Disruptive Innovations using Tech-Business Analytics in the Quaternary Industry Sector

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ABSTRACT

Purpose: *Tech-business analytics are used in the quaternary industry sector for disruptive innovations for a number of reasons. In essence, disruptive innovations in the quaternary industry sector that make use of tech-business analytics aim to alter how companies operate, compete, and deliver value; this will eventually lead to improved results and long-term success.*

Design/Methodology/Approach: *Companies operating in the quaternary sector can create new value propositions, challenge established processes, and obtain a long-term competitive edge by utilizing tech-business analytics. In this industry, disruptive ideas that use tech-business analytics are usually executed in this way.*

Findings/Result: *When tech-business analytics are used in the quaternary industry, disruptive breakthroughs typically have a number of notable repercussions. According to these findings, disruptive innovations that use tech-business analytics have a considerable positive impact on the overall company performance, customer happiness, and operational efficiency of the quaternary industry sector.*

Originality/Value: *The disruptive developments in the quaternary industry sector that use tech-business analytics are distinctive due to a number of significant features. These characteristics show that disruptive innovations that use tech-business analytics are not just improvements on existing practices, but are more like new techniques that create value and establish new industry standards.*

Keywords: Business Analytics (BA), ICCT underlying technologies, Tech-Business Analytics, TBA, Tertiary Industry, Data Science, Big Data Analytics, Research gap in Business Analytics, SWOT analysis, Tech-business Analytics, Quaternary Industry Sector.

1. INTRODUCTION :

The quaternary industry sector, sometimes referred to as the knowledge economy, encompasses research and development (R&D), education, financial planning, consulting, information processing and dissemination, and other knowledge-based activities. Since they promote technological improvements, increase productivity, and support economic growth, innovations in this field are essential. The following are some significant advancements in the quaternary sector:

(1) In contemporary manufacturing, artificial intelligence (AI) has emerged as a key transformation that offers special chances to enhance operational effectiveness and business analytics. This study uses data from a poll of 300 industry specialists to analyze the trends, advantages, and difficulties of AI adoption in US industrial sectors. By examining the operational results of increased productivity, lower costs, higher revenue, and workforce optimization, specific AI applications such process automation, supply chain optimization, and predictive analytics are first examined Hossain et al. (2024). [1]).

(2) It investigates how startups are establishing ecosystems to profit from a revolutionary technology and looks at what it takes to succeed in this field. In contrast to technology innovation, business model innovation may be another factor driving the adoption of new technology in a highly regulated, traditional industry, according to research on business ecosystems and disruptive innovation in the

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construction sector. In order for current construction methods and new business platforms to succeed in this industry, the research identifies their potential and suggests practical measures (Brennan (2020). [2]).

(3) Through Fin-Tech challenger banks, this study examines how digital technology affects banks' business strategies. Bank business models are seeing widespread disruption due to fintechs. The high-income transition economy's study in this area is still lacking, despite the clear advantages. By using a drop/pick-up survey questionnaire given to a sample of all 68 UAE-Federation of Bank members, the study takes advantage of this lacuna. The findings suggest that digital technology is changing the banking landscape from traditional competitive models to novel bank-to-Fin-Tech collaborative models. This shift disintermediates traditional banking into smaller, multi-modal, and multi-directional models, creating previously unheard-of opportunities, particularly for international banks from developed economies (Sibanda et al. (2020). [3]).

Table 1: About innovations in quaternary industry sector.

S.No.	Aspects	Description about
1.	AIML	Quaternary industry services are changing as a result of AI and ML. AI-powered algorithms in finance enhance trading tactics, risk control, and customer support via chatbots and robo-advisors. AI helps in healthcare by maintaining patient data, customizing treatment strategies, and diagnosing illnesses.
2.	Big Data Analytics	Strategic planning, product development, and market research all depend on this. Big data helps businesses make better decisions, run more efficiently, and provide individualized customer service.
3.	Blockchain Technology	Blockchain technology provides safe and open methods for managing data and conducting transactions. Improved financial transaction security, transparent supply chains, and safe data sharing are among of its uses in the quaternary industry.
4.	Cloud Computing	Cloud computing provides scalable and flexible computing capabilities that enable organizations to store and process large datasets efficiently. It makes it easier to collaborate, operate remotely, and implement complex applications without requiring a lot of on-premises hardware.
5.	Internet of Things (IoT)	IoT enables more intelligent decision-making across a range of domains. IoT devices are used in agriculture to enhance irrigation and track crop health. IoT in urban planning facilitates the creation of smart cities by enhancing resource distribution and traffic control.
6.	Advanced Cybersecurity Measures	Advanced cybersecurity measures are crucial given the increase of data breaches and cyber threats. Blockchain for safe transactions, AI-powered threat detection, and quantum encryption for private data protection are examples of innovations in this field.
7.	Biotechnology and Life Sciences	Biotechnology breakthroughs are transforming agriculture and healthcare. Personalized medicine using genetic data, biopharmaceutical advancements, and gene editing technologies like CRISPR are examples of innovations.
8.	Telemedicine and E-Health	To deliver medical care remotely, telemedicine makes use of modern communication techniques. E-health platforms provide mobile health

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		applications, electronic health records, and online consultations, making healthcare more accessible and convenient for patients.
9.	Educational Technology (EdTech)	To improve teaching and learning, EdTech encompasses virtual classrooms, online learning platforms, and educational software. Technologies that customize education and increase student engagement include gamification, AI tutors, and adaptive learning platforms.
10.	Sustainable Technologies	Green practices and lessening the influence on the environment are the main goals of sustainable technology innovations. Smart grids, renewable energy sources, and sustainable farming methods are a few examples.
11.	Quantum Computing	Complex issues could be solved more quickly by quantum computing than by traditional computers. It can be used to improve cryptography systems, expedite drug discovery, and optimize logistics in the quaternary industry.
12.	AR and VR	Using AR and VR is beneficial for training, simulation, and data visualization. They provide immersive educational experiences. Virtual tours enable prospective purchasers to remotely inspect properties in the real estate market.

In addition to increasing the effectiveness and potential of knowledge-based services, these advances open up new markets and opportunities. It's critical for professionals and companies working in this fast-paced industry to stay on top of these advancements.

2. ABOUT DISRUPTIVE INNOVATIONS USING TECH-BUSINESS ANALYTICS IN QUARTERNARY INDUSTRY SECTOR :

In the quaternary industry sector, disruptive advances employing tech-business analytics fundamentally alter traditional business structures, creating new growth opportunities and threatening established market leaders. These innovations transform how data is handled, analyzed, and used in a variety of knowledge-based industries by utilizing state-of-the-art technology. Several noteworthy disruptive breakthroughs include the following:

Global industry transformation has been made possible by the rapid growth of technology, which has allowed for previously unheard-of levels of automation and efficiency. In order to facilitate the seamless automation of primary, secondary, tertiary, and quaternary sectors, this study offers a thorough analysis of the critical field of technology management. Technology management is responsible for a wide range of 21st-century universal technologies, including nanotechnologies and information, communication, and computation technologies (ICCT underpinning technologies). The article's initial argument emphasizes how important effective technology management is to the development of industrial automation. It examines the evolution of technology management strategies to accommodate the diverse and ever-changing needs of modern industries [4]. A 21st-century term for information communication technology (ICT), information communication and computation technology (ICCT) encompass a wider range of developments in computer science technologies and includes roughly twelve fundamental new technologies. Nanotechnology and ICCT are regarded as fundamental components of the Universal Technology System. Artificial intelligence and robotics, blockchain technology, data science and business intelligence, cloud computing, cybersecurity and forensic science, 3D printing, the Internet of Things, information storage technology, mobile business technology, online education technology, quantum computing, and virtual and augmented reality are some of these 12 underlying technologies. Since these ICCT underlying technologies are anticipated to transform the way that different sectors and societies currently address their challenges, they are regarded as 21st-century emerging technologies that will transform the current human generation into the tech-generation [5].

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Table 2: About disruptive innovations using TBA in quaternary industry sector.

S.No.	Aspects	Description about
1.	Financial Predictive Analytics	Statistical methods, machine learning algorithms, and historical data are all used in predictive analytics to forecast future events. In the realm of finance, it upends conventional investing methods by making it possible for more precise risk evaluations, fraud detection, and individualized financial planning. Traditional financial institutions are being challenged by fintech startups that employ predictive analytics to provide automated investing advice and real-time insights.
2.	Data-Driven Healthcare Solutions	Healthcare is being revolutionized by tech-business analytics, which offers data-driven solutions for medical research, operational effectiveness, and patient care. Disease outbreaks are detected, resources are allocated optimally, and treatment regimens are customized by predictive modeling.
3.	IoT Analytics in smart cities	The creation of smart cities depends heavily on IoT analytics. Numerous sensors and linked equipment gather a great deal of information on environmental conditions, energy use, and traffic. By processing this data, analytics platforms optimize public services, save energy consumption, and improve urban infrastructure. Traditional urban planning and management is being disrupted by companies such as Siemens and Cisco.
4.	Advanced Supply Chain Management	Big data and artificial intelligence are used in supply chain analytics to improve visibility, forecast demand, and streamline operations. Businesses may improve delivery times, cut expenses, and predict disruptions by evaluating data from several sources. By upending established supply chain paradigms, this gives businesses like Amazon and Alibaba a competitive advantage through better logistics.
5.	Marketing and Consumer Insights	Real-time client involvement, bespoke content, and hyper-targeted advertising are made possible by advanced analytics in marketing. Businesses like Google and Facebook are upending conventional advertising models and media buying procedures by using data analytics to give advertisers comprehensive insights into consumer behavior.
6.	Human Resources and Talent Management	Employer retention, performance management, and hiring are all improved by people analytics, which uses data. Businesses can spot trends and make informed decisions regarding workforce planning and development by examining employee data. Advanced HR analytics are available on platforms like Workday and LinkedIn, which put standard HR procedures to the test.
7.	Real-Time Analytics in Education	Real-time analytics are used by EdTech businesses to monitor student performance, customize learning, and enhance academic results. Based on the needs of each individual student, learning management systems (LMS) and adaptive learning platforms employ data to modify the way content is delivered. Analytics are used by organizations like Coursera and Khan Academy to challenge established educational paradigms.
8.	Business Intelligence and	Informed decision-making is facilitated by business intelligence (BI) technologies such as Tableau, Power BI, and QlikSense, which allow firms to display and comprehend data in real-time. These solutions give leaders immediate access to actionable insights, which improves agility

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	Decision-Making	and competitiveness and upends conventional decision-making procedures.
9.	Customer Relationship Management (CRM)	Deeper understanding of consumer preferences, behaviors, and buying trends is possible with CRM systems that are coupled with advanced analytics. Traditional sales and marketing strategies are being challenged by platforms such as Salesforce and HubSpot, which leverage analytics to improve customer engagement, loyalty, and lifetime value.
10.	Innovation in Legal Analytics	Legal strategy, case results, and risk management are all influenced by legal analytics, which makes use of data mining and predictive analytics. Legal research and practice are disrupted by data-driven insights from tools like Lex Machina and Ravel Law, which increase the effectiveness and affordability of legal services.
11.	Retail and E-Commerce Optimization	Data is used in retail analytics to improve pricing, customer experience, and inventory management. By using predictive analytics to predict customer demand, customize shopping experiences, and optimize operations, e-commerce behemoths like Amazon are upending established retail structures.
12.	Agricultural Analytics	To forecast yields, track crop health, and improve agricultural methods, agri-tech uses data analytics. Precision farming and drone analytics are two examples of technologies that give farmers useful information, upending conventional farming methods and increasing productivity and sustainability.

In the quaternary sector, disruptive innovations employing tech-business analytics radically alter conventional business models by utilizing data to improve decision-making, streamline processes, and customize offerings. To stay competitive in a market that is changing quickly, firms must embrace and integrate advanced analytics. These innovations challenge existing market competitors, increase efficiency, and open up new opportunities.

3. LITERATURE REVIEW :

Table 3: Examining disruptive technologies in the quaternary industry area with tech-business analytics

S. No.	Area	Issue	Outcome	Reference
1.	Tech Business Analytics is a sector of the quaternary industry.	Technology-enabled business analytics may be very helpful to companies in this sector in making data-driven decisions, streamlining processes, and improving overall effectiveness. An organization's operational effectiveness can be greatly increased by using technology to study business analytics, which can also improve market trends and consumer behavior.	Due to its focus on knowledge-based activities, innovation, and advanced technology, the quaternary industry sector presents unique business analytics opportunities and problems.	Kumar, S., & Aithal, P. S. (2024). [6]
2.	To improve the quality and features of TBA's	A tool that blends data analytics with the core methods of ICCT is called tech-business analytics. It is	Combining qualitative and quantitative research methods, an exploratory study is part of a Tech-	Kumar, S., & Aithal, P. S. (2023). [7]

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	products and services, a new strategy	possible to simplify or solve industry challenges in elementary to quaternary domains.	Business Analytics approach that aims to enhance the features and quality of goods and services across a variety of industries.	
3.	Tech-Business Analytics in the Tertiary Sector.	Tech-business analytics are vital in the tertiary industry sector because they facilitate data-driven decision-making and offer analytical insights to enhance customer experiences, operational effectiveness, and corporate growth.	It includes defining business concerns, gathering and cleansing data, analyzing data, interpreting findings, and communicating findings to stakeholders. Businesses are given the freedom to make decisions that will aid in their growth and development with this strategy.	Kumar, S., & Aithal, P. S. (2023). [8]
4.	Fundamental Industry Sector Data for Tech-Business.	Making sure that agricultural extraction operations are sustainable and effective is the main industry sector's TBA. Data-driven decisions that optimize operations and minimize environmental effect can be made by primary sector enterprises using TBA.	The TBA in the primary industries sector integrates data collection, analysis, and interpretation techniques. The industry and the particular objectives of the organization will determine which particular methodology is employed.	Kumar, S., & Aithal, P. S. (2023). [9]
5.	Business analytics and technology in the secondary industry sector.	As a crucial instrument, tech-business analytics will be adopted by companies in all industries, but especially in the secondary sector. By reducing downtime, businesses can increase output and anticipate when machinery and equipment will break down.	Businesses in the secondary industrial sector can use the tech-business analytics methodology, which comprises of multiple processes, to make data-driven decisions that may be necessary to improve supply chain efficiency or reduce equipment downtime. This data collection could be used to identify trends in customer behavior, forecasts from predictive models, or connections between various variables.	Kumar, S., & Aithal, P. S. (2023). [10]
6.	Improving Industry Automation through Effective Technology Management in the Community.	Fast technical development has transformed companies all around the world and made previously unheard-of levels of automation and efficiency possible. This is the crucial area of technology management.	In addition to discussing the socioeconomic and environmental effects of technology-driven automation in businesses, this essay highlights the significance of ethical and sustainable technology management. These effects are predicated on the anticipated development of technology-based singularity and super	Aithal, P. S. (2023). [11]

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			intelligent machines and their impact on industrial automation.	
7.	TBA innovations' uptake in higher education.	Through the use of ICCT core technologies and big data analytics, a process known as Tech-Business Analytics, this chapter has explored the potential for producing business information in the higher education sector.	Twelve different categories of Tech-Business Analytics (TBAs) are presented below, along with an examination and suggestion of the technology and constituent parts of each category and potential uses for each.	Aithal, P. S., & Aithal, S. (2023). [12]
8.	Analytics for Blue Economy Tech Companies.	Applying data analytics, cutting-edge technologies, and entrepreneurial tactics to encourage innovation, strengthen resilience, and enhance sustainable growth.	The findings demonstrate the potential of creative Tech-Business initiatives to promote innovation, encourage environmentally responsible growth, and support the Blue Economy.	Kumar, S., & Aithal, P. S. (2024). [13]
9.	Utilizing Technology to Enhance Social Business.	A business can produce and deliver a product to a consumer more quickly while using fewer human workers by utilizing technology. Sociocultural, phantasmagorical, needs-based, and want-based appetites are the subjects covered in this section. There is much potential for technology to enhance social commerce.	The difficulties people face and possible research avenues are examined here. Numerous business models, tactics, and generations of technology have all been studied.	Kumar, S., & Aithal, P. S. (2022). [14]
10	The circular economy can optimize resources for a variety of industry sectors.	The circular economy concept is crucial in all industry sectors, including primary, secondary, tertiary, and quaternary. Since this idea encourages resource efficiency, waste reduction, sustainable practices, and innovation, it has a significant impact on all industry sectors.	Using SWOC and ABCD analysis, a number of industry sectors analyze the significance of the circular economy in order to pinpoint areas that would profit from more research and a methodical assessment to determine the field's current status.	Aithal, S., & Aithal, P. S. (2023). [15]

4. OBJECTIVES OF THE RESEARCH PAPER :

(1) Tech-business analytics are being used to examine TBA's new and disruptive concepts in the quaternary industry.

(2) To examine and apply various research techniques about TBA's game-changing innovations in the quaternary industry sector.

(3) To investigate various approaches to dealing with TBA's disruptive technologies in the space of quaternary industry.

(4) It should be well-versed in tech-business analytics and ground-breaking ideas in the quaternary industry.

(5) To use tech-business analytics tools to evaluate several SWOC studies of every potential disruptive innovation in the quaternary industry sector.

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(6) To make additional recommendations for enhancing the present and its comprehensive examination of TBA's ground-breaking innovations in the quaternary industry area.

5. METHODOLOGY :

Implementing disruptive innovation in the quaternary industry sector involves a number of processes based on tech-business analytics. Opportunities, data collection and processing, analytical model development, solution implementation, and ongoing monitoring and optimization are some of these phases. Here is a thorough analysis:

Table 4: Methodology of TBA in quaternary industry sector

S.No.	Aspects	Analysis	Identification
1.	Identifying Opportunities	Do a thorough market investigation to find out where tech-business analytics might challenge current procedures. This entails researching technical developments, rival tactics, and market trends.	Identify certain industry issues or inefficiencies that data analytics might help with. Outdated marketing tactics, insufficient customer insights, and ineffective supply chains are a few examples of this.
2.	Data Collection and Integration	Find and combine different data sources that are pertinent to the issues that have been identified. These may consist of both external (such as market trends, social media, and Internet of Things devices) and internal (such as sales records and customer data) data.	Make sure the information gathered is trustworthy, accurate, and comprehensive. Preprocessing and data cleaning are essential for dealing with errors, duplication, and missing values.
3.	Developing Analytical Models	Learn about current trends and historical data by using descriptive analytics. Techniques for data visualization and statistical analysis are used to summarize the data. Using machine learning techniques, create predictive models that project future patterns, actions, and results.	To offer action recommendations based on the predictive models, use prescriptive analytics. To determine the optimum course of action, this calls for scenario analysis and optimization techniques.
4.	Implementing Solutions	Introduce the created models to the corporate world. Creating new platforms and apps or incorporating them into current systems could be the way to go.	If at all possible, automate decision-making procedures to improve productivity. Predictive analytics-based inventory management automation, for example.
5.	Continuous Monitoring and Optimization	Keep an eye on how well the analytical models and the solutions being used are performing. To gauge achievement, key performance indicators, or KPIs, should be established.	Create feedback loops that allow the models to be improved and adjusted in response to fresh information. This entails updating, validating, and testing models iteratively.

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6.	Tools and Technologies Used	For data visualization and reporting, use programs like Tableau, Power BI, and Qlik.	For creating predictive models, use libraries like TensorFlow, PyTorch, Scikit-Learn, and Keras.
7.	Application in Healthcare	High readmission rates for patients.	To find patients who may need to be readmitted, use predictive analytics.
8.	Data Collection and Integration	Gather information about patients, such as demographics, medical histories, treatment plans, and follow-up appointments, from electronic health records (EHRs).	Identify trends linked to high readmission risks by developing a predictive model using machine learning methods.
9.	Implementing Solutions	To identify patients who are at risk and suggest interventions, include the predictive model into the hospital's electronic health record system.	Track the model's accuracy and make adjustments in light of fresh data and patient results. Put feedback loops into practice for ongoing development.

In the quaternary industry sector, using tech-business analytics to disruptive innovations is a rigorous process that requires careful planning, implementation, and ongoing development. Using advanced data analytics techniques can help businesses make better decisions, discover new opportunities, and obtain a significant competitive advantage.

6. ABOUT TECH-BUSINESS ANALYTICS IN QUARTERNARY INDUSTRY SECTOR :

The goal of tech-business analytics in the quaternary industry sector is to transform knowledge-based services, such as financial services, education, consulting, information technology, and research and development (R&D), by applying sophisticated data analytics methodologies. This combination of corporate analytics and technology aims to improve decision-making, foster creativity, and boost productivity.

Table 5: Concerning tech-business analytics in the quaternary sector

S.No.	Aspects	Source	Integration
1.	Data Collection and Integration	Numerous sources, including internal databases, consumer interactions, Internet of Things devices, social media, and external market data, are used to gather data.	Integrating data from multiple sources into a single data warehouse or data lake guarantees thorough analysis.
2.	Data Processing and Management	Removing mistakes, duplication, and inconsistencies from data through preprocessing and cleaning to ensure data quality.	Putting strong data management techniques into practice to effectively manage massive data volumes.
3.	Advanced Analytics Techniques	Finding trends, patterns, and insights in historical data by applying statistical methods and data visualization tools such as Tableau, Power BI, and Qlik.	Making practical suggestions based on forecasted information. To recommend the optimal course of action, scenario analysis and optimization techniques are employed.

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4.	Machine Learning and AI	Using libraries such as TensorFlow, PyTorch, and Scikit-Learn, machine learning models can be created and trained.	Applying artificial intelligence (AI) to a range of applications, including computer vision for image analysis.
5.	Real-Time Analytics	Real-time analytics are made possible by technologies like Spark Streaming and Apache Kafka.	Personalized marketing, financial trading, fraud detection, and IoT device monitoring all make use of real-time analytics.
6.	Data Visualization and Reporting	Generating dynamic dashboards and reports with sophisticated visualization features. This facilitates stakeholders' comprehension of intricate data insights.	Automatically producing reports to alert decision-makers about important trends and data.
7.	Finance and Insurance	Predictive analytics models for fraud detection, credit risk assessment, and investment portfolio optimization.	Using consumer data analysis to tailor insurance and banking offerings, increasing client retention and satisfaction.
8.	Healthcare	To find high-risk patients, enhance treatment regimens, and enhance patient outcomes, predictive analytics is used.	Managing supply chains, cutting expenses by making data-driven decisions, and streamlining hospital operations.
9.	Education	Putting in place adaptive learning systems that modify course material according to each student's performance and preferences.	Analytics are being used for resource management, student progress monitoring, and institutional performance enhancement.
10.	Information Technology	Finding bottlenecks, allocating resources optimally, and enhancing service delivery through the analysis of IT service performance.	To improve cybersecurity safeguards, machine learning is being used for threat, anomaly, and predictive maintenance detection.
11.	Consulting and Professional Services	Giving companies insights into consumer behavior, rival tactics, and market trends by utilizing big data analytics.	To help clients with risk management, resource allocation, and strategic decision-making, predictive models are used.
12.	Security and Privacy of Data	Protecting sensitive data via robust security measures and ensuring compliance with data protection regulations (e.g., CCPA, GDPR).	Stringent cleaning, validation, and management procedures to maintain excellent data quality.
13.	Integration and Interoperability	Facilitating the smooth integration of several systems and data sources to allow for thorough analytics. creating analytics systems that are scalable in response to the expanding amount of	To effectively integrate and use tech-business analytics, assemble a team with domain-specific knowledge, machine

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		data and the complexity of analytical operations.	learning, and data science experience.

Tech-business analytics is transforming knowledge-based services in the quaternary industry sector by promoting innovation, boosting productivity, and enabling data-driven decision-making. Modern data analytics techniques can help companies in the financial, healthcare, educational, IT, and consultancy sectors gain valuable insights, optimize workflows, and maintain a competitive edge in an increasingly data-centric environment.

7. POSSIBLE DISRUPTIVE INNOVATIONS USING TECH-BUSINESS ANALYTICS IN QUARTERNARY INDUSTRY SECTOR WITH EXPLANATIONS :

In the quaternary industrial sector, disruptive advances based on techno-business analytics have the potential to fundamentally change how knowledge-based services operate. Using advanced data analytics to create new value networks and markets, these innovations defy expectations and result in significant improvements in efficacy and efficiency. Here are some examples of potentially disruptive developments and their explanations:

Table 6: Possible disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Innovation	Explanation
1.	AI-Powered Personalized Financial Services	Creation of AI-powered financial advising services that use real-time data analysis to deliver individualized investing and financial planning guidance.	AI can provide more individualized advice than traditional financial advisors by using machine learning algorithms to examine the risk tolerance, market conditions, and individual financial behaviors.
2.	Predictive Healthcare and Personalized Medicine	Predictive analytics is being used in the medical field to forecast disease outbreaks, readmissions, and treatment plan customization.	Predictive models are capable of identifying high-risk individuals and suggesting individualized treatment strategies by evaluating genetic information, lifestyle factors, and patient data.
3.	Smart Education Platforms	Development of platforms for adaptive learning that personalize instructional materials for every student based on real-time data.	These platforms use learning styles and student performance data to provide feedback, exams, and tailored content.
4.	Optimization of the Supply Chain in Real Time	IoT and big data analytics are used to optimize supply chain operations in real time.	It is operational visibility can be obtained by businesses by gathering data from sensors and devices across the supply chain. Demand forecasting, bottleneck detection, and inventory optimization are all made possible by advanced analytics, which also improves efficiency and increases responsiveness to market fluctuations.
5.	AI-Enhanced Legal Services	Automation of contract analysis, legal research, and case outcome forecasting.	This invention disrupts established law firm paradigms and increases access to high-quality legal services.

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6.	Pricing in Retail and E-Commerce	Dynamic pricing models that employ real-time data analytics to modify prices in response to consumer behavior, competition, and demand.	Through dynamic pricing strategy optimization made possible by advanced analytics, retailers may maximize profits and boost sales.
7.	Advanced Fraud Detection Systems	Creation of advanced fraud detection systems that detect and stop fraudulent activity in real time using machine learning.	These systems are more effective than traditional methods at detecting and mitigating fraudulent actions because they continuously analyze transaction data and spot trends that point to fraud.
8.	Smart City Infrastructure Management	Data analytics and IoT applications for controlling urban infrastructure, such as trash management, electricity distribution, and traffic control.	Through the integration of data from multiple urban sensors, communities can optimize the distribution of resources, alleviate traffic, and enhance the general quality of life for citizens.
9.	Blockchain for Transparent and Secure Transactions	Blockchain technology is being used to increase transaction security and transparency in a number of sectors, such as banking, healthcare, and supply chains.	The decentralized, unchangeable ledger that blockchain technology offers guarantees safe and open record-keeping. By upending traditional centralized systems, this innovation can lower fraud, improve trust, and streamline operations.
10.	Remote Work Optimization Tools	Creation of sophisticated analytics tools, such as resource management, collaboration improvement, and productivity tracking, to maximize remote work settings.	These systems can guarantee efficient resource use, offer insights into worker productivity, and suggest enhancements by evaluating data related to remote work.

These innovations fundamentally transform many industries, create new opportunities, and challenge long-held beliefs. In an increasingly data-driven world, businesses may stay ahead of the curve and thrive by harnessing the power of modern data analytics.

8. SWOC ANALYSIS OF EACH POSSIBLE DISRUPTIVE INNOVATION USING TECH-BUSINESS ANALYTICS IN QUARTERNARY INDUSTRY SECTOR :

8.1 Strengths of Disruptive Innovations using Tech-Business Analytics in Quaternary Industry Sector:

Tech-business analytics-based disruptive innovations in the quaternary industry sector have many advantages that improve the efficacy, efficiency, and overall impact of knowledge-based services [16-20]. Some of the main advantages are as follows:

In many different industry sectors, including the primary, secondary, tertiary, and quaternary sectors, the circular economy concept is crucial. Because it encourages resource efficiency, waste reduction, innovation, and sustainable practices, this idea has a significant impact on all industry sectors. Through the adoption of circular concepts, industries can minimize their environmental impact, create economic value, and aid in the shift to a more resilient and sustainable economy [16]. This research paper's goal is to investigate and evaluate the possible employment prospects that could arise from the integration of Generative Pre-trained Transformers (GPTs) powered by artificial intelligence (AI) in four important industry sectors: primary, secondary, tertiary, and quaternary. The study intends to provide light on how AI-driven GPTs might generate new jobs, change current job functions, and spur innovation in these industries by investigating the disruptive effects of these cutting-edge AI technologies. In order to

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provide a proactive and inclusive approach to workforce development and economic progress, this analysis aims to assist policymakers and industry stakeholders in anticipating and seizing the opportunities brought about by AI breakthroughs [17]. Technology-based industries remain at the vanguard of a country's long-term economic growth. The majority of primary sectors' employment, business activity, and labor income are accounted for by these. Through creativity, the application of new technologies, and the utilization of new information, technology-based industries support the multilateral economic development of a country. With little success, the Brunei Darussalam government has attempted to diversify the economy over the last ten years. Brunei's economy remains primarily depends on government spending and oil & gas. The limited size of Brunei Darussalam's domestic market deters foreign direct investment. The Bruneian government is supportive of international investment, particularly when it comes to technology transfers and emerging new technologies [18]. The article looks at the dedication of the Tata Group to ethical principles in order to show how ethical frameworks can be essential to long-term sustainability, stakeholder trust, and organizational performance. The study sheds light on how competitive advantage and ethical business models interact, providing information that academics, business executives, legislators, and companies seeking ethical leadership can all use [19]. According to the Strategic and Sustainable Plastic Management article, a practical strategy for encouraging responsible plastic consumption is to concentrate on raising awareness rather than enacting complete prohibitions. By tackling the underlying causes of plastic pollution through public campaigns, behavioral nudges, and education, awareness programs enable people and businesses to embrace sustainable practices without the practical and financial difficulties that come with outright bans. Awareness campaigns ensure that stakeholders are involved and equipped to handle plastic responsibly by promoting understanding of recycling, alternatives, and circular economy models. This allows for progressive, inclusive, and long-lasting changes toward sustainability [20].

Table 7: Strengths of disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Strengths	Explanation
1.	Improved Ability to Make Decisions	TBA facilitates more accurate and well-informed decision-making by offering thorough insights from large datasets.	Organizations may anticipate and prepare for changes by using predictive analytics to forecast future trends and behaviors.
2.	Operational Efficiency	Analytics may help find operational bottlenecks and inefficiencies, which enables cost savings and process enhancements.	Routine chores can be automated with AI and machine learning to cut down on human error and free up resources for more strategic endeavors.
3.	Personalization	To improve user satisfaction and results, data analytics makes it possible to personalize services like tailored financial advice, tailored educational opportunities, and tailored healthcare plans.	Targeted marketing and better customer relationship management are made possible by comprehensive insights into consumer behavior and preferences that are provided by advanced analytics.
4.	Scalability	Scalability as the company expands is supported by the efficient management and processing of massive volumes of data by contemporary data analytics tools and cloud computing solutions.	Depending on need, analytics systems can be scaled up or down, giving businesses the flexibility to adjust to shifting demands.

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5.	Innovation and Competitive Advantage	A major competitive advantage can be gained by using disruptive technologies to develop new business models that can surpass established ones.	A business can stand out from rivals by using sophisticated analytics to provide distinctive, data-driven goods and services.
6.	Cost Reduction	Significant cost savings result from automation and process enhancements.	Analytics improve return on investment, minimize waste, and assist allocate resources optimally.
7.	Real-Time Analysis and Responsiveness	In fast-moving marketplaces, real-time analytics gives businesses a strategic edge by enabling them to react swiftly to new trends and problems.	Proactive management and quick decision-making are made easier by real-time data and ongoing monitoring.
8.	Enhanced Security and Risk Management	Fraud detection and prevention are enhanced by artificial intelligence and advanced analytics.	Predictive analytics aids in the identification of possible hazards and the use of mitigation techniques before to their occurrence.
9.	Improved Collaboration and Knowledge Sharing	Departmental data exchange is made easy by integrated analytics tools, which enhance teamwork and promote a data-driven decision-making culture.	All levels of the business may make well-informed decisions by using analytics tools to help spread information and insights.
10.	Sustainability and Environmental Impact	Analytics can optimize resource utilization, lessening its impact on the environment and assisting with sustainability projects.	Data analytics-driven innovations in urban management help create intelligent, sustainable cities.
11.	Customer Engagement & Satisfaction	Timely and customized services increase client loyalty and happiness.	Feedback loops can be established thanks to analytics, guaranteeing ongoing development based on consumer input and behavior.

Disruptive innovations that use TBA in the quaternary industry sector provide a number of advantages, including enhanced decision-making, cost savings, scalability, personalization, and operational efficiency. These technologies increase competitive advantage, foster more sustainability and teamwork, and improve security and risk management. By leveraging these qualities, organizations may significantly improve customer satisfaction, service delivery, and overall performance in an increasingly data-driven environment.

8.2 Weaknesses of Disruptive Innovations using Tech-Business Analytics in Quaternary Industry Sector:

TBA-based disruptive technologies in the quaternary industry sector have a lot of challenges and disadvantages that need to be addressed despite their many benefits. Here are a few of the primary shortcomings [21-23]:

Table 8: Weaknesses of disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Weaknesses	Explanation

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1.	Data Privacy and Security Concerns	Data breaches and cyberattacks are more likely when massive volumes of data are collected and processed.	Privacy issues can arise while handling sensitive personal data, particularly if it is mishandled.
2.	High Implementation Costs	A substantial upfront investment in infrastructure, technology, and qualified staff is necessary for the implementation of advanced analytics solutions.	Ongoing expenses for training, updates, and maintenance can be substantial.
3.	Complexity and Technical Challenges	The specific technical skills needed for advanced analytics and AI might be expensive and hard to come by.	Operational disruptions may result from the difficult and time-consuming process of integrating new analytics tools with current systems.
4.	Data Quality Issues	High-quality data is essential for analytics to work well. Decisions can be poorly informed by incomplete, out-of-date, or erroneous facts.	Isolated systems can make it more difficult to conduct thorough research and provide complete insights.
5.	Resistance to Change	Employees used to traditional methods of working who are dubious about data-driven techniques may oppose organizations.	To secure buy-in from all stakeholders, disruptive innovations must be implemented successfully, which calls for effective change management techniques.
6.	Ethical and Bias Concerns	Unfair or discriminatory results may result from AI and machine learning algorithms unintentionally reinforcing or even exacerbating biases in the training data.	Ethics pertaining to autonomy, consent, and justice may be called into question by the application of analytics in fields like healthcare, finance, and law.
7.	Dependence on Data Availability and Quality	The quality and accessibility of data are critical to analytics solutions' success. Insufficient information may restrict these solutions' efficacy.	Rapid shifts in the quality and sources of data can have an impact on analytics models' stability and dependability.
8.	Scalability Issues	Even if analytics systems can be made to grow, it can be challenging and resource-intensive to scale up in practice to handle more datasets and more intricate analyses.	Analytics systems' performance may deteriorate as data volume increases if it is not adequately handled.
9.	Legal and Regulatory Challenges	The intricate web can be difficult to navigate and expensive.	Legal liability concerns may arise from the use of AI and predictive analytics in decision-making.

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10.	Over-Reliance on Technology	Blind spots and supervision could result from an over-reliance on analytics and automated technologies.	An organization's reliance on technology exposes it to operational disruptions from technical malfunctions and outages.
11.	Short-Term Focus	Businesses may make less-than-ideal decisions if they concentrate on the immediate benefits of analytics rather than the long-term strategic ramifications.	Analytics projects must be continuously funded and adjusted to ensure their sustainability, which can be difficult.

These include worries about privacy and data security, high implementation costs, technical complexity, issues with data quality, resistance to change, ethical and bias issues, dependence on data availability, scalability issues, legal and regulatory barriers, an over-reliance on technology, and a potential short-term focus. To address these deficiencies, a well-rounded approach that combines human judgment with state-of-the-art analytics, solid data governance, constant investments in technology and knowledge, and careful planning are all required.

8.3 Opportunities of Disruptive Innovations using Tech-Business Analytics in Quaternary Industry Sector:

TBA offers a multitude of opportunities to transform knowledge-based services in the quaternary sector. These prospects span sectors such as IT, professional services, healthcare, education, and finance and lead to better outcomes, new business models, and increased efficiency. Here are some of the biggest opportunities [24-25]:

Table 9: Opportunities of disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Opportunities	Explanation
1.	Enhanced Decision-Making and Strategy Formulation	Utilizing big datasets and sophisticated analytics to learn more about consumer behavior, market trends, and operational performance in order to make more strategic and informed decisions.	Organizations are able to optimize their strategy and get ready for future uncertainties by simulating different business scenarios using predictive and prescriptive analytics.
2.	Personalized Customer Experiences	Examining consumer data, interests, and behavior to create highly customized goods and services. Increased client loyalty and satisfaction may result from this.	Putting into practice precision marketing techniques that provide tailored offers to particular client categories, increasing conversion rates and marketing return on investment.
3.	Operational Efficiency	AIML can be used to automate repetitive jobs and procedures, lowering operating costs.	Supply chain operations, inventory control, and resource allocation may all be improved with analytics.
4.	Innovation and New Business Models	Producing cutting-edge goods and services that upend established markets, creating new sources of income and advantages over competitors.	Building new markets and utilizing network effects to link customers and merchants through data-driven platform business models.

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5.	Improved Healthcare Outcomes	In order to improve patient outcomes and streamline healthcare delivery, predictive analytics is being used to detect high-risk patients, customize treatment regimens, and forecast disease outbreaks.	Maximizing hospital operations, controlling supply chains, and cutting expenses by using data to inform decisions.
6.	Advancements in Education	Using adaptive learning tools to adjust the pace and substance of instruction according to each student's performance and preferred method of learning.	Analytics can be used to boost student engagement and retention, manage resources more efficiently, and improve institutional performance.
7.	Enhanced Financial Services	Assessing credit risk, identifying fraud, and refining investment plans through the use of advanced analytics, which results in safer and more lucrative financial operations.	Enhancing consumer satisfaction and financial results by analyzing financial trends and behaviors to provide tailored financial advice.
8.	Smart Cities and Infrastructure	Creating smarter and more sustainable cities by using data analytics to manage urban infrastructure—such as trash management, electricity distribution, and traffic management—more effectively.	Boosting living quality and public administration operational efficiency by leveraging data-driven insights to improve public services.
9.	Environmental Sustainability	By using analytics, industries may improve sustainability processes, save waste, and make the best use of natural resources.	Putting into practice data-driven energy management, consumption reduction, and renewable energy source promotion strategies.
10.	Enhanced Security and Compliance	Developing sophisticated fraud detection systems that use machine learning to identify and halt fraudulent activities in real time.	Utilizing analytics to lower the risk of fines and other consequences by ensuring adherence to data protection laws.
11.	Workforce Optimization and Development	Finding skills shortages, improving workforce planning, and strengthening employee training and development initiatives are all made possible by data analytics.	Examining performance and engagement data to increase productivity and job satisfaction.

Tech-business analytics-based disruptive technologies in the quaternary industry sector offer a plethora of opportunities to enhance decision-making, optimize processes, foster innovation, and propel sectors such as healthcare, education, and finance forward.

8.4 Challenges of Disruptive Innovations using Tech-Business Analytics in Quaternary Industry Sector:
These barriers can be classified as technological, organizational, regulatory, or market-related, and they hinder the quaternary industry sector's ability to develop and implement innovative technologies that

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use tech-business analytics. The utilization of tech-business analytics and disruptive innovations have a big impact on the Quaternary Industry Sector, which is centered on knowledge-based services such information technology, research and development, financial planning, teaching, and consulting. An overview of the difficulties brought about by this convergence is provided below [26-27]:

Table 10: Challenges of disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Challenge	Impact
1.	**Data Overload and Problems with Quality**	The amount of data needed for tech-business analytics can be overwhelming, yet it is necessary. Outdated records, inconsistent formats, and unstructured data all reduce ineffectiveness.	Poor decision-making based on false information may interfere with innovation processes or result in erroneous market projections.
2.	**The rate of technological advancement**	Technology is advancing more quickly than businesses can adapt.	Legacy systems' incapacity to integrate new machine learning models or analytical tools hinders their disruptive potential.
3.	**Deficits in Analytical Ability**	Too few professionals with a mix of corporate strategy, data science, and topic understanding.	The inability to effectively translate analytical results into innovative strategies that cause disruption.
4.	**Reluctance to Adjust**	Often, organizational culture resists disruptive changes due to fear of job loss or skepticism of data-driven models.	Prevents the use of innovative techniques and tools, even when their long-term benefits are clear.
5.	**Privacy Issues and Data Security**	When using sophisticated analytics to handle sensitive data, including customer information or confidential research, there are ethical and legal issues.	Limiting the amount of data used, especially in sectors like healthcare and finance, stifles potential innovation.
6.	**Barriers to Regulation**	Following evolving laws (like GDPR, HIPAA, or AI governance requirements) could make it more difficult to produce innovative concepts.	New technology-based services and products are more expensive and harder to implement in knowledge-based industries.
7.	**Business alignment and ROI uncertainty**	In knowledge-intensive sectors, quantifying the advantages of disruptive innovation through analytics is difficult.	Strategic analytics initiatives risk being neglected or abandoned if their results are not immediately noticeable.
8.	**Implications of Automation and AI for Ethics**	As AI-driven analytics plays a bigger role in disruption, questions about bias, accountability, and transparency arise.	Breach of trust and potential for criticism, particularly in the fields of education, legal advice, and policymaking.

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9.	**Integration and Interoperability Issues**	Disjointed systems and fragmented data make it difficult to get the coherent view needed for useful analytics.	Hinders the development of sector-spanning disruptive platforms (e.g., combining edtech with finance).
10.	**Cannibalization of Markets**	Disruptive innovation powered by analytics could jeopardize the company's current products.	Fear of self-destruction is known as the "innovator's dilemma" because it keeps companies from coming up with new ideas.

Organizational, technological, regulatory, and market-related concerns must be addressed for successful implementation and long-term results. Organizations must spend heavily in robust infrastructure, foster a culture of continuous learning, ensure regulatory compliance, and develop effective change management strategies in order to overcome these constraints and fully utilize tech-business analytics [28-30].

9. SUGGESTIONS :

In order to use tech-business analytics to effectively harness disruptive technologies in the quaternary industry sector, businesses need take into account a number of important recommendations and hypotheses. They will make it easier to overcome the obstacles and take advantage of the chances that come with enhanced analytics and data-driven strategies [31-35].

Table 10: Suggestions of disruptive innovations using TBA in quaternary industry sector

S.No.	Aspects	Suggestions	Explanation
1.	Make an Investment in Sturdy Data Infrastructure	To ensure consistency and accessibility, create a centralized data repository that integrates data from multiple sources.	In order to manage growing data quantities and computing needs, make an investment in scalable cloud-based infrastructure.
2.	Ensure High-Quality Data	To preserve data integrity, accuracy, and quality, put in place robust data governance procedures.	Maintain data cleanliness and monitoring on a regular basis to avoid problems like errors, missing values, and duplication.
3.	Develop Advanced Analytical Capabilities	Invest in the education and employment of qualified engineers, analysts, and data scientists.	Promote a culture of lifelong learning to keep abreast of the most recent developments in AI and analytics.
4.	Adopt Ethical and Responsible AI Practices	Create frameworks to help AI models detect and reduce biases.	To gain the trust of stakeholders, make sure AI decision-making procedures are transparent.
5.	Enhance Data Privacy and Security	Continue to adhere to data protection.	Put in place cutting-edge security measures to shield private information from hacks and breaches.
6.	Foster a Data-Driven Culture	Verify the leadership's dedication to developing a culture that is driven by data.	Encourage staff members at all levels to adopt data-driven decision-

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			making by implementing training and awareness initiatives.
7.	Focus on Change Management	Early on in the implementation phase, involve important stakeholders to resolve issues and obtain buy-in.	Make sure all staff members understand the objectives and advantages of analytics projects.
8.	Implement Agile Methodologies	Utilize agile approaches to create and improve analytics systems, enabling prompt modifications in response to user input and evolving specifications.	Prioritize proving the worth of trial ventures before expanding.
9.	Postulates for Strategic Alignment	The goal of disruptive innovations should be to solve actual problems and improve user experiences in order to generate substantial value for both the company and its clients.	Understanding client demands and providing timely, individualized services should be the top priorities of analytics programs.
10.	Collaboration and Integration	Promote interdepartmental cooperation to dismantle data silos and incorporate analytics into every facet of the company.	Make smart investments in personnel and technology.
11.	Continuous Improvement	To continuously evaluate and enhance analytics procedures, models, and results, create a feedback loop.	Make sure that all analytics operations adhere to applicable laws and moral principles in order to preserve confidence and stay out of trouble with the law.
12.	Risk Management and Mitigation	Take proactive steps to identify and control data analytics risks, including as model errors, data breaches, and ethical issues.	Create AI-powered tools that provide financial planning, credit scoring, and individualized investment advice based on user data.
13.	Example Applications	Use predictive analytics to find patterns in disease, enhance treatment regimens, and enhance patient outcomes with personalized medicine.	Provide learning systems with adaptable features that may be customized,
14.	Example Applications	Implement dynamic pricing methods that adapt to consumer behavior, market demand, and competition using real-time information.	Reduce expenses and increase efficiency by optimizing supply chain operations with the help of IoT.

It is revolutionizing a range of knowledge-based services. Organizations can successfully leverage the potential of advanced analytics to spur innovation, boost productivity, and generate substantial value by adhering to these recommendations and presumptions. The effective adoption and long-term viability of these advances depend on addressing issues including data quality, ethical dilemmas, and change aversion [36-38].

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10. CONCLUSIONS :

It is constituting a significant change in the way knowledge-based services are provided, revolutionizing sectors like education, healthcare, and finance, among others. Personalized experiences, efficiency, and creativity can be unlocked by enterprises through the utilization of sophisticated analytics. But in order to fully utilize these breakthroughs, a number of issues must be resolved, such as data quality, technological limitations, cultural opposition, and regulatory compliance. Businesses may overcome these obstacles and use the revolutionary potential of tech-business analytics to generate substantial value for stakeholders and customers by putting in place a strong data infrastructure, encouraging a data-driven culture, and embracing moral and responsible AI practices.

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