THE USE OF BIG DATA MINING TO IMPROVE THE QUALITY OF FORECASTING CASH FLOWS FOR COMPANIES LISTED IN THE IRAQ STOCK EXCHANGE

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DOI: http://doi.org/10.37648/ijrssh.v12i04.054

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ABSTRACT

This study aims to improve the quality of financial reports by providing information about future cash flows as important information that benefits decision makers. By testing the effect of using the data mining method on improving the quality of big data using one of its tools based on neural network models and fuzzy logic, this method has proven its worth in solving many accounting problems. and to predict future cash flows. Publicly available data and data mining techniques were used to predict the cash flows of the companies listed in the Iraq Stock Exchange, through the use of a scientific model that can be justified in theory and applied practically on actual data, which leads to an increase in the accuracy of forecasting cash flows.

Keywords: *Data mining, forecasting cash flows*

INTRODUCTION:

Information technology is one of the most important challenges facing the management of establishments, as it seeks to achieve increasing growth rates in light of the new world order and intense competition between establishments based on the employment of work and technology, and its use in obtaining and transferring information has become one of the most important jobs that enable progress in all fields. Reducing the cost of producing accounting information and increasing confidence in it, in addition to saving time and effort, and the importance of information technology has increased as a result of the changes and developments that occurred in the business environment that was characterized by reliance on this technology. Business applications benefit from artificial intelligence methods in making the huge volumes of data in the establishments' databases meaningful (for example, unknown patterns and relationships in sales data, consumers' purchasing habits, etc.), and artificial intelligence methods are also used in solving complex problems and decision support, Many researchers believe that the use of artificial intelligence methods helps meet the needs of internal and external users of financial reports, especially after the increased interest of countries and establishments in developing artificial intelligence methods. One of the studies presented the experience of Sage Works to use artificial intelligence methods to facilitate the preparation and presentation of financial reports, and to reach inferences from them based on a set of ready-made programs, which helped investors in reaching reports on financial analysis and customer structure, and this method also helped managers reduce costs and achieve speed accuracy in disclosing information. Intense competition in the global market forces decision makers in

enterprises to search for competitive advantages by eliminating inefficiency, making optimal use of internal operations, and maximizing relations with all stakeholders (employees, customers, partners, shareholders), and to achieve this, all enterprises of all sizes strive to achieve this. to the development and application of data mining technologies and the use of its data sources, and the use of data mining tools to enhance decision-making capabilities by converting data into valuable knowledge to gain a competitive advantage. A large number of companies apply data mining as a technology to market their products and services to targeted customers. Data mining is used in business establishments in the Department of Accounting and Finance to predict the total profits of the establishment based on historical data, forecast cash flows, and forecast total profit / loss.

RESEARCH METHODOLOGY:

Research Problem:

In light of these challenges, the problem of increasing the volume of internal data and information arises, which results in a huge amount of data and information, especially cost information and the difficulty of managing it. Here, the importance of data mining techniques, which allows classification and analysis of data, and the

exploration of relationships and characteristics between a huge amount of multiple information stored in databases to highlight new patterns and knowledge, as well as its ability to predict the future, which reduces potential risks. The concept of big data quality is related to the usefulness of information provided by financial reports, which in turn is linked to the most important objectives of big data, which is to provide future information about cash flows to help users of those reports make rational economic decisions. Most studies that predict cash flows depend on regression models, but these models are subject to a set of assumptions that are difficult to fulfill, such as the normal distribution of data and the existence of a linear relationship between variables, so the real benefit of using these models decreases. Hence, the problem of the study is the use of publicly available data and data mining techniques to predict the cash flows of companies listed in the Iraq Stock Exchange, through the use of a scientific model that can be justified in theory and applied practically on actual data, which leads to an increase in the accuracy of forecasting cash flows.

The importance of research:

With the connection of the concept of big data quality to the most important objectives of financial reports, which is to

help current and potential investors to predict the expected cash flows of the enterprise, the importance of this study comes through increasing the accuracy of forecasting this important information by using the data mining method because of its advantages in providing simulation that results in a higher degree of fit and accuracy, this study is a step in this direction, and this study is the first of its kind that presents a proposed model based on the use of the data mining method in forecasting cash flows from the operating activities of the facility, especially since data mining is considered one of the modern and fertile fields.

Research objective:

The main objective of the study is to test the effect of using the data mining method on improving the quality of big data by using one of its tools based on neural network models and fuzzy logic. Achieving this objective requires the following set of sub-objectives:

1- Studying and analyzing the nature and objectives of the quality of financial reports, as well as the measures of quality of big data, the factors affecting it, and the efforts of professional organizations to improve its quality.

2- Proposing a model for accurately forecasting cash flows, given that

providing information about future cash flows is the main objective of financial reports, as the concept of big data quality is linked to its objectives, and therefore achieving its most important objectives contributes to improving its quality.

3- Determine whether there is a significant difference between the traditional methods and the modern methods based on the method of data mining when forecasting cash flows.

Research hypothesis:

Based on the problem that this research seeks to answer a question, the researchers formulated the hypothesis:

(There is a significant effect of applying the data mining method on improving the quality of big data for cash flow forecasting).

Method of collecting data and information:

The researchers relied on several methods in collecting data and information to cover the theoretical and applied aspects, including:

- **Theoretical side:** The researchers relied on scientific references from books, research, doctoral dissertations, master's theses, Arab and foreign periodicals that serve the research, as well as relevant

laws, instructions and accounting standards, as well as relevant sources on the Internet.

- **Applied side**: The financial statements of the Bank of Baghdad, visits and personal interviews with a number of specialists in the field of banking work.

SECOND TOPIC: DATA MINING:

Businesses collect huge amounts of data in addition to the data received daily, which puts them in front of a huge amount of data in light of the increasing storage of financial data at a very rapid rate (Westphal, 2009, p.4). On the other hand, The accounting profession has recently witnessed a great development in light of the rapid and successive developments in the field of information technology, which resulted in the emergence of the so-called electronic data operation (Osaimi, 2010). Which led to a review of accounting treatments, the emergence of electronic commerce, and thus financial information became more complex, and then accountants had to adapt to new matters and take into account the impact of the information technology environment on the accounting profession (Al-Dayah, 2009, p. 2), In a recent survey of forty-one executives, they discovered that information technology plays an important role in supporting the strategic decision, and that poor knowledge management is due to inefficient information systems that represent an obstacle to the decision-making process (Nemati & Barko, 2003, p.282). In this regard, the study of Nagano & Moraes (2013, p.282) presented one of the methods of artificial intelligence, which is Object-Oriented Modeling using the Intelligent Agent according to the needs of users of accounting information, and it was noted that the use of this method enables the development of reports for different users , With the achievement of development in the quality of information, it was considered as one of the new methods for developing accounting information systems. The great advantage of this method is the continuous development and analysis of accounting, and thus the accounting information system is able to meet the needs of users without losing understanding, relevance, reliability, and comparability, even with changes in the business model or accounting standards used. Furthermore, The development of intelligent agent technology enables the analysis of the previous year at a later time. This study concluded that even after developing traditional accounting reports (balance sheet and income statement, for example), the smart agent can move forward in

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analyzing traditional financial indicators by using an expert system developed for that, and in this way these programs can continuously monitor the position and financial/operational performance of the facility and thus Helping internal users make decisions, And other methods of artificial intelligence can be used, for example, the use of neural networks to predict results, and therefore accounting information systems are essential for decision-making, provided that the needs of its users and the way accounting works are taken into account.

The concept of data mining method:

After the end of World War II, many developments took place, whether with the emergence of new sciences such as computer science or the development of sciences such as operations research, as well as the overlap between sciences with the aim of cooperation and scientific development, and the emergence of precise disciplines, in addition to an important factor which is the occurrence of a revolution in information and diversity in intellectual production. Where the requirements of researchers and decision makers require answering important questions quickly and accurately in giving information and diversity in providing answers, and this is what created the emergence of new techniques and

applications, including database mining techniques. The process of collecting data in records of large sizes such as (Data warehouse) may contain great knowledge, which may be useful to its owners by knowing many of the statistics required in the future (Ranjan and Bhatnagar, 2011). Therefore, there is a need for different techniques to benefit from it, and this is what data mining techniques achieve, as normal techniques are not useful and impractical in such a large amount of data. Therefore, artificial intelligence techniques, including data mining, appeared to facilitate and improve the process of research and deduction. As previously mentioned, DM aims to extract the information hidden in it, and it is a modern technology that has imposed itself strongly in the era of informatics and in light of the great technological development and widespread use of databases. It provides organizations in all fields with the ability to explore, Focusing on the most important information in the databases, it focuses on building future predictions and exploring behavior and trends, allowing the right decisions to be estimated and taken at the right time. Excavation techniques also answer many questions in record time, especially questions that were difficult to answer. Sirikulvadhana (2002, p.24) defines data

mining as "a set of computer techniques designed to automatically mine large volumes of integrated data to access unexpected or hidden information or patterns. This method of data mining is sometimes known as knowledge discovery in databases.

Data mining is "a term used to describe the analysis of data to discover previously unknown relationships that provide useful information" (Ata & Seyrek, 2009, p.161). Data mining is also defined as "the process of analyzing data by linking it with artificial intelligence techniques and statistical processes in analyzing this data, and using it to identify useful information, and subsequent knowledge from large databases or extract hidden predictive information from large databases". As well as discovering the hidden value in the data warehouse, and some see it as a step in "Knowledge Discovery In Database" while others deal with data mining as a synonym for exploring knowledge from databases (Han & Kamber, 2006, p. .5).

The general idea of the data mining method:

This part of the study includes the general idea of the method of data mining according to a vision in the following points: (Westphal & Blaxton, 2018, p.5) There are many companies, whether affiliated to the private sector or the government, in which the bureaucracy has devoted a huge number of resources to building and maintaining databases information giants over the past few decades, including the development of a wide range of data warehouses.

1. In many cases, the information contained in the databases cannot be accessed or analyzed.

2. The data cannot be analyzed by traditional statistical methods, either because too many records are missing or because the data is in a descriptive form rather than quantitative measures.

3. Some databases have been developed greatly, but systems administrators often do not know what information may be expressive or its relevance to the questions posed.

4. It is useful for organizations to find their way to "dig" their huge databases in order to find important information or forms that they may contain.

5. There are many data mining approaches and techniques that can be used to analyze data sources in order to discover new patterns and trends.

This is the general idea of data mining, and unlike cases where mathematical and

statistical analyzes can be employed to test pre-determined hypotheses, data mining is more useful for discovering analysis scenarios in which there are no pre-established notions of what will constitute an interesting outcome. Whatever precise form the analysis takes, the key is to adopt a flexible approach that enables you to make unexpected discoveries beyond expectations within your problem area (Kirkos et al., 2007, p.996).

Objectives of using data mining in business establishments:

The objectives of data mining are to discover hidden knowledge, unknown patterns, new rules, correlations, changes, anomalies, and significant structures from large databases, which are potentially useful and understandable, mainly for making important decisions. It is a technology that provides different methodologies for making decisions. Decision, problem solving, analysis, planning, diagnosis, identification, detection, prevention, innovation. (Tsai, H., 2013, p.3161). Data analysis and knowledge discovery techniques are applied within the limits of computer efficiency and provide a number of patterns through data, and ideas obtained through a high level of understanding of data that can help improve work practice, and data mining software vendors are

recently The latter integrates data mining capabilities into database engines so that users can perform data mining tasks in parallel within databases, saving time (Zhang & Zhou, 2004, p.513). The users of data mining are often experts in the field who not only own the data but also collect the data themselves, assuming that the data owners have some understanding of the data and its generation processes. Business is considered the largest field for users of data mining, where a huge amount of data is collected, and because the primary goal of businessmen is to make their companies more profitable and more competitive, so data owners want not only a better understanding of their data, but also gaining new knowledge about their field (existing in their data).) for the purpose of solving problems in better ways, mining organizations' data enables them to answer questions related to the past (what happened?), the present (what happens?), and the future (what could happen?), by finding patterns and relationships between work practices and establishments. The advantages of mining are that the data is real and quantifiable, and the new knowledge discovered must have essential features; It must be understandable, new, available, useful, and the most important requirement is that the new knowledge

discovered needs to be understood by data owners to use and benefit from it.

Areas of using data mining in business establishments:

DM techniques are used successfully in various applications such as fraud detection and forecasting, bankruptcy, strategic decision-making, marketing, and financial performance (Ozgulbas and Koyuncugil, 2006:329) and reviews the areas of use of DM methods in many applications, including: (Segura and Vidal-Castro, 2011:162).

1- Writing a brief report on a specific category: Profiling Populations: Developing and creating summary reports on important customers and credit cards.

2- Analysis of Business Trend: such as finding markets with strong or weak growth capabilities.

3- Target Marketing: Finding customers in order to give them discounts for a specific reason.

4- Usage Analysis: Finding a specific pattern for the use of services and goods.

5- Campaign Effectiveness: Comparing campaign strategies with each other in order to find the most effective and influential one.

6- Attractiveness of the commodity: discovering the commodities that are sold together.

Therefore, the researchers believe that in light of the threats that companies face, whether they are internal in the form of fraud and manipulation, for example, and external in the form of competition with other companies in the same field of industry, it has become imperative for companies to make better use of modern systems in important areas of analysis such as discovery Fraud, study and analysis of capital markets by identifying important and useful patterns in decision-making to achieve more profits, great competitive advantages, lower costs, and gain the confidence of shareholders.

Data mining models:

Data mining mainly analyzes data and generates descriptive and predictive models that help solve problems. There are many applications used in practice. The following is a presentation of the descriptive and predictive models:

A. Descriptive Models distinguish the general characteristics of data in databases, and try to extract useful patterns that can describe the data that is mined for it and explore the characteristics and focus on finding new information or patterns that describe the data that a person

can interpret, for example In grocery store databases, a large number of customers who purchase product A can be explored with product B, and among the most important data mining tools that are used in descriptive models are decision trees, association rules, and support beam machine (Zhang & Zhou, 2004, p.513).

B. Predictive Models: infers current data to make predictions, and attempts to predict unknown values, future trends, or behavior based on other variables or historical values presented in the databases that are being mined, and this includes the use of some variables or fields in The set of data to predict the future or unknown values of other variables of interest, for example predicting customer response to a promotion, or forecasting quarterly cash flow.

THE THIRD TOPIC: BIG DATA

With the continuous development of the market economy, and the increasingly fierce competition between companies, there was a need to comprehensively enhance financial accounting through the use of advanced technologies such as big data (Big Data) to meet the development

trend of the times, reduce errors caused by human operations, improve the efficiency and quality of financial management, and increase earning money. (Gao, 2022:1). There are many definitions of this term (Big Data), as defined by Gartner Inc. (2018), specialized in information technology research, as "information assets that are large in size, fast-flowing and highly diversified, which require economically viable and innovative processing methods in order to surround insights and decision-making methods." As defined by the International Organization for Standardization (ISO 2017) as "a set or groups of data that have unique characteristics such as size, speed, diversity, variability, credibility and validity of data", and as defined by the International Telecommunication Union (2018, ITU) as "a set of data Which is characterized by large size, high speed, and clear diversity compared to the types of known data sets.

The researchers believe that big data are systems that enable us to store and analyze huge amounts of data and benefit from them in making various financial and administrative decisions.

Characteristics of big data:

The main characteristics of big data are as follows: (Hariri et al, 2019; 3-4).

1- Size: Size refers to the huge amount of data that is generated every second, the increasing volume of data, the speed of growth of that data, and the emergence of new sources for it.

2- Speed: It means the speed of producing and extracting data to cover the demand for it, as speed is a crucial element in decision-making based on this data, with an emphasis on the speed with which the data is processed must be compatible with the speed with which the data is produced.

3- Diversity: Diversity refers to the different forms of data in a data set including structured data, semi-structured data and unstructured data, as more than 80% of data today is unstructured or unstructured and that data is usually too much to manage effectively .

4- Value represents the context of data and its usefulness in decision making, for example Facebook, Google and Amazon have all benefited from the value of big data via analytics in their respected products. Amazon analyzes large sets of data about users and their purchases to make product recommendations, thus increasing sales. Google collects location data from Android users to improve location services in Google Maps, and Facebook monitors users' activities to provide targeted ads and friend recommendations.

5- Honesty: It refers to the accuracy and quality of the data, as the beneficiaries are interested in information about the quality of the data, and not all data can be used in serving the organization and decision-making, so some useless data is discarded because the data can be inconsistent, noisy, ambiguous, or incomplete .

Challenges in big data analysis:

The study (Zicari, 2017) reviewed a number of challenges it faces organizations when using and analyzing big data, and this study focused on the main characteristics of that data and the challenges associated with it, and worked on dividing the challenges into three sections:

1- Section One: Challenges related to data: volume, diversity, speed, credibility and data quality, data discovery, relevance, comprehensiveness and privacy.

2- Section Two: Challenges related to processing: These include storing

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data, the difficulty of choosing between similar data, converting data into an analytical form, modeling data, understanding the output, and how to display complex analyzes of data.

3- Section Three: Challenges Related to Management: These include data privacy, security, governance, and ethics.

The role of data mining in increasing the accuracy of forecasting cash flows in big data:

Forecasting future cash flows is essential for investment analysis and enterprise evaluation, and the facility's ability to generate cash flows affects the market value of shares. According to the Financial Accounting Standards Board FASB (1978) and the International Accounting Standards Board IASB (IFRS Foundation, 2010), providing information to help users of financial statements to predict future cash flows is one of the main objectives of financial reports (Farshadfar & Monem, 2013, p.111). Where the List of Financial Accounting Concepts No. 1 in 1978 (paragraph 37) indicated that the main objective of financial reports is to provide information that helps investors, creditors and others in evaluating the size, timing and conditions of uncertainty surrounding cash flows. Moreover, it was emphasized

in paragraph (44) that information Earnings have a better predictive power than current cash flows in predicting future cash flows (Barth et al., 2001, p.28; Cohen, 2003, p.2).

In 1987, the Financial Accounting Standards Board issued Financial Accounting Standards Bulletin No. 95, which requires establishments to prepare a statement of cash flows, and the statement of cash flows was classified into three activities: operating, investing, and financing. The FASB noted that the statement of cash flows should help investors, creditors, and other users to:

1- Determine the facility's ability to generate a positive net cash flow.

2- Determine the facility's ability to meet obligations and pay dividends and its need for external financing.

Yoo & Pae (2013) indicated that cash flow information enables a better understanding of the real operating performance and financial stability of the enterprise, especially when the quality of earnings is low. Accurate determination of the cash flows of the enterprise can make important financial decisions resulting from future expectations regarding the continuity of the enterprise or its bankruptcy. It also indicates the ability of the enterprise to pay dividends, in addition to it representing a measure of profitability and the financial

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position of the enterprise. Therefore, forecasting cash flows is of great benefit and value to parties. Several come on top of each of the directors of companies, investors and financial analysts. Investors are interested in cash flows as inputs to investment models to enable them to know the ability of the facility to pay dividends. The cash flows also measure the operating ability of the facility to meet daily financial contracts. Creditors are concerned with financial solvency decisions related to the establishments. Employees are also concerned with job security and the continuity of the establishment in which they work. Likewise, rating agencies are concerned with the continuity of the establishment and the ability of the establishment to pay debts when due. When forecasting cash flows, both the identification of useful variables in forecasting that must be included in the forecasting model must be taken into account, as well as the type and structure of models that are employed in forecasting must be carefully chosen to provide a more accurate forecast (Li et al., 2015, p.24). On the other hand, financial analysts use forecasting cash flows in addition to forecasting profits, considering that cash flows are an important complementary tool that helps avoid wrong inferences due to a

misunderstanding of accounting profits prepared on the basis of accounting accrual, as the analysis of both cash flows and profits can result in Better results than earnings analysis alone especially when earnings quality is low.

Profits are sometimes referred to as net income, which is the sum of both net cash income and net credit income (entitlements) Net Credit Income, and the latter depends on credit transactions with the enterprise's customers that are expected to be settled in cash at a later period, and it is possible that the volume of credit given to customers is ignored in the flow information cash, which may lead to misleading investors about the risks of cash shortage in the enterprise (Li et al., 2015, p.25; Bilinski, 2014, p.401). Dechow et al. (1998) indicates that earnings are better at forecasting future cash flows than current cash flows, and this explains the use of earnings information rather than cash flows from operating activities in evaluation models and performance measures. In this regard, Brochet (2007) studied the role of cash flows from operating activities and accruals in detail in predicting future cash flows. The study concluded that accruals are superior to cash flows in predicting future cash flows, consistent with the assertion of FASB (1978) that accounting

profits and their components are better than current cash flows in predicting future cash flows, while the study of Al-Attar & Hussain (2004) concluded The preference of current cash flows in predicting future cash flows over profits. The study of Barth et al. (2001) indicated that disaggregation of accruals into its main components enhances the predictive power of the model, while Cheng & Hollie (2008) indicated that the classification of cash flows disaggregation of cash flows has an additional value that exceeds cash flows in their total form, as some contents of cash flows in their classification form have informational content greater than cash flows in aggregate, while the study of Li et al. (2015) concluded that disaggregating cash flows into their main components does not enhance the predictive power of cash flows by applying them to companies in South Africa, in contrast to the findings of Barth et al. (2001) by application in the United States of America and the study of Farshadfar & Monem (2013) in Australia.

The researchers believe that with the difference in previous studies that dealt with forecasting future cash flows as to whether the current cash flows or profits are better in forecasting, most of them agreed that the use of information about both current cash flows and current profits (on an accrual basis) has a greater predictive power than using each separately.

THE FOURTH TOPIC: THE APPLIED SIDE

Commercial banks were chosen in the Iraqi market for securities to apply the use of big data mining to improve the quality of forecasting cash flows, because the banking sector is one of the largest sectors in the Iraqi market for securities and the largest sectors in terms of the number of shares traded and trading volume for the years (2020-2021), respectively, to become In the first place and excels in all sectors.

Middle East Investment Bank:
1. Date of incorporation:
The Middle East Investment Bank was established as a joint stock company with a nominal capital of 400 million Iraqi dinars, of which 25% was paid, i.e. 100 million dinars, according to the incorporation certificate numbered MSh / 5211 dated 7/7/1993 issued by the Companies Registration Department, and after obtaining the banking license issued From the Central Bank of Iraq under book numbered p. A/D/4/941/4 issued on 9/28/1993, the bank commenced its operations on 5/8/1994.

2. Reasons for choosing:

Because it enjoys a good reputation among Iraqi commercial banks, which has been providing its various services to citizens for more than 27 years, and the bank has proven its ability to continue, progress and develop. In addition to his cooperation with the researcher in facilitating his task.

3. Neuro Fuzzy Model Estimations Using ANFIS Technique:

The hypothesis can be tested:

"There is a significant effect of applying the data mining method on improving the quality of big data for forecasting cash flows".

To test this hypothesis, the input variables of the model were determined (the numerical values of the input variables of the Bank of Baghdad were mentioned). This study aims to know the value of applying the Neuro Fuzzy model as one of the data mining tools.

The model was applied using the Matlab program, where the data set of variables for the years from 2018 to 2021 was used to train ANFIS)) as one of the functional achievements of this model and to obtain the Fuzzy Inference System (FIS) using nine variables as inputs to forecast cash flows from operating activities for the year 2012, and Figure No. (1) shows The structure of the ANFIS model is as follows:
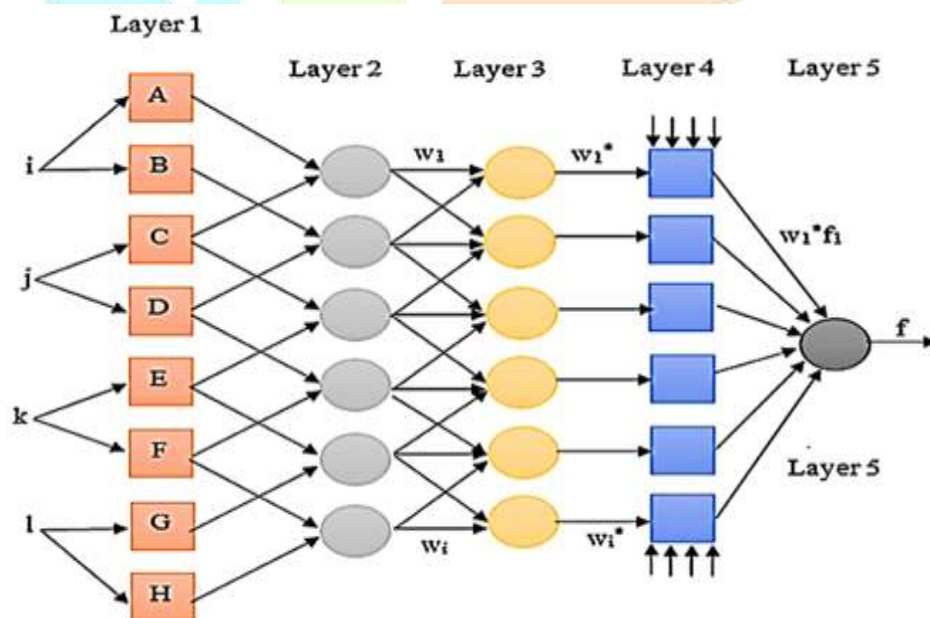

Figure (1)

The structure of the ANFIS model

The paired t test was used, and the value of t = .862), (Sig. = .393), meaning that the difference between the actual and the estimated value is not significant at the 5% level of significance, as the value of (Sig.) is greater than the level of significance, which confirms There is no significant difference between the actual and estimated cash flows using the Neuro Fuzzy model.

From the foregoing, we deduce the validity of the hypothesis:

"There is a significant effect of applying the data mining method on improving the quality of big data for forecasting cash flows". The researchers applied the Neuro Fuzzy model to the actual data for the forecast period in 2022 following the period in question. The results are in Table (1) as follows:

Table No. (1) Neuro Fuzzy model applied to actual data for the forecast period 2022:

Company	Net actual cash flows on 12/31/2021	Projected net cash flows under Neuro Fuzzy	The expected net cash flows under the decline
1	4230.24	-4256	95204.592
2	2216690.56	2237984	3817685.76
3	5065.76	5040	93180.9648
4	949791.36	960176	1872864
5	1222970.56	1223712	290190.768
6	1774587.36	1775424	308264.096
7	177443.84	176848	138751.2
8	17264.8	17024	76202.6608
9	43350.72	43120	98073.0576
10	211098.72	211344	188788.88
11	197214.08	197120	141700.608
12	174065.92	173488	220717.84
13	26806.08	-26992	73910.0768
14	216632.64	216272	120291.024
15	97611.36	97552	184609.04
16	158553.92	17024	137606
17	4045.44	3808	122131.52
18	90948.48	90832	162716.064
19	5802.72	5824	115047.408
20	1003990.4	950880	600702.032
21	59299.52	59248	147913.584
22	-21601.44	21728	92773.9792
23	2915.36	2912	102044.3872
24	32488.96	24080	80550.2096
25	69812.96	69776	97591.8608
26	49748.16	49840	98424.5024

27	172792.48	172592	108024.4256
28	1085343.84	1085392	145325.936
29	597042.88	593824	685374.816
30	23026.08	22848	106926.8368
31	18873.12	18816	106198.9936
32	30640.96	82544	429890.496
33	-34386.24	-37632	80238.7264

The table is from the numbers of the researchers

To judge the predictive ability of the Neuro Fuzzy model, the following two criteria were used in the comparison between the estimated models:

(a) The square root of prediction error (RMSPE).

RMSPE =

$$(\frac{1}{m} [\sum_{h=1}^{m} (\hat{y}_{n+h} - y_{n+h})^2])^{\frac{1}{2}}$$

(b) Mean Absolute Relative Prediction Error (MAPE)

MAPE = $\frac{1}{m} [\sum_{h=1}^{m} | (\hat{y}_{n+h} - y_{n+h}) / y_{n+h} |]$

The smaller the value of RMSPE, MAPE, this indicates the high efficiency of the prediction model. Table No. (2) presents the estimation criteria, and it is clear from the table that the values of the two criteria of comparison (the square root of the prediction error ((RMSPE), the average absolute relative error of the prediction (MAPE) have significantly decreased for the Neuro Fuzzy model, which means that the predictive ability of the Neuro Fuzzy model has improved

Table No. (2) Criteria for comparison between estimated models:

Model	RMSPE	MAPE
Neuro Fuzzy model	96.8128	5.712

From the foregoing, the hypothesis is valid:

"There is a significant effect of applying the data mining method on improving the quality of big data for forecasting cash flows".

CONCLUSIONS AND RECOMMENDATIONS:

Conclusions:

1- One of the most important benefits of DM techniques is its ability to classify, aggregate and analyze

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data and thus the accuracy of the information generated from it, as data inaccuracy has direct effects on the organization.

2- The ability of DM tools to support managers of organizations to re-design and analyze processes to suit the surrounding business environment and achieve competitive advantage, and achieve a high level of interoperability to provide knowledge integration.

3- Big data ensures the integrity and quality of data, and by integrating with DM technology, the efficiency of DM technologies increases during data collection and classification processes, thus improving data quality.

4- Organizations' adoption of big data integration and DM technology enables them to make their operations more efficient, and allows them to achieve operational and financial results by increasing access to information, developing new products quickly and effectively, improving operations, and taking effective measures to change the values and timing of cash flows.

Recommendations:

1- Work in a sound technological environment to create a solid ground that accommodates information and its technologies and interacts with it.

2- The need to use data mining technology with its cognitive and technical concepts and to provide all the necessary data warehouses in creating new knowledge that would help improve the quality of cash flow forecasting.

3- The need to choose modern technologies, information systems and research that would improve financial and accounting operations.

4- Strengthening the relationships between the existing information systems of the organizations, and the need to work on benefiting from the outputs of the systems, and train the appropriate human cadres for that, which will reflect positively on improving the quality of forecasting cash flows and improving their performance and excellence in their work.

5- The necessity of researching the reasons for the decline in interest in some areas that would affect the

application of data mining concepts in the field of big data.

Financial support and sponsorship: Nil

Conflict of Interest: None

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