Intelligent Decision Making in IoT-Based Enterprise Management through Fusion Optimization with Deep Learning Models

Saif Saad Ahmed[1], Anwar Ja'afar M. Jawad[2], Shorook K. Abd[3], Aymen Mohammed[4], Amjed Hameed Majeed[5]

[1] Al-Turath University College, Baghdad, 10021, Iraq
[2] Department of Computer Techniques Engineering, Al-Rafidain University College, Baghdad 10064, Iraq
[3] Department of Computer Techniques Engineering, Mazaya University College, Thi Qar, Iraq
[4] Department of Medical instruments engineering techniques, Alfarahidi University, Baghdad, Iraq
[5]Business Administration Department, Al- Mustaqbal University College51001 Hillah, Babylon , Iraq

Emails: saif.saad@turath.edu.iq; anwar.jawad@ruc.edu.iq; shurooqkamel7@gmail.com; ayman.mohammed@alfarahidiun.edu.iq; amjed_hameed@uomus.edu.iq

Abstract

Because of the proliferation of digital technologies, organizations now have access to previously unimaginable troves of data. In order to make educated choices and generate beneficial results, accurate data analysis and interpretation are essential. The use of data visualization in this context has proven its value. Recent studies found that data visualization increased business owners' drive to make a profit. To aid business owners in evaluating issues related to self-service data resources, a dynamic IoT-based enterprise management framework (IEMF-IDM) was presented. The suggested system uses fusion optimization techniques to maximize the fusion score and enhance decision-making through the use of various models and methods, such as machine learning and fuzzy approaches. Simulation studies in a number of domains, including robots, cloud settings, and multimedia data fusion, attest to the system's efficacy.

Keywords: Internet of Things; Business Intelligence; Enterprise Management; Data Visualization; Fusion Optimization.

1. Introduction

The Internet of Things (IoT), data fusion, optimization, and deep learning are all powerful tools that can be combined to improve enterprise management decision-making [1]. The goal of this method is to create a holistic view of business operations by combining data from several IoT devices [2]. The data is then evaluated with cutting-edge deep learning algorithms, revealing previously undiscovered patterns and correlations and empowering organizations to make better decisions [3]. The term "fusion optimization" is used to describe the process of optimizing the fusion score by mixing different models and methods, such as machine learning and fuzzy techniques [4]. Businesses may increase their profits and efficiencies by adopting this strategy since it helps them make more informed decisions. Intelligent decision-making in IoT-based enterprise management via fusion optimization with deep learning models is, all things considered, a promising topic that has the potential to alter the way organizations utilize data and make choices. [5]. ERP software is intended to make cross-functional operations in a company more efficient [6]. This software eliminates the inconsistency and duplications of work, data can be shared between organizations, and information can be accessed in real-time [7-9]. Supply chain management systems are the third category of business application [10]. To manufacture and transfer goods from a vendor to the client supply chain must be comprised of people, tasks, equipment, and other resources [11]. These management syatems make possible relationships between all points of products, services, and consumers [12].

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

Specific applications with a more comprehensive architectural design and dependability might be included within the enterprise system umbrella [13]. They're designed to deal with exact data and are put through a lot of testing to ensure the data they save is accurate [14]. Email marketing systems, business intelligence, and payment processing are all prevalent among organizations that deal with enterprise systems [15]. Enterprise systems that track financial data benefit from such capabilities because they enable scalability [16]. Individuals go through a decision-making process to select the best alternative or course of action to fulfill needs [17]. Set activities performed by managers to identify planned courses for company objectives and set particular actions in motion in a business setting [18]. To make a decision, one must weigh the pros and cons of many options, some of which involve taking no action at all [19]. The information gathered is used by individuals throughout companies to make a wide range of decisions [20]. These choices can significantly impact other people's lives and careers and an organization's direction [21]. One of the most important aspects of a manager's job is decision making. It is critical in the planning process [22]. Managers plan various issues such as the direction their organisation will take, the resources they will use, and who will be in charge of each task [23]. Deep Learning technology improves decision-making by providing deeper insight and greater precision [24]. As a result, manual data aggregation and document inspection are no longer necessary, freeing up data processing, analysis, and application time [25]. IoT data handled by ML removes bias from business choices by delivering information based on facts and data patterns.

The Internet of Things (IoT) is a powerful technology that enables businesses to connect devices and appliances remotely, providing relevant and useful data in real time. This data can be leveraged to make informed decisions, enhance business processes, and improve overall efficiency. However, with the vast amount of data generated by IoT devices, effective data fusion, and optimization techniques are crucial for intelligent systems. This includes multi-level and hybrid-level fusion, multi-classifier and decision-level fusion, and multi-sensor fusion system architectures. Intelligent techniques for fusion processing, fusion system design, and fusion score improvement are also important. Deep learning models can also be used for fusion, and combining multiple models can improve the performance of intelligent systems. Fuzzy approaches and optimization algorithms are other strategies that can be used for data fusion in IoT applications. Overall, machine learning plays a critical role in data fusion for IoT, enabling businesses to fully utilize the benefits of this technology.

The study contributions of this study are:

- The proposed system uses fusion optimization techniques to maximize the fusion score and enhance decision-making through the use of various models and methods, such as machine learning and fuzzy approaches. Simulation studies in a number of domains, including robots, cloud settings, and multimedia data fusion, attest to the system's efficacy. This approach may significantly alter how organizations utilize data and make choices, which might increase their bottom line and productivity.
- A dynamic IoT-based enterprise management framework with data visualization and deep neural network analysis was suggested (IEMF-IDM) to aid business owners in evaluating worries about self-service data resources.
- The ability to swiftly and easily interpret complicated data sets has made data visualization a vital tool for enterprises. Recent studies have shown that data visualization may boost business owners' profit incentive by helping them spot patterns and spot opportunities for growth.

The other part of the article is part 2 for existing research work on enterprise business management and part 3 for the proposed method as a dynamic IoT-based enterprise management framework in intelligent decision-making (IEMF-IDM). Part 4 is the experimental result analysis, and part 5 is the conclusion of enterprise management decision-making.

2. Existing research work on enterprise management in intelligent decision-making:

Iryna Hnatenko et al. (2020) [26] discussed several ways to evaluate a business's creative potential because of the complexity of the enterprise and its many facets. As a result, developing a comprehensive strategy to quickly and completely diagnose the company's current innovation potential is an essential study field. This paper provides a methodology for evaluating innovation potential (IPE) using resource and productive methods. The following assessment objectives have been defined according to the suggested integrated approach: an investigation into how effectively inventive potential can be used and how relevant such potential is to a company's current development plan.

Tsvetkov V.Ya et al. (2020) [27] introduced cybernetic enterprise management research using the digital twin model and technology and the IEM (intelligent enterprise managing) system idea. It is a meta-model of a real company and digital companies exchanging information and interacting in an informative way. Digital management has progressed to a stage known as cybernetic management (CM). By writing this piece, I hope to codify the fundamental concepts of CM. The "mirroring" technique, derived from their idea of database replication, is proven to use the twofold business model. All genuine processes in cyberspace can be reflected

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

thanks to this mirroring. Modeling and transferring ideal manufacturing processes to a real business are done using a system of standard management and standardization standards in cyberspace.

The paper proposed by Anatolii Asaul Asaul et al. (2020) [28] focuses on the urgency of implementing cloud technologies (CT), which is a necessity for the creation of enterprise management systems, giving rise to a complex of phenomena and processes that are insufficiently studied and determining the need to find new tools for making and implementing reasonable management decisions. A mathematical model was developed to estimate the likelihood of making an error-free decision, to evaluate the effectiveness of decision-making, and to create a model for making management decisions over a specified time period using parallel operation methods for the various components of the enterprise management system. This model was used to generate a mathematical prediction of the possibility of making an error-free decision.

Amy H. I. Lee et al. (2020) [29] studied to share information quickly and transparently, prevent wasteful waste, and maintain coordination inside a company and among supply chain partners; ERP adoption is increasingly critical. However, ERP implementations frequently fail because the chosen ERP system is inappropriate for the company. It's critical to have an effective evaluation strategy before deciding which ERP system to implement. This research provides a methodology for evaluating ERP systems that incorporates the decision-making trial and evaluation laboratory (DEMATEL), analytic network process (ANP), and fuzzy set theory. To pick the best ERP system, the high-tech company uses the recommended decision-making framework to guide its decision-making. According to the findings, the suggested framework can assist companies in effectively evaluating ERP systems by gathering expert opinions in an unpredictable environment.

Ricardo Pérez-Castillo et al. (2020) [30] contributed to the need for Enterprise Architecture (EA) to represent and manage IT, and business holistically is becoming increasingly apparent to organizations. EA modeling has become critical when it comes to creating models that correctly depict company behavior and assets. This study offers a genetic algorithm as the brain of a decision-support system. An EA model is initially specified, as are the aforementioned missing relationships. A genetic algorithm uses this data to decide whether automated, manual, or hybrid modeling by picking the best suitable input artifacts, mining techniques, and expertise. While keeping costs from expert assignments and needless automated generations in check, the genetic algorithm (GA) has been fine-tuned to help GA-EA architects maximize EA models' accuracy and completeness.

Qasim Ali Nisar et al. (2020) [31] discussed that the favorable correlation between big data (BD) decision-making capabilities and quality decision-making for BD might help decision-makers attain environmental performance excellence. BD governance serves as a balance between the ability of business units to make decisions and the quality of those decisions. Making decisions based on knowledge has enabled companies to efficiently retain large amounts of data and make systemic decisions based on knowledge. Improving technical proficiencies to successfully ingest and assess data will be critical to their success in BD management. It became clear from the study that BD decision-making capacities in healthcare face many obstacles. There are several possibilities for healthcare stakeholders to track the progress of BD implementation in their system.

I V Popova (2020) [32] mentioned identifying uncertainty as a risk factor for peasant farm enterprises; this study looks at the trends of small businesses in agriculture throughout the Irkutsk region, identifies one method of management decision-making under uncertain conditions for the peasant economy, considers performance indicators for the peasant farm throughout Irkutsk region in dynamics, and uncovers the main problem.

Siqing Shan et al. (2020) [33] introduced variations in decision-making processes, and the dynamic value of UGCs in different emergency periods are among the dynamic characteristics. This work offers an EM-DVAM model to fill the research gap, which gives the dynamic value of UGCs to assist decision-making for different types of decision-makers. The study's contributions include the following. To begin, this study builds a dynamic evaluation model with many phases. Second, a concept is created for a dynamic evaluation of user-generated content (UGC). Included in this study is a quantitative approach to evaluating the dynamic value of social media data. Third,

Yulyanty Chandra et al. (2020) [34] detailed the dedication of a university to quality has driven the implementation of a quality management system to sustain the whole education program. As a result, company management may benefit from the knowledge by making faster decisions. Designing enterprise architecture as an architectural base for supplying data to study university management circumstances using big data technologies and data analytics is the solution for strategic planning and university business management procedures.

Jiachen Sun et al. (2020) [35] specified improving the safety of port operations by examining the variables that influence them and looking at how investments in safety interact with the degree of system risk. A decision-making model for safety investment in port enterprises was created using system dynamics by evaluating the major elements impacting the port operation and their reciprocal connection within a man-machine–environment–management system (SD). The suggested model was justified and validated using an illustrative example and sensitivity analysis. According to the findings, port security may be improved by raising port companies' overall safety investments, enhancing safety management investments in personnel, and reinforcing the implementation impact of investments.

Doi: https://doi.org/10.54216/FPA.110201

Received: December 03, 2022 Accepted: April 01, 2023

Tatyana Khudyakova et al. (2020) [36] discussed the better management of the company's investment policy in light of the company's environmental and economic situation. The model is built on the concepts evaluated from three angles - economic, social, and environmental. According to the proposed framework, management decision-making is closely linked to the formulation of investment policy, and the sustainability of a plan is assessed as a whole. The practice of managing industrial businesses has been analyzed based on scientific works. Some gaps in theoretical sources linked to the study's issue, problem, and goals have been identified. Methodological components of examining the ecological condition of business projects and creating the strategic management of investment activity in an industrial company are established and proven.
Tytenko Larysa et al. (2020) [37] illustrated techniques for gathering, simplifying, transforming, monitoring, analyzing, and applying information in building the contemporary knowledge economy and analytical assistance for flexible governance. Contemporary business intelligence tools and methodologies for producing, predicting, valuing, and monitoring important indicators and dashboards utilizing modern visualization techniques are integrated into business analysis. Data warehouses, data marts, OLAP systems, knowledge discovery tools, and end-user tools meant to satisfy information demands are all examples of business intelligence systems. These tools and technologies are used to automate company-wide data analysis and processing.
Intuitive use of data management aids in making decisions. Real-time consultations and findings mean more responsiveness. Strategy improvement based on more precise prediction models. Taking organizational procedure and appropriateness into consideration decision-maker weighs all of the options. The optimum course of action must be chosen to ensure seamless functioning and the achievement of organizational objectives. The first step in decision-making is to develop strategies and policies. There are several issues to consider when it comes to adopting and using data resources, and an IEMF-IDM is presented in this study to help alleviate such issues.

3. IoT-based enterprise management framework in intelligent decision-making:
It may develop a strong IoT product strategy using the Internet of Things (IoT) decision framework. Because of this, we can better identify the areas that require decision-making and maintain consistency across all the strategic business decisions, technological choices, and other aspects. Because of the real-time monitoring provided by IoT platforms integrated into corporate processes, it is possible to maintain workflow while processing items in real time. Detecting problems and taking prompt action are both made easier with real-time monitoring.

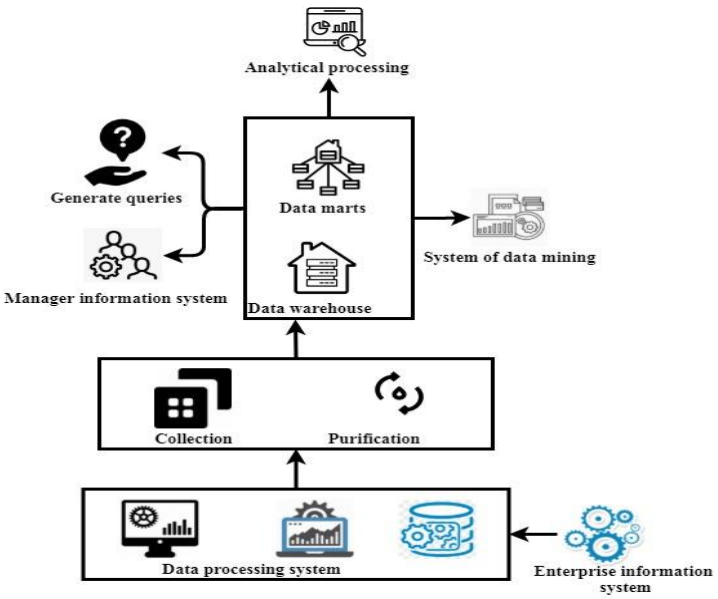

Figure 1: Enterprise information system

As shown in Figure 1, the interaction between analysts and data collection can be recast into different kinds of representation to improve analysis performance. This is known as analytical processing. Patterns and useful data may be found and gathered using data mining tools. In the business world, an inquiry is simply a request for information tailored to fit the firm's needs. Transaction processing, managerial support, and office automation are all included in an information management system. An entry-level data warehouse that focuses on a single department or business line, such as sales, finance, or marketing, is known as a data mart. Data warehousing makes it easier for decision-makers to get insights that drive the firm and its marketing strategies by speeding up and enhancing the efficiency of access to diverse data sets. Intensify efforts to succeed. A business uses the term "collection" to describe the money owed by a client to that business. Purification in a chemical environment is defined as the physical separation of a chemical compound of interest from external or contaminating

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

contaminants. The strategic goal of data processing is to turn raw data into valuable information that can be used to improve or address an existing problem.

$$\boldsymbol{H = \frac{1}{3}\sum m \sqrt{D\left(A + \pi H^{2^2} - \frac{m}{2}\right)} - \sum(m)} \quad (1)$$

Equation 1 denotes H for maximum database storage, D for structured data, A for error rate, m for business history. This large technology platform allows the organization to integrate and systematize all of its activities. A business system integrates programs, procedures, and strategies to streamline business activities such as sales, accounting, and inventory management. Various applications, protocols, and formats are included in enterprise systems. Enterprise systems include things like enterprise resource planning, supply chain management, and customer relationship management.

$$\boldsymbol{P_d = \oint 2\cot^{-1}\left(\frac{1}{2}\right) + J^2(d)} \quad (2)$$

There are several meanings associated with the word "business." equation 2 says P is the learning observation, $\cot^{-1}$ is the trigonometric function of respiration rate, d for lab reports, J for sensed data. Integrating various information systems into a single system is known as an EIS. Sections and levels of an enterprise information system (EIS) must be able to utilize an EIS. Various applications, protocols, and formats are included in enterprise systems.

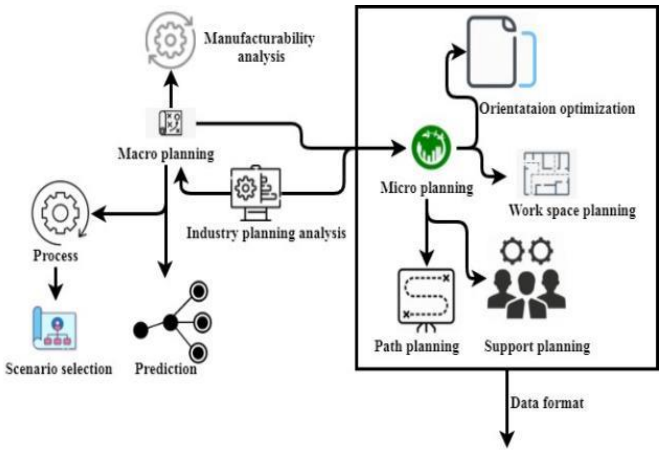

Figure 2: Planning analysis of the industry

Figure 2 explains that a production process analysis is a performance study of the manufacturing process. An overall project plan is known as a macro plan. In the business world, a process is a collection of linked acts that offer a service or product to a client. A scenario is a probable occurrence or sequence of events that might have significant ramifications regarding strategic planning and corporate strategy. There are classification difficulties in forecasting discrete target values, such as what will happen when a certain procedure occurs or when service level agreements are violated. Industry analysis is a technique used in business planning to assist a company in understanding its position with other companies that provide similar products or services. As a result, microplanning may be described as a decision-driven planning and execution process. Focusing on company processes rather than organizational structure or hierarchy is known as process orientation (PO). The space planning process entails thoroughly analyzing the structure's utilization of available physical space. It considers who will be using the places, as well. The routing approach aids people in seeing a future based on common values and beliefs. Planned strategy is the skill of developing long-term corporate objectives or aspirations to put them into action and evaluate how well they work.

$$\boldsymbol{M = \prod_0^7 \alpha_n o - (o + M^2)\frac{o}{n} * \exp\sigma^2} \quad (3)$$

Equation 3 explained M for histogram match, α is the mathematical function of the image's pixel, n for some regions, o is the resolution, $\exp\sigma$ is the exponential function of the making. Industry analysis is a technique used in business planning to assist a company in understanding its position with other companies that provide similar products or services. A company needs to understand the dynamics of its industry while doing strategic planning. The term industry analysis refers to a method used to evaluate a certain industry's complexity for a firm's benefit.

$$\boldsymbol{c(G) = \int_{-\infty}^{\infty}(\frac{1}{2} * G_z) * G^c(\frac{(N-1)}{2}) + \mathrm{N}\sum \; G\,\mathrm{in}\frac{1}{\beta}} \quad (4)$$

Equation 4 says c care of region, G is the time taken for identifying the area, z for binary level, N for several threshold values, $\sin$ is the trigonometric function of business level, β is the mathematical function of the histogram. Industry analysts refer to an evaluation approach used to fully understand a given industry's complexities. It examines commercial, political, and economic concerns directly impacting the sector's progress. Identifying opportunities and hazards in a competitive environment is the primary goal of an industry study.

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

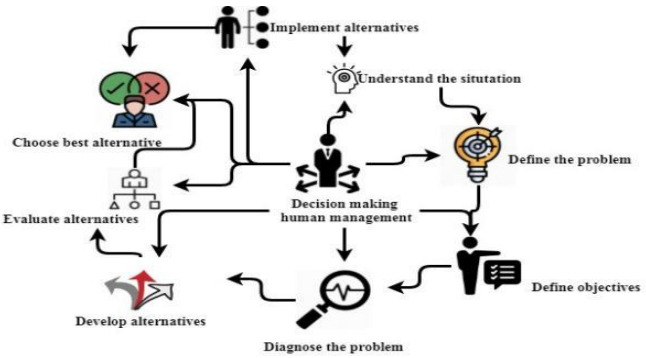

Figure 3: Decision-making in human management

As seen in Figure 3, a wide range of creative policies or management choices are developed to achieve the goals. Experiences, experiments, research, and analysis are all typical decision-making tools or strategies for selecting the best alternative. It's time to consider options as a final step before making a purchasing decision. At this point, buyers evaluate all of their available product and brand options based on various criteria, including whether or not they can provide the customer's desired benefit. Decision-makers must gather data, assess it, and generate various possibilities that can be compared and categorized to develop alternatives. Using Business Diagnosis, an organization may go backward to identify the root causes and effects of poor performance. Small and medium-sized enterprises (SMEs) have business objectives as their company expands. In the workplace, problem resolution involves putting procedures to make it easier for employees to meet operational and strategic corporate goals. In the business world, a process refers to a group of interconnected activities that offer a service or a product to a buyer.

$$\boldsymbol{g^2(IL) = \sum g\, L_{I-1}(g) + I_{L-1}(g) + \frac{1}{log(g-1)}} \quad (5)$$

Equation 5 denotes g for the manufacturing system, I for the number of raw materials, L for the amount of energy, *and* log for the logarithmic function of uniform regions. Making decisions on human resources necessitates figuring out how best to spend money on employees. By doing this, organizations and employees will better understand how money and resources may enhance their performance. Managers like to increase the amount of time and experience they have while making decisions, which aids them in learning and growing as professionals.

$$\boldsymbol{P_{2-1} = \left(\frac{1}{2P}\right) r + \int r \cos p\, 1 \left(\frac{1}{2r}\right) - \left(\frac{1}{P}\right) rP(\partial) + r/P} \quad (6)$$

Equation 6 gives P for the environment in the problem, r for a range of alternatives, and cos for the trigonometric function of self-learners. To improve overall operations, management of business processes is critical. Lowering expenses is only one of the many benefits. Others include improving workflow management, detecting operational faults, and providing insight into better business decisions. A process is the lifeblood of every business since it aids in the optimization of individual activities to make the most use of available resources.

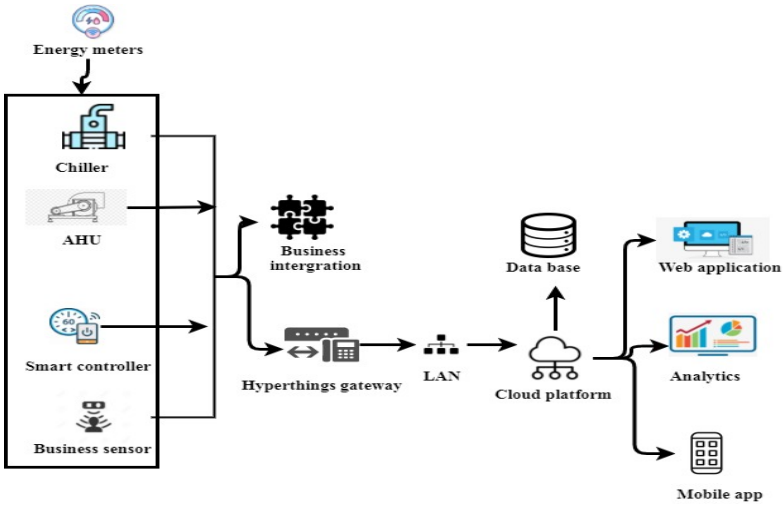

Figure 4: IoT in data visualization

Fig. 4 shows an electric meter, a device for measuring the quantity of energy consumed by a building, a tenant's area, or electrically powered equipment. Every chiller system has a coolant. First, a low-pressure coolant is injected into the machine to get things started. An air handling unit (AHU) reconditions and circulates the air when employed as an HVAC system. Smart controllers are watering schedule controllers that update themselves

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

automatically to keep up with seasonal water demands. As a result of the sensors, the plant's data may be more transparent, reflecting peaks and valleys across the facility. Integrating heterogeneous systems in real-time, business process integration (BPI) allows a company's internal business activities to synchronize with its other firms and trading partners. a business transaction involving the input or modification of data in a database is referred to as a "database transaction." Cloud BPM is a service-based platform for process design and optimization. Web applications include online forms, shopping carts, word processors, tablets, tools for editing videos and images, and file conversion. Business process analytics aids firms in completing a time-consuming business process in real time. Workdays are made more efficient and engaging for employees thanks to mobile apps.

$$\boldsymbol{B^e = (a^2 - 1) + \sum a\,(B^2 + 1)\sqrt{B} - (e^2 - 1)} \quad (7)$$

Equation 7 denotes B for the pollution of the environment, e for pollution impact on the environment, a for the health impact of humans. IoT Big-Data analytics processing and insight extraction are crucial for real-time data visualizations, interactive graphs, and charts. Because of the simple user interface, companies and individuals can integrate and manage their assets, develop apps and workflows, and show data in dashboards from a single location and workflows

$$\boldsymbol{y_k = k^4 + \frac{w}{k} \pm \frac{1}{log(y-1)}\sqrt{k}} \quad (8)$$

Equation 8 says that y for the total number of logins, k for the data set, w planning and scheduling of the grid, and log for the logarithmic function of a web application. IoT data analysis is the process of analyzing the massive volumes of data generated by connected devices. Organizations can benefit by streamlining operations, automating controls, boosting customer involvement, and giving employees more authority. Thanks to the easy-to-use interface, users will be able to create apps, manage processes, build applications, and view data in dashboards.

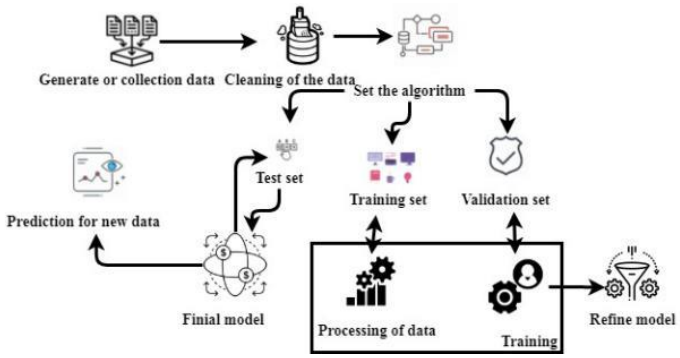

Figure 5: Datacenter in deep learning

To answer questions, test hypotheses, and evaluate outcomes, researchers use data collection shown in figure 5 as a procedure for gathering and measuring information about relevant factors. Data purification includes more than just removing data; it includes fixing errors like misspellings and grammar, standardizing data sets, and fixing errors like missing codes. Algorithms designed specifically for sets are referred to as set algorithms. Predictive analytics uses data analytics to make predictions based on the current situation. This method incorporates data, statistics, and machine learning techniques to create a predictive model that may be used to anticipate future events. After an initial training set has been trained, a machine learning test set is used to evaluate the learning algorithm's performance. Computers process information using a training set as its content. A validation package is a set of data used to train AI to identify and optimize the best model for a certain problem. Data processing has as its goal the synchronization of data from many sources. Professionals who need to handle business processes effectively may take advantage of the Company Process Management Training. Refining is the process of removing impurities from a substance.

$$\boldsymbol{e(t) = a_t^{-1}(a_t e(t) + a^t e(t))} \quad (9)$$

Equation 9 says e for energy results, t for several electricity cares, a for orientation. A company's most vital and proprietary assets are housed in its data centers, which are critical to day-to-day operations. An IT data center collects, processes, and disseminates IT operations and equipment information and applications for a company.

$$\boldsymbol{(u) = s_0 + \sum u\left(u_s \cos\frac{u\pi}{s} + u_s \sin\frac{u}{v}\right) \neq u^s} \quad (10)$$

Equation 10 says u for industry, s for the mediator, v for motivation, and sec for the trigonometric function of strength and weakness. With today's advancements in artificial intelligence, the data center may be utilized to keep an eye on and protect a network and filter out and shift workloads. However, due to operational problems,

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

the industry is hesitant to switch to AI from IT. Data centers are composed of three primary components: computation, storage, and network. The contemporary iceberg they are only the tip of the iceberg.

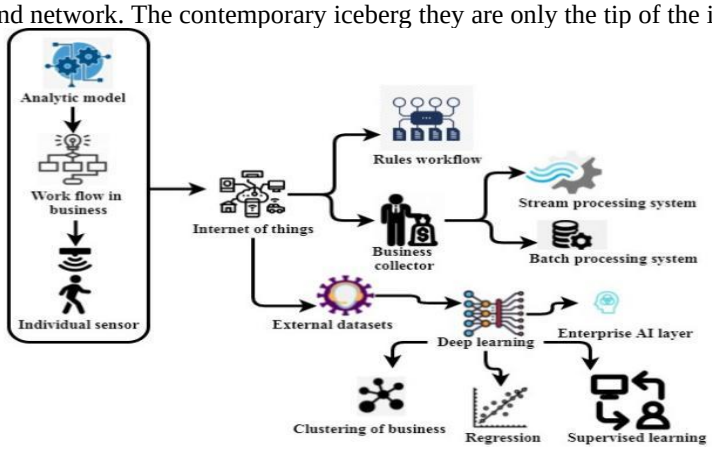

Figure 6: Deep learning in IoT decision-making and enterprises management

Figure 6 depicts the analytical model, which describes the processes, people involved, information flows, and documentation generation. A company's workflow is a collection of actions that must be done in a specific order to be repeatable. By external data, we mean any information that has been gathered, processed, and provided from sources other than the company. Debt collection is a process used to recover money owed to people or businesses. In a particular field, clusters are concentrations of similar businesses and organizations. Analytical statistics Regression Analysis examines the relationship between a pair of variables. For example, supervised learning (SL) uses input-output pairs to teach a machine a function that converts an input into an output. To achieve digital transformation enterprise AI sector utilizes cutting-edge artificial intelligence technologies, including machine learning. Batch processing is a method for handling large numbers of transactions in a centralized fashion. Continuous data streams in real-time are the subject of stream processing, a large-scale technology.

$$\sqrt{\boldsymbol{b}} = \boldsymbol{B}(\log_{\boldsymbol{f}} \boldsymbol{h} + (\tan \boldsymbol{f})) + \frac{\boldsymbol{b}}{\boldsymbol{h}} \quad (11)$$

Equation 11 says B is the human responsible for the message, b for no.of.test, f for planning, h for intelligent web, tan for the trigonometric function of computers with internet access, log for the logarithmic function of innovative learning spaces. IoT data helps remove bias from corporate judgments by providing data based on facts and patterns, resulting in better decisions. Artificial intelligence machine learning may assist in determining the value and significance of the data in real time.

$$\boldsymbol{C_1} - \boldsymbol{\gamma^2} \sin \boldsymbol{E}(\boldsymbol{l}) = \boldsymbol{C}(\boldsymbol{l}) \sin\left(\frac{1}{\log(\boldsymbol{l},\boldsymbol{E})}\right) < \infty \quad (12)$$

Equation 12 denotes C for heart rate monitoring data, E for blood pressure monitoring data in business, l for processing, ∞ IoT technology usage, γ for adaptive learning students, log for the logarithmic function of business, tan for the trigonometric function of making a decision. The internet of things' strategic decision-making framework revolves around this. The IoT decision framework can better identify choice points and maintain consistency across strategic, technical, and business decisions.

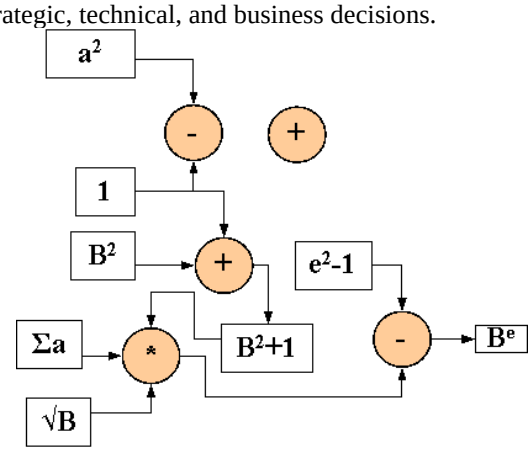

Figure 7: Deep learning process of enterprise management flow

Figure 7 says Deep learning is the most rapidly expanding area of artificial intelligence (AI), causing havoc across all industries. The most difficult situations are being solved using cutting-edge neural network modeling approaches. It is possible to build prediction systems that generalize and adapt thanks to deep learning techniques. Predictive systems that use rigid business principles are less dynamic than cutting-edge applications. In other words, when new knowledge is provided, their abilities increase.

Doi: https://doi.org/10.54216/FPA.110201

Received: December 03, 2022 Accepted: April 01, 2023

4. Result and discussion for deep learning on enterprise management in decision-making:

IoT device management refers to the processes involving provisioning and authenticating, configuring, maintaining, monitoring, and diagnosing connected devices operating as part of an IoT environment to provide and support the whole spectrum of their functional capabilities. Intelligent decision is the discipline that augments data science with theory from social science and decision theory. Deep learning is a class of machine learning algorithms that progressively uses multiple layers to extract higher-level features from the raw input. It is an autonomous approach to making a knowledgeable and concise decision about the systems.

a) Determination of profit change:

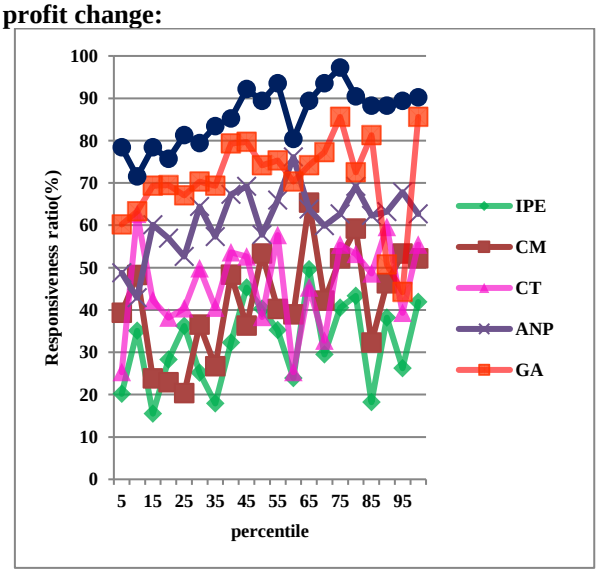

Figure 8: Profit change determination

Figure 8, in the next years, organizations will gain a significant advantage if they can mobilize their data assets and fuel mission-critical business activities. Data management may be seen as a difficult task by companies. A deluge of old and new information will swamp those who do not reevaluate policies and processes. This situation may make determining, organizing, and storing assets more difficult. However, developing an enterprise data management system is possible with the help of a reliable technology partner with an established track record, appropriate methods, and a capable staff.

b) Discuss of response with microservices:

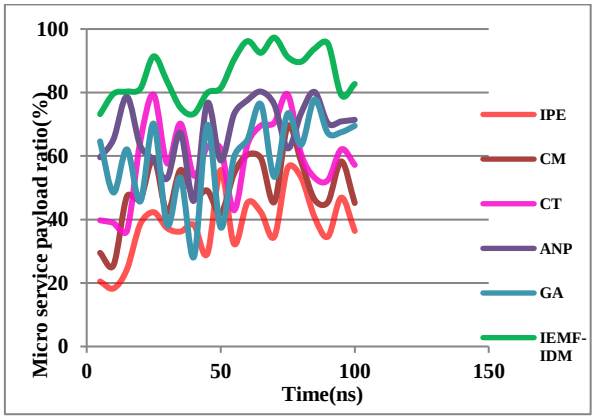

Figure 9: Response time analysis

Figure 9 Adding or modifying a feature does not necessitate rewriting the entire codebase when using microservices, which function with loosely linked services. It application and services will reach the market faster if you build and test them in smaller increments. Microservices communicating synchronously with one other is something I typically oppose since it introduces coupling and makes it such that if one fails, the other remains completely or mostly functioning.

Doi: https://doi.org/10.54216/FPA.110201
Received: December 03, 2022 Accepted: April 01, 2023

c) Detailed of change of risk & safety level:

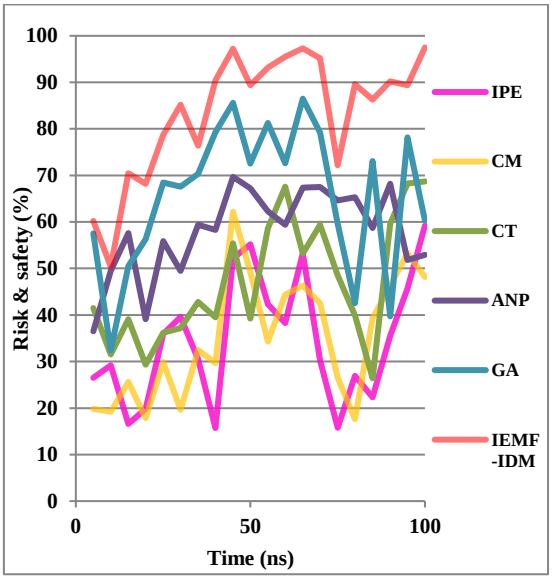

Figure 10: Level risk and safety management

Figure 10 Enterprise risks are threats to a company's long-term viability that originate at the very top of the organization. Corporate governance and senior management must pay attention to these issues. To reduce damage and sickness, risk management is a systematic approach to identifying hazards, assessing and controlling the risks associated with those hazards, and then taking action to remove or mitigate the risks that cannot be avoided entirely. Enterprise-wide risk management relies on the efforts of all employees. Still, management is ultimately responsible for recognizing and managing risks and implementing a systematic, consistent, and coordinated strategy.

d) Determination of speed and agility:

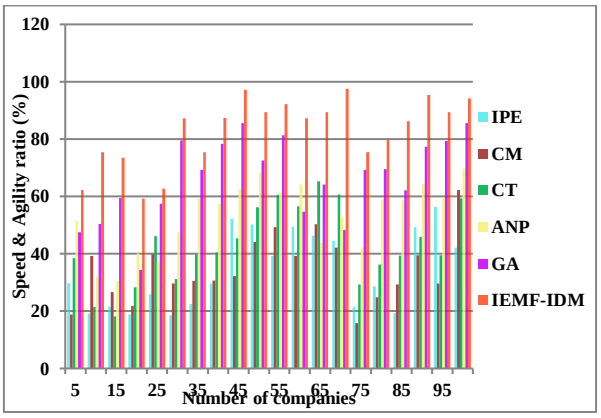

Figure 11: Speed & Agility identification

Figure 11 shows the combination of core and lower-body strength required for both speed and agility; quickness refers to the body's reactive responses. Speed measures the ability to make quick decisions and respond quickly. Drills to increase speed last only a few seconds. In sports, speed is defined as the capacity to move rapidly in a single direction. To be agile, one must accelerate and decelerate while maintaining good posture and quickly changing directions. A person's speed is defined as their capacity to respond and alter their bodily posture at the fastest possible rate.

Doi: https://doi.org/10.54216/FPA.110201

Received: December 03, 2022 Accepted: April 01, 2023

e) Preparation of Data Efficiency:

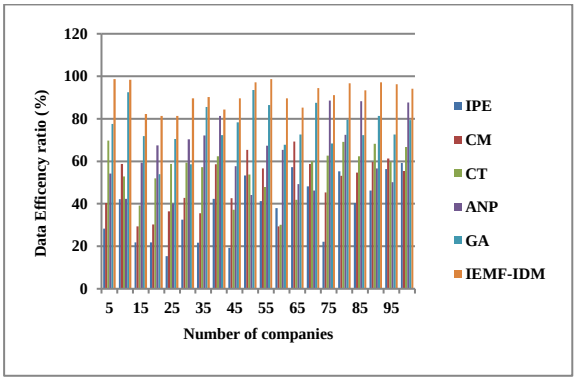

Figure 12: Ratio of data efficiency

Figure 12 a collaborative self-service solution for data discovery and preparation, enterprise data preparation (EDP) lets data analysts and data scientists do just that: work together. Quickly identifying and transforming raw data into insight allows analysts to use it and allow for more transparency and governance. When data is properly prepared, accurate insights may be gleaned from it. Insights might be wrong due to trash data, an undetected calibration issue, or easily corrected across datasets if data isn't prepared properly before analysis.

5. Conclusion

By analyzing past execution log data, this technique hopes to anticipate the future process event based on completed process instance activities already performed. This is an example of intelligent techniques for fusion processing and fusion score improvement. The multi-stage deep learning technique mentioned in the statement is one way of combining multiple models for intelligent systems. Furthermore, the statement discusses the integration of IoT with cloud ERP to automate business processes and improve customer service. This integration requires a fusion system design that can handle data fusion in a cloud environment. The statement also touches on data fusion in multimedia data applications, robotics, and decision-making. In terms of fusion optimization, the statement mentions the identification of appropriate hyper parameters for the suggested method and how to deal with unbalanced data sets due to business process events. Optimization algorithms for data fusion could be applied in this case to improve the accuracy of the predictive model. Finally, the statement briefly mentions fuzzy approaches for data fusion applications, which is another intelligent technique for information fusion. Fuzzy logic is used when dealing with uncertainty and imprecision in data, making it a suitable technique for data fusion in complex systems. In summary, the statement touches on various aspects of fusion processing, including multi-level and decision-level fusion, fusion system design, optimization, and intelligent techniques for fusion processing such as deep learning, fuzzy logic, and machine learning. It also highlights the application of fusion in various fields such as robotics, multimedia data applications, and decision-making.

Funding: “This research received no external funding”
Conflicts of Interest: “The authors declare no conflict of interest.”

References:

[1] Özemre, M., & Kabadurmus, O. (2020). A big data analytics based methodology for strategic decision making. *Journal of Enterprise Information Management*.

[2] Nguyen, T. N., Liu, B. H., Nguyen, N. P., & Chou, J. T. (2020, June). Cyber security of smart grid: attacks and defenses. In *ICC 2020-2020 IEEE International Conference on Communications (ICC)* (pp. 1-6). IEEE.

[3] Fattahi, R., Tavakkoli-Moghaddam, R., Khalilzadeh, M., Shahsavari-Pour, N., & Soltani, R. (2020). A novel FMEA model based on fuzzy multiple-criteria decision-making methods for risk assessment. *Journal of Enterprise Information Management*.

[4] Liu, B. H., Pham, V. T., Nguyen, T. N., & Luo, Y. S. (2019). A heuristic for maximizing the lifetime of data aggregation in wireless sensor networks. *arXiv preprint arXiv:1910.05310*.

[5] Abd Al-Aziz Hosni El-Bagoury , Sundus Naji AL-Aziz , S.S.ASKAR, Social Spider Optimization Algorithm with Gradient Boosting Tree Model for Decision Making in Telemarketing Sector, American Journal of Business and Operations Research, Vol. 7 , No. 1 , (2022) : 09-18 (Doi : https://doi.org/10.54216/AJBOR.070101)

[6] Kranthi Kumar Singamaneni , S V Bharath Kumar Reddy , U Sreenivasulu, A Novel Framework to Enterprise Smart City with IOT and Analytics, Journal of Neutrosophic and Fuzzy Systems, Vol. 1 , No. 1 , (2021) : 37-47 (Doi : https://doi.org/10.54216/JNFS.010104)

[7] Mona Mohamed, A comparative study on Internet of Things (IoT): Frameworks, Tools, Applications and Future directions, Journal of Intelligent Systems and Internet of Things, Vol. 1 , No. 1 , (2020) : 13-39 (Doi : https://doi.org/10.54216/JISIoT.010102)

[8] Naomi A. Bajao, & Jae-an Sarucam. (2023). Threats Detection in the Internet of Things Using Convolutional neural networks, long short-term memory, and gated recurrent units. Mesopotamian Journal of CyberSecurity, 2023, 22–29. https://doi.org/10.58496/MJCS/2023/005.

[9] Gopal Chaudhary , Smriti Srivastava , Manju Khari, Generative Edge Intelligence for Securing IoT-assisted Smart Grid against Cyber-Threats, International Journal of Wireless and Ad Hoc Communication, Vol. 6 , No. 1 , (2023) : 38-49 (Doi : https://doi.org/10.54216/IJWAC.060104).

[10] Gao, J., Wang, H., & Shen, H. (2020). Task failure prediction in cloud data centers using deep learning. *IEEE Transactions on Services Computing*.

[11] Obrenovic, B., Du, J., Godinic, D., Tsoy, D., Khan, M. A. S., & Jakhongirov, I. (2020). Sustaining enterprise operations and productivity during the COVID-19 pandemic: "Enterprise Effectiveness and Sustainability Model". *Sustainability*, *12*(15), 5981.

[12] Gao, J., Wang, H., & Shen, H. (2020, August). Machine learning based workload prediction in cloud computing. In *2020 29th international conference on computer communications and networks (ICCCN)* (pp. 1-9). IEEE.

[13] Nwadigo, O., Naismith, N. N., Ghaffarianhoseini, A., Hoseini, A. G., & Tookey, J. (2020). Dynamic Bayesian network modelling for predicting adaptability of time performance during time influencing factors disruptions in construction enterprise. *Engineering, Construction and Architectural Management*.

[14] Amudha, G. (2021). Dilated Transaction Access and Retrieval: Improving the Information Retrieval of Blockchain-Assimilated Internet of Things Transactions. *Wireless Personal Communications*, 1-21.

[15] Xin, Q., Alazab, M., Díaz, V.G., Montenegro-Marin, C.E. and Crespo, R.G., 2022. A deep learning architecture for power management in smart cities. *Energy Reports*, *8*, pp.1568-1577.

[16] Samiei, E., & Habibi, J. (2020). The mutual relation between Enterprise resource planning and knowledge management: A review. *Global Journal of Flexible Systems Management*, *21*(1), 53-66.

[17] Ramprasad, L., & Amudha, G. (2014, February). Spammer detection and tagging based user generated video search system—A survey. In *International Conference on Information Communication and Embedded Systems (ICICES2014)* (pp. 1-5). IEEE.

[18] Han, Y., Deng, Y., Cao, Z., & Lin, C. T. (2020). An interval-valued Pythagorean prioritized operator-based game theoretical framework with its applications in multicriteria group decision making. *Neural Computing and Applications*, *32*(12), 7641-7659.

[19] Ilmudeen, A., 2022. Artificial Intelligence, Big Data Analytics and Big Data Processing for IoT-Based Sensing Data. In *Transforming Management with AI, Big-Data, and IoT* (pp. 247-259). Cham: Springer International Publishing.

[20] Challa, S., Das, A. K., Odelu, V., Kumar, N., Kumari, S., Khan, M. K., & Vasilakos, A. V. (2018). An efficient ECC-based provably secure three-factor user authentication and key agreement protocol for wireless healthcare sensor networks. *Computers & Electrical Engineering*, 69, 534-554.

[21] Beric, D., Havzi, S., Lolic, T., Simeunovic, N., & Stefanovic, D. (2020, March). Development of the MES software and Integration with an existing ERP Software in Industrial Enterprise. In *2020 19th International Symposium INFOTEH-JAHORINA (INFOTEH)* (pp. 1-6). IEEE.

[22] Darwish, A., Hassanien, A. E., Elhoseny, M., Sangaiah, A. K., & Muhammad, K. (2019). The impact of the hybrid platform of internet of things and cloud computing on healthcare systems: opportunities, challenges, and open problems. *Journal of Ambient Intelligence and Humanized Computing*, 10(10), 4151-4166.

[23] Bzai, J., Alam, F., Dhafer, A., Bojović, M., Altowaijri, S.M., Niazi, I.K. and Mehmood, R., 2022. Machine Learning-Enabled Internet of Things (IoT): Data, Applications, and Industry Perspective. *Electronics*, *11*(17), p.2676.

[24] Huifeng, W., Shankar, A., & Vivekananda, G. N. (2020). Modelling and simulation of sprinters' health promotion strategy based on sports biomechanics. *Connection Science*, 1-19.

[25] Huifeng, W., Kadry, S. N., & Raj, E. D. (2020). Continuous health monitoring of sportsperson using IoT devices based wearable technology. *Computer Communications*, 160, 588-595.

Doi: https://doi.org/10.54216/FPA.110201

Received: December 03, 2022 Accepted: April 01, 2023

[26] Hnatenko, I., Orlova-Kurilova, O., Shtuler, I., Serzhanov, V., & Rubezhanska, V. (2020). An approach to innovation potential evaluation as a means of enterprise management improving. *International Journal of Supply and Operations Management*, *7*(1), 112-118.

[27] Tsvetkov, V. Y., Shaytura, S. V., & Sultaeva, N. L. (2020, May). Digital enterprise management in cyberspace. In *2nd International Scientific and Practical Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth" (MTDE 2020). Advances in Economics, Business and Management Research* (Vol. 138, pp. 361-365).

[28] Asaul, A. A., Voynarenko, M., Yemchuk, L., & Dzhulii, L. (2020). New realities of the enterprise management system information support: Economic and mathematical models and cloud technologies. *Journal of Information Technology Management*, *12*(3), 44-60.

[29] Lee, A. H., Chen, S. C., & Kang, H. Y. (2020). A decision-making framework for evaluating enterprise resource planning systems in a high-tech industry. *Quality Technology & Quantitative Management*, *17*(3), 319-336.

[30] Pérez-Castillo, R., Ruiz, F., & Piattini, M. (2020). A decision-making support system for Enterprise Architecture Modelling. *Decision Support Systems*, *131*, 113249.

[31] Nisar, Q. A., Nasir, N., Jamshed, S., Naz, S., Ali, M., & Ali, S. (2020). Big data management and environmental performance: role of big data decision-making capabilities and decision-making quality. *Journal of Enterprise Information Management*.

[32] Popova, I. V. (2020, February). Management decision-making by the head of the peasant farm enterprise under conditions of uncertainty. In *IOP Conference Series: Materials Science and Engineering* (Vol. 753, No. 6, p. 062021). IOP Publishing.

[33] Shan, S., Liu, X., Wei, Y., Xu, L., Zhang, B., & Yu, L. (2020). A new emergency management dynamic value assessment model based on social media data: a multiphase decision-making perspective. *Enterprise Information Systems*, *14*(5), 680-709.

[34] Chandra, Y., Triana, R., Wang, G., & Legowo, N. (2020). Utilizing Big Data Framework to Support Decision Making Process: Enterprise Architecture Approach. *International Journal*, *9*(3).

[35] Sun, J., Wang, H., & Chen, J. (2020). Decision-Making of Port Enterprise Safety Investment Based on System Dynamics. *Processes*, *8*(10), 1235.

[36] Khudyakova, T., Zhuravlyov, V., Varkova, N., Aliukov, S., Shmidt, S., & Zhuravlyov, N. (2020). Improving approaches to strategic enterprise management in the context of sustainable development. *Sustainability*, *12*(20), 8375.

[37] Tytenko L. V., Bohdan S. V., Klyuchko O. O., Tymoshenko V. Yu. Software and information support for business analysis in enterprise management. Modern Economics. 2020. No. 20(2020). P. 272-277. DOI: https://doi.org/10.31521/modecon.V20(2020)-42.

Doi: https://doi.org/10.54216/FPA.110201

Received: December 03, 2022 Accepted: April 01, 2023