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A Survey on Business Intelligence Approach Based on Deep Learning

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Abstract—*The article provides an overview of two recent developments in technology: Business Intelligence (BI) and Deep Learning (DL). In order to support decision-making processes, BI entails gathering, integrating, and analyzing data from various sources, while DL uses artificial neural networks to learn and generate predictions from complicated datasets. This paper introduces the concepts and principles and highlights recent developments and applications in different domains of research: education, organizations, stock market, forecasting, decision-making in real-time, and security. However, the fundamental problem with the business intelligence approach is that there is no learning involved. Other limitations and challenges include the capacity that affects the data analysis process, the variety of data in results, and the need for a complete presentation of results in the form of dashboards, scorecards, reports, and portals. The approach choice hinges on the problem's context and requirements and the nature and characteristics of the data. Although BI and DL are widespread, alternative methods may suit well too, such as machine learning, data mining, and statistical analysis. Justifying the selection based on precise needs and goals is crucial. Recurrent neural networks (RNN), convolutional neural networks (CNN), long short-term memory (LSTM), gated recurrent units (GRU), and Business intelligence tools are used in the research problem to address these limitations and explore the potential advantages and difficulties of integrating BI and DL* to achieve an advantage in a given sector.

Index Terms— *Business Intelligence Tools; decision making; deep learning algorithms*.

I. INTRODUCTION

Business Intelligence (BI) and Deep Learning (DL) are two concepts that have gained recent interest in the field of information technology. BI is a data-driven approach that leverages tools to aid in decision-making, while DL is a subfield of machine learning that uses neural networks to solve complex problems [1]. DL leverages NN models to automatically extract features from input data, obviating the need for feature extraction stages. This method can efficiently classify vast and complex data and does not require preprocessing steps for feature description acquisition, making it an advantageous alternative [2]. The integration of BI and DL can revolutionize how businesses analyze data, as traditional BI tools have limitations in terms of data variety and capacity, as well as the inability to learn from data. The research problem is solved by using various methods of neural networks such as the convolutional neural network (CNN) holds great significance in the field of deep learning [3]. With remarkable accomplishments in various domains, Computer vision based on CNN has enabled people to accomplish what had been considered impossible in the past few centuries, such as face recognition, autonomous vehicles, self-service supermarkets, and intelligent medical treatments. To better understand modern CNN and make it better serve human beings, CNN has garnered substantial attention from both industry and academia in recent years. Existing reviews

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predominantly concentrate on CNN's applications in specific scenarios, lacking a comprehensive overview. recurrent neural networks (RNN) Recurrent Neural Networks (RNNs) detect patterns in sequential data like handwriting, genomes, text, or time series [4]. They can also handle images by treating them as sequential inputs [5, 6]. RNNs have diverse applications in Language Modeling, Text Generation, Speech Recognition, Image Captioning, and Video Tagging. Unlike Feedforward Neural Networks (MLPs), RNNs have cyclic connections, allowing information to be passed back into itself for memory-like processing. long short-term memory (LSTM) has significantly impacted the fields of machine learning and neurocomputing. It has played a crucial role in enhancing Google's speech recognition, machine translations on Google Translate, and the performance of Amazon's Alexa, as reported by various online sources [7]. The success of LSTM can be attributed to its capability to address the challenging exploding/vanishing gradient problem encountered during the training of recurrent or deep neural networks. gated recurrent units (GRU) were introduced by Cho et al. in 2014 [8] as a simplified alternative to LSTM. It involves two gates, namely the reset gate (r) and the update gate (z). Like LSTM, the GRU cell utilizes the hidden state from the previous time step and the current input value to compute the hidden state output at time t [9]. The reset gates in GRU perform a function similar to the forget gates in LSTM. Due to the numerous similarities between GRU and LSTM neural networks, they share several common characteristics and business intelligence tools. It additionally examines the potential benefits and challenges of bringing together BI and DL to gain a competitive advantage.

II. LITERATURE REVIEW

Nedelcu, Bogdan (2013), The article emphasizes the significance and rising impact of business intelligence, highlighting its role in reducing complexity and cutting costs for organizations to survive in a competitive environment. Additionally, The use of machine learning algorithms to recognize data patterns and trends for intelligent decision-making is highlighted. which gives businesses a competitive edge [10]. Saif Bashsr (2015), Thesis proposes a Hadoop-based data processing system that combines business intelligence and big data analytics, with parallel processing on a three-computer cluster for efficient query execution [11]. Sifat, Sajid Hasan (2019), The research paper suggests a Machine Learning algorithm model for optimal use in Business Intelligence, based on the datasets. BI software employs diverse algorithms to establish correlations between the variables and the data. Data experts are focused on creating business intelligence software as a new decision-making tool [12]. Susan, Athey (2018) The research paper examines how machine learning is being used in economics currently and in the future., while also addressing concerns about its application to policy problems and issues of fairness and manipulability. The paper offers insights into the future impact of machine learning on research tools, collaborations, and fundamental questions [13]. Zohuri, Moghaddam, Bahman, Masoud (2020), In the article, machine learning (ML) and deep learning (DL) are discussed as examples of artificial intelligence (AI), that can strengthen organizations against cyberattacks and reinforce daily operations. The potential for AI to reduce the frequency and impact of cyber-attacks is highlighted, making it a valuable tool for organizations seeking to improve their security and efficiency [14].in their study, Umadevi et al (2018), utilized analytical techniques to develop a prediction model for stock market data. Using six months of stock prices for Google, Apple, and Microsoft, they analyzed four attributes (low, high, open, and close) and employed stock scores and candlelight plots to visualize the data parameters [15]. Gegic et al (2019), utilized machine learning techniques such as artificial neural network (ANN), support vector machines (SVM), and Random Forest to predict second-hand car prices in Bosnia-Herzegovina. Due to the requirement of an

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ensemble method, they utilized web scraper-collected data through PHP programming for accurate predictions. The accuracy of the model, assessed using testing data, was found to be 87.83% [16]. Aleksei K et al (2020), The study addresses the difficulty of effectively monitoring cyber security measures and proposes a solution involving the use of KPI to gather security incident data and represent it visually in a business intelligence system. Open-source data sets of cyber threats and current security incidents were analyzed to inform this approach [17]. HEIs should consider components such as people, processes, and KPIs in their Business Intelligence system to achieve their strategic vision and mission, according to Zulkefli et al (2015). BI systems use information infrastructure and technologies to address (key performance indicators (KPIs) measuring HEI performance within their institutional mission/vision [18]. Senior management commitment, a business need, and satisfactory data quality are needed for the successful implementation of Business Intelligence (BI), according to D. Bent-ley (2017). BI systems in Higher Education Institutions (HEIs) should align with the institution's strategy to ensure strategic objectives are met, and the human aspect is a key component for successful implementation as the decision-makers and stakeholders are the system's target users[19]. S. Kulshrestha et al (2018), propose modifying ERP online models to increase the gaining growth rate of a specific business. This approach suggests improving customer service by changing the traditional method of product delivery. Implementing this procedure can enhance the sale of specific products, customer relationships, profit, and customer retention [20].

III. METHODOLOGY

In order to gather, analyze, and present data for wise decision-making, the Business Intelligence methodology makes use of a variety of techniques and tools. Higher education, healthcare, cyber security, web services, data warehousing, and stock market analysis are just a few industries that are rapidly embracing BI to acquire insights into their operations, clients, and markets. This information can help universities and colleges identify areas for improvement in higher education, identify trends and improve patient care patient data in healthcare, monitor network activity, identify potential threats, take preventative measures to stop cyberattacks in cyber security, optimize the website design and marketing strategies and user behavior in web services, and analyze market trends in the stock market.

A combination of data gathering, processing, and presentation techniques specifically adapted to the needs of a certain industry makeup business intelligence, a vital tool for making informed decisions. The visual representation of our research can be found in Table I.

TABLE I. THE USE OF VARIOUS TECHNIQUES AND TOOLS TO COLLECT, ANALYZE, AND PRESENT DATA

[Ref.], Year	Domain	Datasets	Problem Identified	Methods
(Minsang et al, 2021)	Airports commonly use Business Intelligence practices	Collecting data from books, case studies, and websites	How can machine learning be integrated with business intelligence?	Using linear and random forest regression for data analysis.
(Ardhian et al, 2018)	Higher Education	Data from 15 faculties and 46 programs (2015-2017) were analyzed	What higher education management issues impede timely data analysis by integrated online	Employing data-driven decision-making to analyze data and identify processes in tuition systems, and designing

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		for applicants from two databases.	application systems?	a data warehouse and dashboard for visualization.
(Dursun et al, 2018)	BI and Advanced Analytics on Business Decision Behavior.	Collecting datasets through two online experiments.	Do decision-makers respond to warnings and change their decisions accordingly?	Experiment 1: Probability theory with a non-zero reference point. Experiment 2: Studied BI&a warnings' impact on decision-making.
(Július et al, 2020)	The EU labor market	Online session collection is used for extracting machine learning datasets.	What are the data mining techniques for pattern discovery and insights generation?	Supervised (binary, general, regression) and unsupervised (hierarchical, K-means, agglomerative) learning, along with semi-supervised and reinforcement learning, are ways to uncover hidden patterns and insights from data
(Hind et al, 2020)	The case study analyzes a fictional small-sized enterprise	The data is from a small enterprise	How can BI automate manual business processes؟	The BI solution employs Excel, VBA, and KPIs for development.
(Ruchi et al, 2018)	BI, ML, and Data Mining	Online data	How to extract and use hidden information from business data for Business Intelligence?	Outlier detection approaches include depth-based, deviation-based, nested loop, index-based, grid-based, SVM, neural network, angle-based, and subspace-based techniques.
(Khan et al, 2017)	ML and BI in enterprises	Sales, inventory, and calendar data are the primary data sources	How does demand forecasting in an enterprise affect decision-making?	Deep AR's algorithm performance in ML and BI
(Owoc et al, 2018)	Education sector	Data of students enrolled in the semester	How do different teaching methodologies, diversification, and specific software packages impact teaching effectiveness؟	Power BI as a selected tool
(Berhane et al, 2021)	Swedish public organizations/agencies	Swedish agency data were chosen for investigation.	what is BI implementation's impact on decision-making processes and influencing factors?	BI's three core elements: data quality, analysis, and human factor
(Khan et al, 2020)	Organizational Performance	Orgs collect customer data for a deeper understanding of behavior.	Risks to data security and privacy if unqualified organs manage BIS cloud؟	Data warehousing and information mining
(Sorour et al, 2020)	Higher Education	Types of data: academic, interaction, and application.	Role of BI & Analytics in Higher Education Decision-making and Quality Assurance?	BI components: KPIs, ETL, data warehouses, OLAP, data mining, reporting, and presentation.
(Idris et al, 2021)	Cars' selling price.	Derived from BMW specs dataset.	How to determine the selling prices of innovative specification cars from automotive manufacturers?	Regression analysis and feed-forward backpropagation were used.
(Saqib et al, 2018)	Organizational Performance	Small or medium-sized organization datasets from the Kaggle repository	How does critical knowledge leverage improve organizational performance and yield valuable business insights?	Knowledge Management and Business Intelligence

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(Krivo et al, 2020)	cyber security	Open-source cyber threat incidents datasets	How to enhance cyber security monitoring for safeguarding sensitive data and preventing cyberattacks in organizations?	Through KPIs and business intelligence system
(AlArmouty et al, 2019)	Stock Market	Stock market's historical or current data	How to reduce the stock market trading risk for inexperienced traders?	The dashboard presents OLAP-applied data to the user
(Somya et al, 2018)	Satya Wacana Christian University (SWCU)	Academic data is from the AIS database, while financial data is from SWCU's Satya Wacana Financial System.	How to integrate academic and financial data into SWCU's data warehouse?	Dashboard Application for OLAP integrates data on Service-oriented Business Intelligence (SoBI) using Web Service.

A. Analysis

The categories of the six research that are highlighted in this introduction are education, organizations, the stock market, forecasting, real-time decision-making, and security. Each field is represented by a paper that details the methodology employed, the data set used, and the problem definition.

Each of the aforementioned disciplines in the area of business intelligence has a particular research issue. However, machine learning techniques and algorithms have been used to address these issues. These algorithms and techniques give users the resources they need to analyze enormous amounts of data and produce insights that may be applied to decision-making. Table I presents the work's details.

B. Discussion

In the organization's performance sector, these papers [1],[24],[25],[29],[32] focus on various aspects of business intelligence (BI) and how it can be improved and automated using machine learning algorithms (ML), data mining techniques, and knowledge management practices [36],[37]. They identify problems such as integrating ML with BI, automating manual processes, extracting hidden information from business data, ensuring data security and privacy, and leveraging critical knowledge for organizational performance. The methods used include linear and random forest regression, Excel, Visual Basic for Applications (VBA), key performance indicators (KPIs), outlier detection approaches, data warehousing, information mining, and knowledge management techniques.

Both papers [23], and [34] investigate the utilization of business intelligence and data analytics in the stock market. The first paper explores the application of machine learning for pattern discovery and insight generation using online session data, while the second paper focuses on developing a data analytics and business intelligence framework for stock market trading, utilizing an OLAP-applied dashboard for data visualization and analysis [38].

In the education sector, these papers [21],[27],[30],[35] talk about the use of BI and analytics in higher education, focusing on data-driven decision-making, software selection, architecture, and service-oriented integration of academic and financial data [39]. They identify problems such as impediments to timely data analysis, teaching effectiveness, quality assurance, and data integration. The methods used include data visualization, Power BI, KPIs, extract transform and load (ETL), data warehouses, online analytical processing (OLAP), data mining, reporting, and dashboard applications. The papers offer valuable insights into improving the management and decision-making processes in higher education institutions.

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Both papers [22], and [28] examine the effect of business intelligence on decision-making. The first paper investigates whether decision-makers respond to warnings and adjust their decisions accordingly through two online experiments, using probability theory and studying the impact of BI and advanced analytics warnings. The second paper explores the effect of BI implementation on decision-making in general organizations, examining the three core elements of BI: The human factor, analysis, and data quality. The first paper collects datasets through experiments, while the second paper investigates Swedish agency data [40].

In the demand forecasting sector, both papers [26], and [31] utilize business intelligence systems and machine learning algorithms to address decision-making challenges in different domains, including demand forecasting and pricing in the automotive industry. The first paper evaluates Deep AR's performance in ML and BI using sales, inventory, and calendar data as the primary sources. The second paper employs regression analysis and feed-forward backpropagation to predict the selling prices of cars, with the dataset derived from BMW specs.

As for the cyber security section [33], To enhance cyber security used KPIs and a business intelligence system. Steps include defining KPIs, collecting/cleaning data using open-source datasets, creating interactive dashboards, analyzing data for trends/anomalies, and communicating findings with visualizations and reports for recommendations.

IV. RESULTS AND EXPERIMENTS

For businesses and organizations to make wise decisions based on data analysis, business intelligence (BI) is a vital tool. BI has grown in importance over the past few years across a number of sectors, including education, the stock market, demand forecasts, vehicle prices, institutional performance, cyber security, and real-time decision-making. In each of these sectors, BI has been used to examine vast amounts of data in order to obtain knowledge about various facets of the business and make informed decisions. Table II displays the showed results of our research.

TABLE II. PROVIDES A QUICK REVIEW OF A SOLUTION'S APPLICATIONS AND LISTS THE ADVANTAGES, DISADVANTAGES, AND IMPACTS OF THE SOLUTION

[Ref.], Year	Solution applied	Advantage	Disadvantage	Contributions
(Minsang et al, 2021)	ML algorithms (linear & random forest regression) with BI tools are common approaches for data analysis.	ML combined with BI enhances data-driven decision-making and gives businesses a competitive edge.	Cost, effort, expertise, and modifications to current systems and procedures are obstacles to implementing this approach.	Strategies are improved through performance comparison, and separating risks from non-threats is essential to combating cybercrimes.
(Ardhian et al, 2018)	The BI system uses a data warehouse for central decision-making.	Data warehouse unifies higher education data for better student management.	BI's data-driven approach poses cost and logistical obstacles for organizations.	BI uses diverse data sources for real-time response, enhancing decision-making, efficiency, and profitability.
(Dursun et al, 2018)	Business analytics informs evidence-based business decisions for managers.	The study reveals how decision-makers perceive warnings of potential outcomes.	Managers need more info for effective decisions but often rely on intuition/emotio	Online experiments improve decision theory and BI& design via warning effects on decision-makers.

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			ns leading to ignoring data.	
(Július et al, 2020)	BI tools and ML algorithms collaboration enable effective data assessment for decision-making.	AI agents surpass human capabilities, assess training efficiency, enhance readability with graphs, structure data using Tensor Flow, and visualize using Power BI.	Data prep is crucial; a lack of expertise can yield inaccurate results.	ML & BI identify risks/opportunities, predict trends, and drive data-driven decisions for a competitive edge.
(Hind et al, 2020)	BI empowers SMEs & impacts bigger enterprises by creating strong strategies.	BI implementation boosts small enterprises' data analysis, decision-making, efficiency, and profitability.	Affordable storage allows fast data access, but inconsistent handling needs a unified platform for requests, reviews, and approvals.	Objective: Implement BI solutions for seamless data flow among employees, managers, and directors.
(Ruchi et al, 2018)	Data analysis methods include Statistical, Distance-based, Density-based, Machine Learning, and Higher Dimensionality Approaches.	ML and data mining reveal patterns, enhance insights and accuracy, and increase revenue through improved decision-making and marketing strategies.	ML requires resources, depends on data quality, and may not be suitable for all business problems.	The taxonomy of BI methods includes ML and data mining, for cyber security, manufacturing, fraud detection, medical, quality, and social media.
(Khan et al, 2017)	ML predicts future demand for businesses	Enhanced system models increase forecast accuracy, and productivity, and reduce waste by efficiently comparing predicted and actual data.	Relevant data, expertise, resources, updates, and possible forecasting errors are factors to consider in ML implementation.	ML contributes to productivity, resource optimization, decision-making, adaptation to market conditions, and automated data processing.
(Owoc et al, 2018)	Training students with BI tools through lectures, guides, and problem-solving activities.	BI teaching with open-source software boosts creativity, and hands-on experience, and provides free access to industry-standard tools.	Tool selection challenges: user needs, advanced system accessibility, and data capacity limitations restricting enterprise use.	Advanced tech supports decisions; free software is cost-effective and flexible in teaching BI, reducing infrastructure costs, especially for SMEs.
(Berhane et al, 2021)	BI decision-making focuses on data quality, analysis, and human factors.	BI enhances data quality, and creates data warehouse; analytical BI systems use OLAP.	BI can neglect intuition, create imbalances, be costly for public organs, and cause decision issues.	The paper contributes to knowledge of BI's impact on Swedish agency decision-making.
(Khan et al,	Utilizing BI	BI turns data into	Lack of cloud	BI identifies opportunities, resolves

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2020)	Systems for data warehousing and information mining.	actionable insights and improves efficiency, decision-making, and sales/marketing effectiveness.	skills challenges data security; managing BIS is expensive and resource-intensive. Expensive tech limits small institutions.	issues proactively gives a competitive edge, and enables informed decisions.
(Sorour et al, 2020)	BI and KPIs monitor quality assurance in higher education.	Oversee higher education quality assurance for student/faculty performance insights and informed decision-making.	Analytics miss intangible quality. Data-driven decisions neglect subjective factors.	Architect boosts data analysis for performance, BI offers student insights. through data integration/warehousing, analytics/reporting, and data security.
(Idris et al, 2021)	BI & regression analysis forecast car selling price using a feed-forward backpropagation algorithm, providing valuable pricing insights for automotive companies.	The algorithm predicts car selling price from specs, including premarket models, to inform pricing & production strategies and maximize profits.	The algorithm needs accurate data; may have errors due to unforeseeable factors, and high costs/technical expertise required for development/maintenance.	Algorithm boosts accuracy, decision-making for dealerships & competitive advantage for companies with informed decisions.
(Saqib et al, 2018)	enhances organizational performance by using ICT for strategic planning, learning, problem-solving, and decision-making.	enhances decision-making, knowledge sharing, innovation, and problem-solving & boosts competitive advantage.	Implementation challenges, high costs, data quality issues, security concerns, and resistance to change.	Increases productivity, profit, and awareness. -Improves reputation, and creates wealth.
(Krivo et al, 2020)	Collecting security incident data through KPIs and visualizing it in the form of graphs and tables using a business intelligence system	Enables quick detection and response to cyberattacks, informs decision-making for better security strategies, and improves protection of sensitive information.	BI challenges: complex implementation requires expertise, is costly for small organizations, and data overload makes useful information identification difficult.	early threat detection, real-time monitoring, improved incident response, reporting, and cost-effective security.
(AlArmouty et al, 2019)	Propose a framework for business intelligence that utilizes historical stock market data	Business intelligence frameworks analyze large amounts of stock market data, providing real-time insights for	BI frameworks use historical data, aren't reliable for future market movements, and are expensive	BI frameworks enhance competitiveness, investment performance, profitability and enable risk management by identifying/mitigating portfolio threats.

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		informed and timely decisions by traders and investors.	for small/individual investors due to software and data cost.	
(Somya et al, 2018)	The data warehouse was developed using Galaxy Diagram and implemented with SQL Server 2012 and dashboard as well.	-Web Service uses a dashboard app as a mediator for smooth data exchange, transformation, and loading from multiple sources during the entire ETL process.	- Integrating academic and financial data involves multiple systems, formats, and security with high costs, unfeasible for universities with limited budgets.	- Service-oriented Business Intelligence (SoBI) boosts data accuracy/accessibility, reduces errors and manual effort by integrating multiple sources, and enables real-time data insights for data-driven decisions.

A. Analysis

This paper provides an analytical overview of sixteen research papers, each addressing six distinct areas of work: higher education, enterprise management, demand forecasting, cyber security, the stock market, and real-time decision-making. Each of these papers applied business intelligence tools and machine learning algorithms. Each research study presents a different approach to solving the problem, showing both benefits and drawbacks. For those making decisions in these crucial areas, this research offers insightful suggestions. As a result of the research's high degree of precision and clarity, it is a crucial tool for anyone looking to use analytical methods to achieve success.

Business Intelligence (BI) is an essential tool for companies and organizations to make informed decisions based on data analysis. In recent years, BI has become increasingly important in various sectors, including educational methods, the stock market, demand forecasting, car prices, institutional performance, cyber security, and real-time decision-making. In each of these sectors, In order to obtain insights into various aspects of the market and make data-driven decisions, BI has been utilized to analyze huge amounts of data.

B. Discussion

The research (Aleksei, 2020) proposes using a business intelligence system to analyze cyber threats by collecting security incident data via KPIs and presenting it through graphs and tables. Benefits include quick detection and response to cyberattacks, informed decision-making, improved incident response, and cost-effective security. However, complex implementation, cost, and data overload may pose challenges. Organizations should weigh the benefits and drawbacks before implementing a business intelligence system for cyber security [44].

Both (Dursane, 2018), (Berhane, 2020) studies highlight the potential benefits and drawbacks of using business intelligence and analytics in decision-making. While BI can enhance data quality and provide valuable insights, it can also be costly and may neglect the importance of intuition and emotions in decision-making. The studies suggest that a balanced approach to decision-making that incorporates both data analysis and human factors is crucial for effective decision-making. In conclusion, organizations should carefully consider the costs and benefits of using BI in decision-making and develop strategies to ensure a balanced approach.

The five research (Minsang D, 2021), (Hind, 2020), (Ruchi, 2018), (Shahnawaz, 2020), (Muhammad, 2018) papers on organization performance shed light on the advantages and drawbacks

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of adopting business intelligence (BI) and machine learning (ML) algorithms [34]. The implementation of BI and ML has proven to enhance data-driven decision-making and increase organizational efficiency, revenue, and competitive advantage. Nevertheless, organizations may face challenges in terms of cost, time, expertise, data quality, security, and resistance to change. Therefore, careful evaluation of the potential impact and feasibility of BI and ML is essential for organizations to achieve their desired outcomes.

The two studies (Muhammad,2020), (Nur,2021) in prediction, focusing on machine learning and business intelligence to enhance forecasting models, were examined. One predicted future demand, increasing forecast accuracy and reducing waste, while the other forecasted car selling prices, providing pricing insights. Both studies emphasized the need for accurate data, expertise, and potential errors to be considered in successful implementation. Informed decision-making is crucial in improving institutional performance through accurate forecasting [42].

Various research papers (Ardhian, 2018), (Mieczysław,2018), (Ali,2020), (Ramos,2018) have explored the implementation of business intelligence (BI) systems in education to enhance decision-making, student management, and quality assurance [43]. The papers propose using data warehousing, free software, key performance indicators, and service-oriented BI. Although BI offers benefits such as better insights and quality control, there are limitations such as high costs and integration complexities. Organizations must, therefore, weigh the advantages and disadvantages of BI before adoption.

The two related research papers (Július,2020), (Batool,2019) in the field of the stock market focus on the application of business intelligence (BI) and machine learning (ML) for predictive analytics. The first paper discusses the collaboration of BI and ML tools, highlighting their advantages in surpassing human capabilities, assessing training efficiency, and enhancing data visualization. However, data preparation and lack of expertise can lead to inaccurate results. The second paper proposes a BI framework utilizing historical stock market data for real-time insights but warns about the limitations of relying on historical data for future market movements and the high cost of software and data for small investors. Both studies demonstrate the potential benefits and challenges of utilizing BI and ML in the stock market.

V. COMPARISON

Tools for machine learning and business intelligence can be applied in many different ways in these domains. The six sectors you listed have a variety of scientific research methods and areas, which contribute to their distinct qualities and ways of development. A brief comparison of the fields is shown below:

1. Field of institutional performance: This field is focused on analyzing and improving the overall performance of organizations. The research methods used in this field may include statistical analysis, data mining, and machine learning. Proposed development in this area in the use of advanced analytics and big data to improve decision-making.
2. Field of education for research: This field is concerned with researching the effectiveness of educational methods and techniques. Research methods used in this field may include qualitative and quantitative research methods, surveys, and case studies [45]. Proposed development in this area in the use of learning analytics and personalized learning methods.
3. Field of real-time decision-making: This field involves making decisions in real-time using data-driven methods. The research methods used in this field may include simulation modeling, optimization, and machine learning. Proposed development in this area is the use of advanced algorithms and real-time data analysis.

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4. Field of forecasting demand and sales: This field is focused on predicting future demand and sales using data-driven methods. The research methods used in this field may include time-series analysis, statistical modeling, and machine learning. Proposed development in this area in the use of predictive analytics and big data.
5. Field of the stock market: This field is focused on analyzing and predicting the behavior of the stock market using data-driven methods. Time series analysis, and machine learning, econometric modeling may be employed as research techniques in this area. The usage of big data and artificial intelligence in this field is a proposed development.
6. Field of cyber security: This field is focused on protecting computer systems and networks from unauthorized access and cyberattacks. The research methods used in this field may include vulnerability assessments, penetration testing, and machine learning. Proposed development in this area in the use of advanced algorithms and real-time data analysis to detect and prevent cyberattacks [46].

In conclusion, the research areas, methodology, and ways of development vary between the areas of study. However, the use of data-driven techniques to enhance decision-making, performance, and results is a common objective across all of these sectors.

VI. CONCLUSIONS

The report emphasizes how crucial data integration and analysis are to decision-making in a variety of businesses, future research directions and recommendations for practitioners and researchers are also discussed. the higher education sector, the stock market, cyber security, enterprise management, demand forecasting, real-time decision-making, and other sector analysis can all benefit from business intelligence (BI). linear and random forest regression, Supervised (binary, general, regression) and unsupervised (hierarchical, K-means, agglomerative) learning, along with semi-supervised and reinforcement learning, Visual Basic for Applications (VBA), key performance indicators (KPIs), Deep AR's algorithm, Power BI, and Service-oriented Business Intelligence (SoBI) are more straightforward methods of integrating data and analyze. All of these methods may enhance decision-making procedures, give companies a competitive edge, and produce the results they want. Businesses and organizations from all industries must invest in and take advantage of the power of data analysis and integration to make it simple and more effective.

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