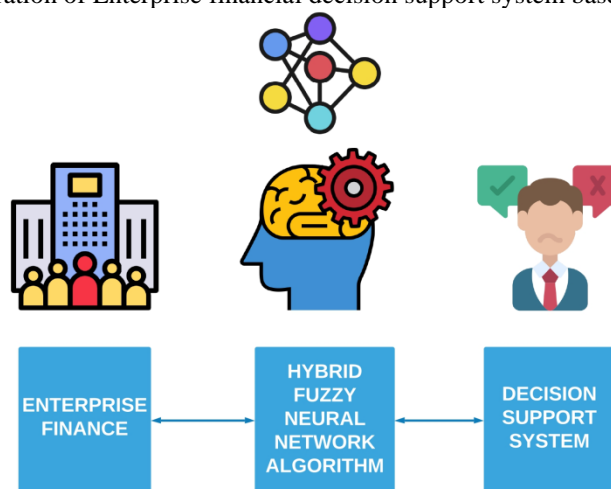
Business intelligence refers to the processes and tools used to gather, store, and analyse information about a company's operations (BI). Business intelligence includes techniques like big data analysis, process optimization, performance benchmarking, and descriptive analytics (Umurzakov, 2017). Business intelligence (BI) processes and organises all of an organization's data into digestible reports, analytics, and trends that management can use to make better decisions. There are many applications for business intelligence. Hiring, compliance, manufacturing, and marketing are just few of the areas where it has proven useful. It's hard to imagine a company that wouldn't profit from having access to more accurate data, which is why business intelligence (BI) is so important. Faster, more accurate reporting and analysis, enhanced data quality, greater employee satisfaction, reduced costs and higher revenues, and the ability to make smarter choices are just some of the many benefits that firms can gain by adopting BI into their marketing efforts. It's important to note that data analytics and business analytics are only a small part of the bigger picture when it comes to business intelligence.

Information gleaned from BI can then be used to inform user decisions. In order to predict future trends, data scientists analyse past data and use cutting-edge statistical and predictive analytics techniques. We identify yearly trends to keep users abreast of advances in the field of business intelligence, which is continually developing in response to changes in company needs and technological capabilities. AI and ML are expected to undergo constant development, and as a result, businesses can benefit from incorporating AI insights into their broader BI strategy. The push to share and collaborate on data will increase as companies try to become more data-driven. More emphasis will be placed on data visualisation as cross-departmental cooperation increases. If you want to learn more about business intelligence, this

article is just a starting point. With business intelligence (BI), users may monitor sales in real time, understand client habits, predict revenue, and do much more(Hannig,2002).

Similar to neural networks, hybrid neuro-fuzzy systems have a high degree of consistency. The fuzzy system is understood to be a neural network in this context. With this kind of hybrid NFS, the fuzzy system and the neural network can work independently of one another, which is a major improvement over the traditional approach. They make up a whole, whole, whole. These systems can acquire knowledge in either an online or offline environment (refer Figure1).

Figure 1. Graphical illustration of Enterprise financial decision support system based on business Intelligence



Source: Prepared by the authors (2022)

You can think of the rules and the input and output variables as neurons, and the fuzzy sets as the weights. During the learning process, neurons can be added or destroyed. The neurons in the network stand in for the fuzzy knowledge base. A major drawback of ANN is that it cannot deal with vague or ambiguous information. Given the availability of imprecise and ambiguous input information, some doubts may occur at any point of the data classification process. Fuzzy Set (FS) is a highly effective method for managing ambiguity.

Each feature's degree of membership functions with respect to multiple class labels can be calculated using the FS. Membership functions like this are adept at handling vague or imprecise information. The ability of FS to function well with partial or imperfect data is what sets it apart from other mathematical models. However, this fuzzy expansion is a common notion used to address uncertainty in a wide variety of difficult problems. Fuzzy logic is a formal approach of capturing appropriate patterns of reasoning under uncertainty, and it has

found widespread use in decision support systems. Networks of neurons are often referred to as "black boxes" since they do not reveal their inner workings.

The brain system discovers the  $f [n, n + 1]$  process as part of self-awareness achieved through fuzzy inference. Using time period denoted by  $k$  and also the structural condition  $k + 1$ , it should provide  $f (n + 1)$ . A stochastic altering module provides a final result in addition to increasing the authorities of a fuzzy role utilizing  $f(k)$  and the predicted possibility of choices.

$$f[n'(k)] = \sum_{k+1}^k d(m(k), g[k, k + 1]) \quad (1)$$

To examine the fuzzy rules, Equation (1) computes the fuzzy rule element  $f[n'(k)]$ . A simple predecessor seems to be the data device, which stands to obtain the unit  $d(n(k))$ . The established it system that ensures is communicated by the unit  $(g[k, k + 1])$ . The procedure ends with a neutralizing combination.

Signs as well as weightlifting are inputs neurons' values. The data has no effect on these measures. The outcome is almost equal to the data. The communication  $n_i$  may work with  $s_i$  to create similar items by collaborating with a box full all them.

$$g = \sum_{i=n}^s s_i n_i + f[n'(k)], \quad i = 1, 2. \quad (2)$$

Using Equation, all input files  $g$  are handled to gather with in capacity to accomplish the data (2).

$$FL = \sum_{g \rightarrow 1}^{s \rightarrow k} g_1 + g_2 = s_1 k_1 + s_2 k_2, \quad (3)$$

As shown in Equation (3), the network employs its transfer effort  $f(y)$ , which might be a non - linear function result  $f(y) = (1 + e^{-y})^{-1}$ , to estimate the FL in Fuzzy logic manufacture (4)



$$y = \int f(FL) = \sum_{s \rightarrow k}^k f(s_1 k_1 + s_2 k_2) \quad (4)$$

A simple neural network that uses redundancy, inclusion, and also the sigmoid function  $f$  is known as a normal neural net. A new set data fuzzy rules is created for usage in Intelligence patient records by a decision support tool. These guidelines focus on the both accurate and ambiguous information. Here are a few examples of fuzzy rules in action:

So, because technique command approach permits both the point of entry and also the available radiation characteristics for data transfer when carrying out work, as well as the internet service transmission of  $s_i^g$  is shown in Equation (5)

$$s_i^g = \sum_{i=1}^n \alpha_i R \log \left( 1 + \frac{|g_{i,n}|^2 Y_{i,n} g^{-n}}{\sigma^2} \right) \quad (5)$$

where  $i$  designates the fraction of broadband internet throughput occupied by command prompt update designated challenges,  $g_{i,n}$  denotes this same link downturn developing strong between point of entry but also terminal,  $Y_{i,n}$  denotes command line products and services,  $g^{-n}$  denotes ground station facility separation distance, provision with respect newscaster destruction, and  $\sigma^2$  denotes communication sound level, and  $b$  denotes ground station equipment spacing, provision with respect newscaster

As a result, Equation shows the efficiency of  $g_i$  data transfer transmitting data (6)

$$g_i^k = \beta_i B \log \left( 1 + \frac{|g_{n,i}|^2 X_n g^{-b}}{\sigma^2} \right) + \sum_{s \rightarrow k}^k f(s_1 k_1 + s_2 k_2) \quad (6)$$

The goal of this kernel is to automatically navigate the Yahoo Finance website, retrieve information in REAL time, and send it back to a specified address through E-mail. The largest daily gainers, i.e. the stock that gained the highest value that day, will be Information. Alternatively, the largest losers, depending on the user's preference.

The neuron uses its transfer work  $f(y)$ , and it can be a nonlinear function conclusion  $f(y) = (1 + e^{-y})^{-1}$ , as shown in Equation (4) to calculate its Enterprise financial decision support based on business management in online transaction in Fuzzy logic production

(Equation (3)). Sensors are utilised in this technique for measure the financial condition of the enterprise under investigation.

## RESULTS AND DISCUSSION

To determine possible conditions and cures, the scheme employed a business of information with fuzzy logic system in decision support for financial, overseeing, and management businesses. In terms of time, cost, quality labour consumption, the fuzzy logic technique strived to increase the system performance for corporate financial monitoring as well as decision assistance.

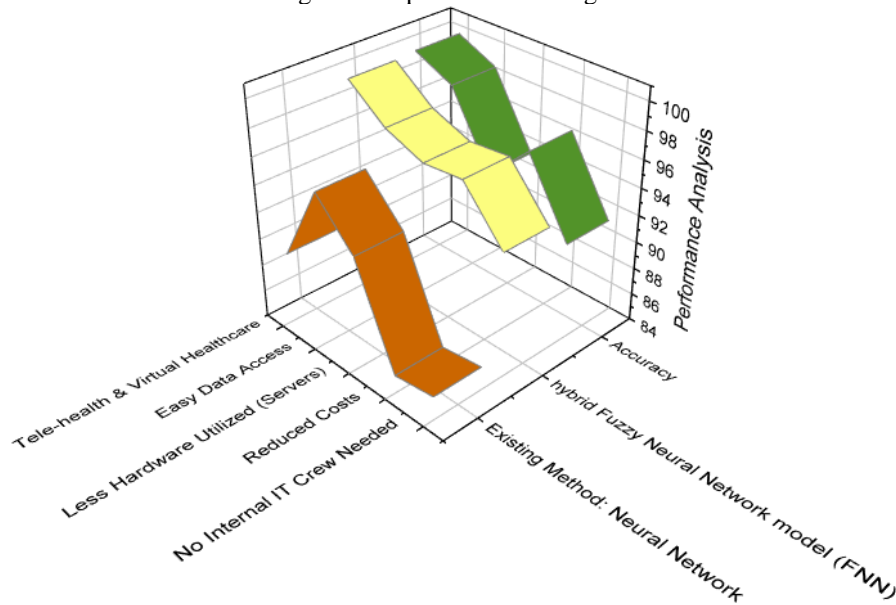
Table 1. Overall Report from the Enterprise Financial Decision Support System based on Business Management for Online Transactions Using Artificial Intelligence vs. Existing Method

Patient Information	Training Values (%)	Testing Values (%)	Accuracy (%)
Networking and online transactions	87.25	88.58	98.45
Technology for mobile devices	96.47	97.57	99.67
Business finance Bill generation (on or off)	97.48	99.48	99.44
Business Bill transaction	79.25	85.26	93.55
Successful enterprise transaction	100	100	100
Information transaction that is automated	99.97	99.95	99.99

Source: Prepared by the authors (2022)

The Enterprise Financial Decision Support System is based on a business documentation measure which is generated only on the computer within a week after receiving data from sensors that delivered through smart device. The data is organized into three sections: financial data, location data, overall business issues. Table 1 details the specific places where we put the model to a test. Nearly 8 different locations will be used for testing. The locations of the chosen establishments, as well as the testing period, are listed below.

Figure 2. In Enterprise Financial Decision Support System based on Businessmanagement in utilizing Artificial Intelligencecompare with existing method



Source: Prepared by the authors (2022)

Knowledge processing at its terminal nodes (g ik) is what makes it possible to allocate resources and prioritise activities at the regional level. Figure 2 shows that the whole-time lag identified by g i scientists is only displayed at the little level (8) in Equation. Improved accuracy and efficiency can be shown when comparing the method to those currently in use (refer Figure 2).

A tiny population sample was studied, and those results were found to be effective, precise, and efficient for the original purpose. Although this method has thus far been generalised, it can be adapted to address more specific concerns, such as the costs associated with maintaining an Enterprise Financial Decision Support System based on Business considerations and providing more complex financial decision support in financial management through the application of artificial intelligence.

Table 2. Result Analysis in Financial Decision Support System based on Businessmanagement in utilizing Artificial Intelligencecompare with existing method

	Existing Method: Neural Network (%)	Hybrid Fuzzy Neural Network (FNN) (%)	Neural Algorithm Accuracy (%)
There's no need for an internal IT team.	88.86	94.34	92.34
Cost Savings	88.46	97.84	97.53
Utilized on Less Hardware (Servers)	94.47	97.56	94.56
Easy to Accessing the Data	97.48	98.67	99.67
Financial decision support in Business management	88.94	99.84	99.98

Source: Prepared by the authors (2022)

The sending of personal information to a vendor unconnected to the organization is a privacy issue when employing artificial intelligence inside the business industry. These vendors are artificial intelligence (AI) service providers who handle financial decision support data. Despite the fact that it looks to be a disadvantage, AI technology has several benefits. It illustrates the benefits of using a network in business financial management (refer table 2). As a result of multiple AI technology operations, the overall operation cost is greatly reduced.

The number of IT employees working in financial services and the amount of hardware (servers) required are both lowered, resulting in a small reduction in overall capital expenses. As compared to prior methods, gaining access to financial data is easier and faster, resulting in increased productivity. Financial decision support in business, which has an accuracy result of 88.94% in the existing technique, has an accuracy result of 99.84% in our suggested method, while financial decision assistance in business is simple to implement, lowering the cost of doing business.

## CONCLUSION

When using AI in the business world, privacy concerns arise when sensitive data is transmitted to a third-party vendor who has no connection to the company. Financial decision support data is managed by these AI service providers. Even while it may seem like a drawback, artificial intelligence technology actually has several advantages. The results of this research show that a network can improve the financial management of a corporation. Using many applications of AI technology helps bring down the overall cost of operations. When it comes to financial services, both the number of IT workers needed and the number of necessary pieces of hardware (servers) can be reduced, resulting in a marginal drop in capital expenditures. It is

now simpler and quicker to get your hands on relevant financial information, which should lead to greater efficiency.

The proposed research can help society and academia as the accuracy of financial decision support in companies increases from 88.94% to 99.84%, while the implementation time and cost are also reduced. The proposed research needs to focus more on security, and in future work, the proposed method needs to collaborate with IOT and machine learning for better security.

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